

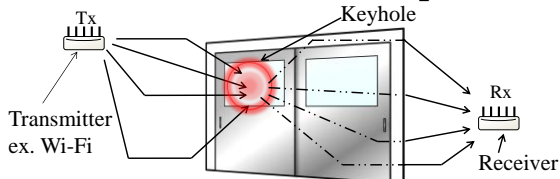
# Improvement of MIMO Channel Capacity Using Block-wise Controlled Transmit-Array Antenna

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## Introduction

### Environment with limited paths

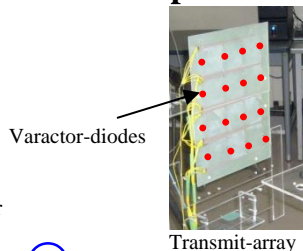


- Keyhole effect increases spatial correlation
- High propagation loss degrades SNR

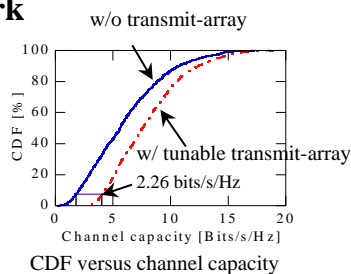


Need to increase the channel capacity

### Our previous work



CDF : Cumulative Distribution Function

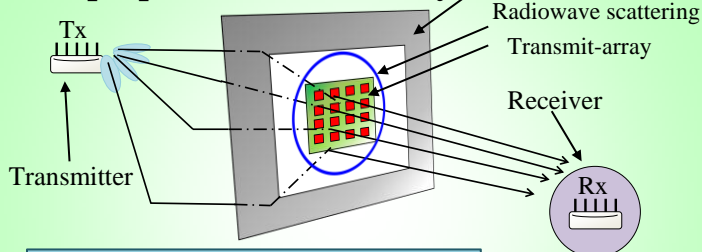


- ☺ Experiment result demonstrated that transmit-array can overcome keyhole effect
- ☹ A large number of elements cause high complexity in hardware and control algorithm

Simplified control system is needed

## Proposed Mechanism and Configuration of Transmit-array

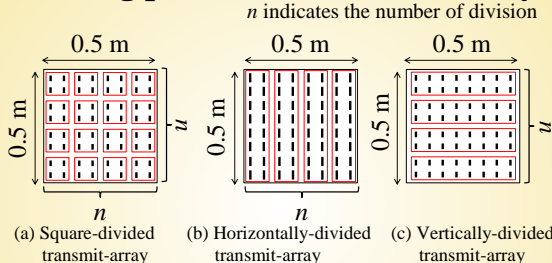
### The proposed transmit-array



- ☐ By controlling load impedance,
  - SNR can be improved by controlling path directions
  - Spatial correlation can be decreased by path dispersion

Enhancement in MIMO channel capacity

### Dividing pattern for transmit-array

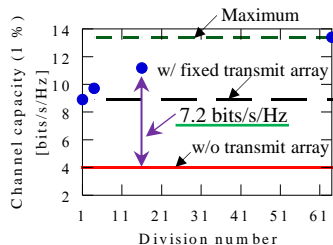
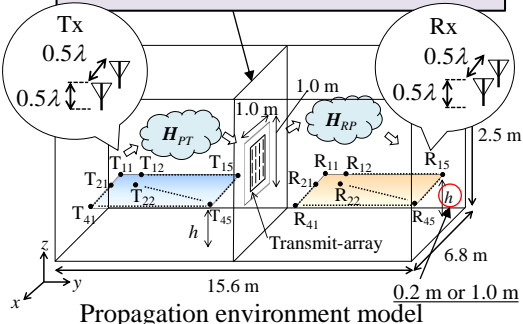


- ☐ Transmit-array is divided into partitioned sub-array
- ☐ Evaluate value of  $n$ :  $1 \leq n \leq 8$
- ☐ Each sub-array has same termination reactance

Control system becomes simpler than that with fully controlled structure

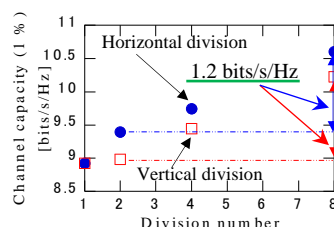
## Numerical Result

Blocks the paths except aperture area



1 % capacity versus division numbers (square division type)

Large number of antennas realize high channel capacity



1 % capacity versus division numbers (Horizontal division and vertical division)

The horizontal division type yields greater capacity than the square and vertical ones

Analysis condition	
Simulation method	Raytracing
Frequency	2.4 GHz
Antenna element (Tx / Rx)	Dipole antenna
Number of antenna (Tx × Rx)	2x2 (MIMO)
Reactance value	$-100 \leq X_i \leq 10$
Optimum method	Steepest gradient method

## Conclusion

Transmit-array with square division type ( $n=4$ )

1 % value of channel capacity can be improved by 7.2 bits/s/Hz