

# [Intra-cluster response model and parameter for channel modeling at 60GHz (Part 3)]

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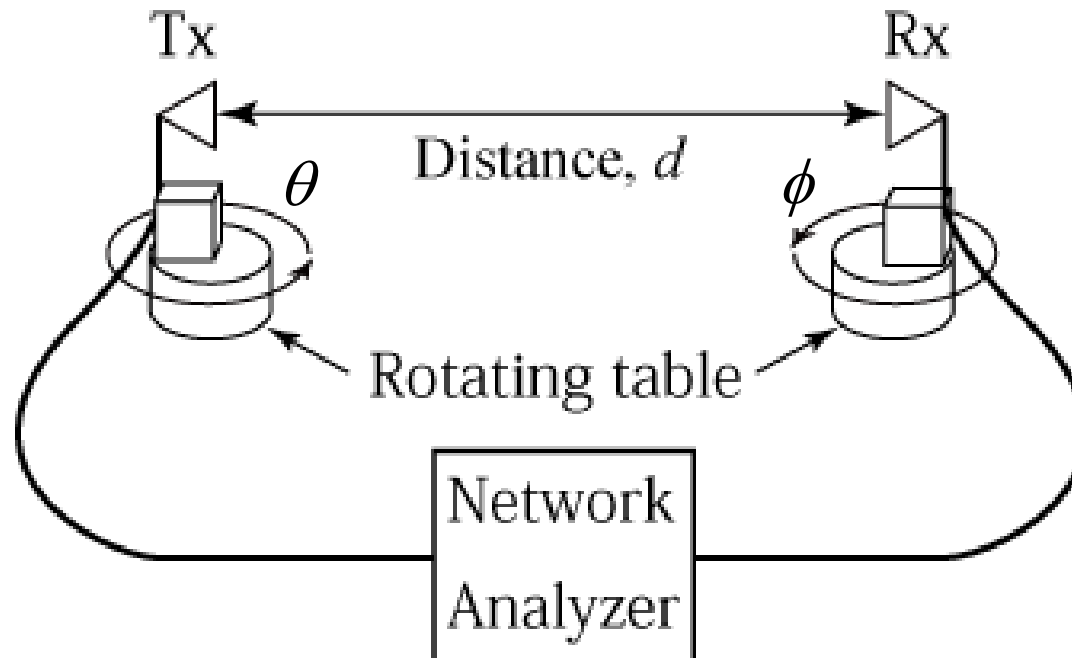
## Abstract

- This paper will give all intra-cluster parameters for 3 different environments defined by TGad
- To align intra-cluster channel models, this paper has adopted K-factor and ready to be integrated with inter-cluster channel models given by doc. 09/334r4 by Alexander

For simpler PHY simulations:

- Single channel model for each living, conference, and cubicle room environment is good preferable rather than too many channel models
- We suggest to use the channel model with 30 degree HPBW antennas and vertical polarization for simulation scenarios for directional antenna communications.

# Measurement system



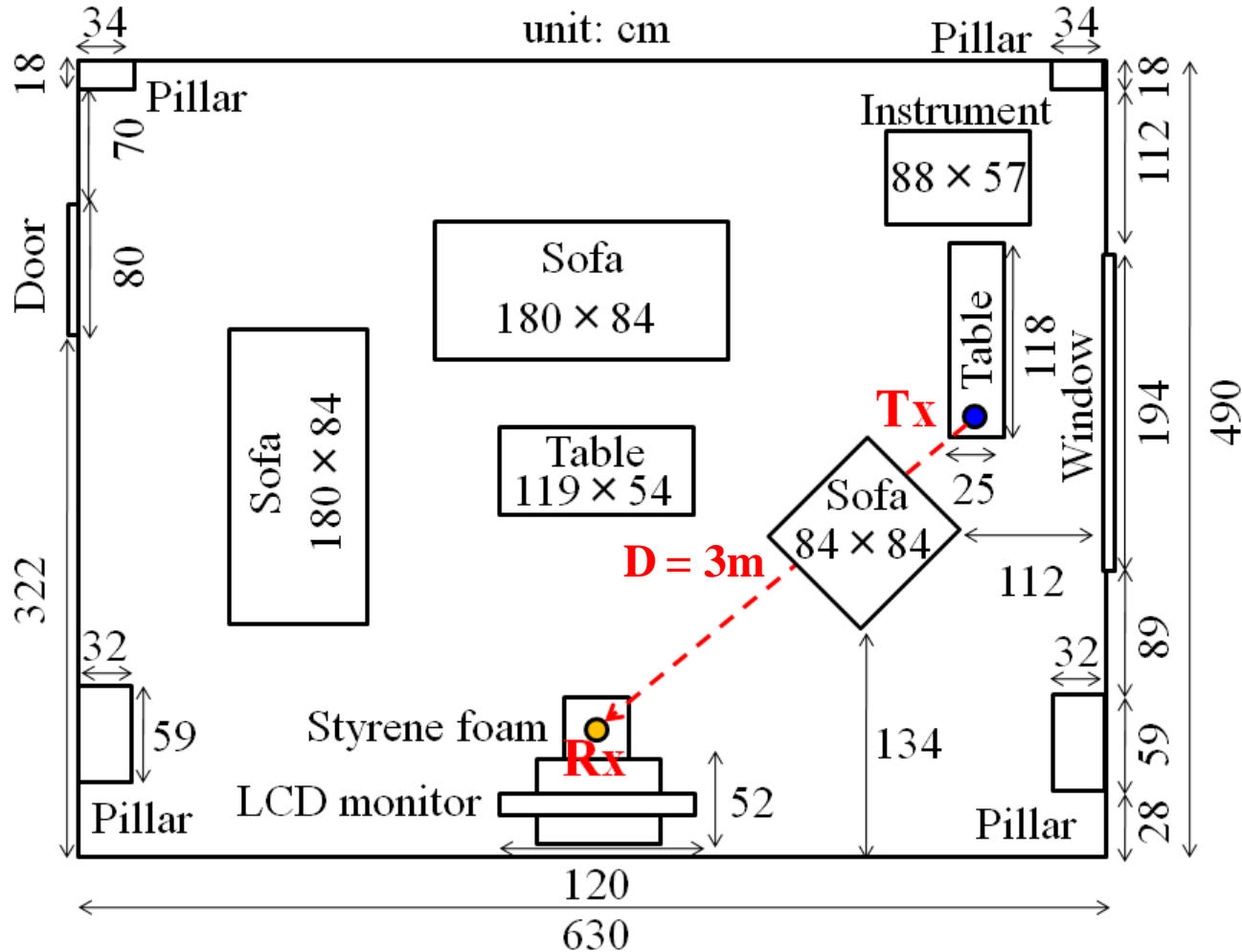
- Instrument: Vector network analyzer
- Antenna: Conical horn antenna

## Measurement set up

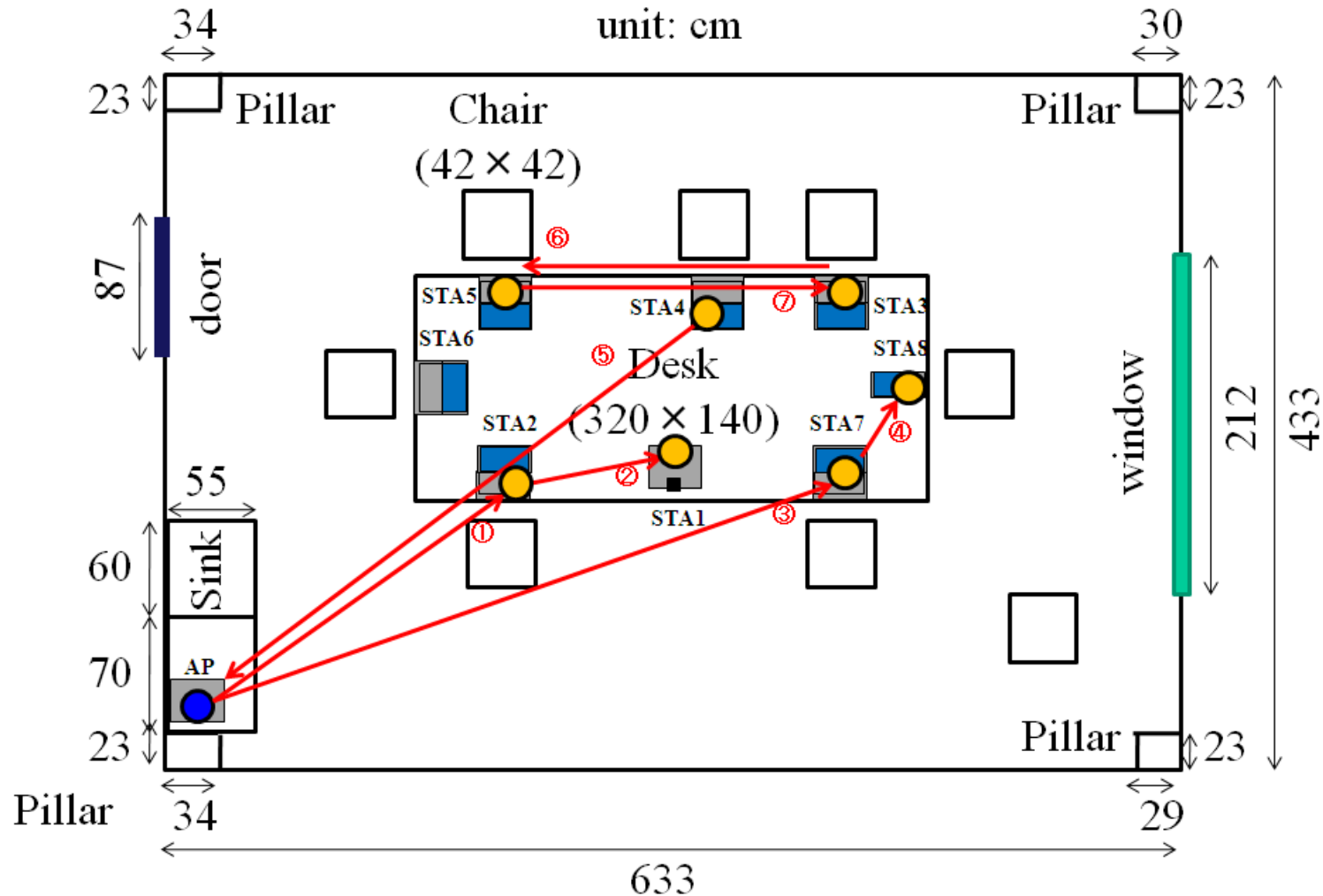
Parameter	Value
Center frequency	62.5 GHz
Band width	3 GHz
Number of frequency points	801
Frequency step	3.75 MHz
HPBW of antenna (Gain)	30degree(STA), 90 degree(AP)
Polarization	Vertical(STA), Circular(AP)
Calibration	Direct port connection without antennas

# Living room environment 'defined by TGad'

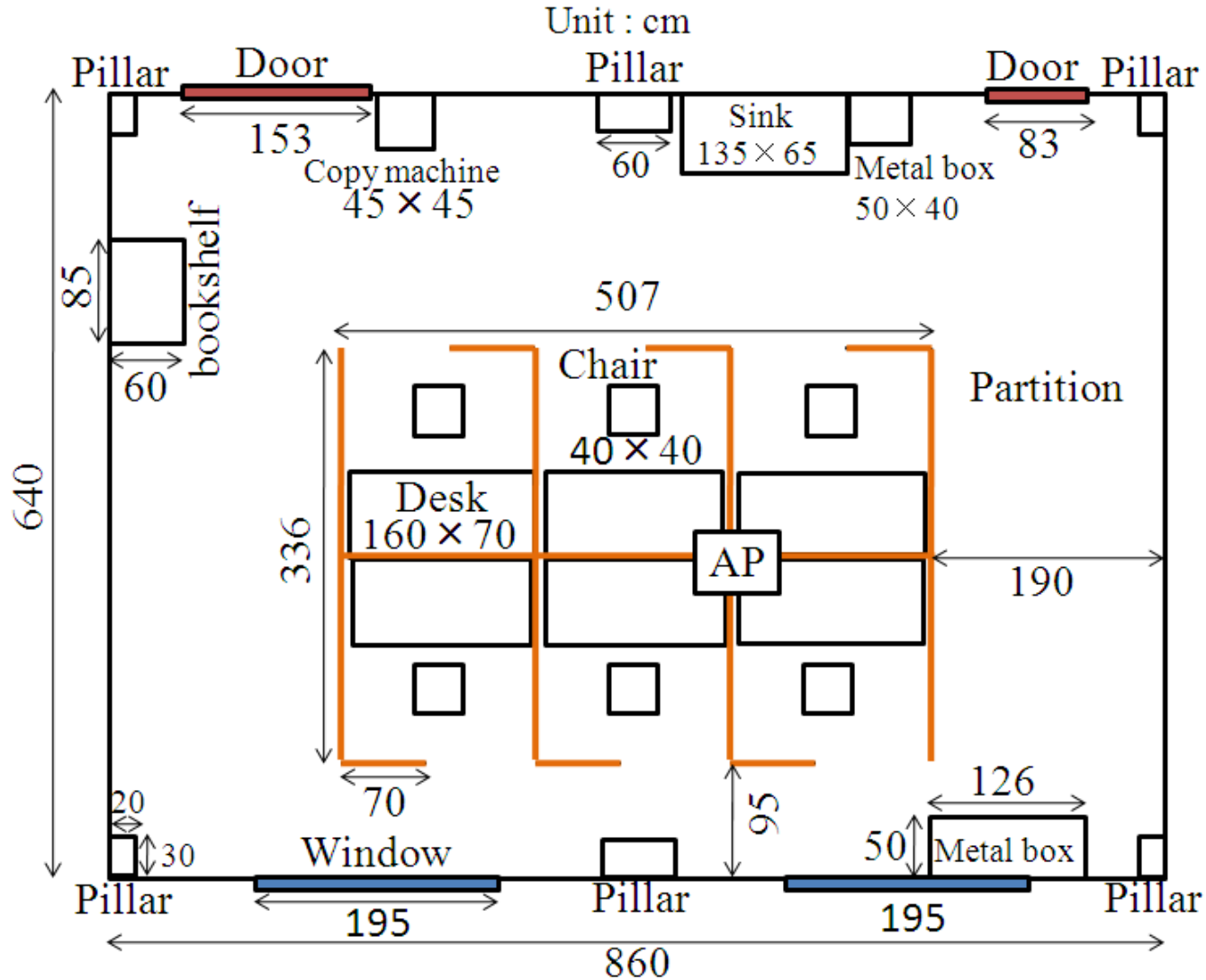
Antenna height:  
1.5m (LoS scenario)  
1.0 m (NLoS scenario)



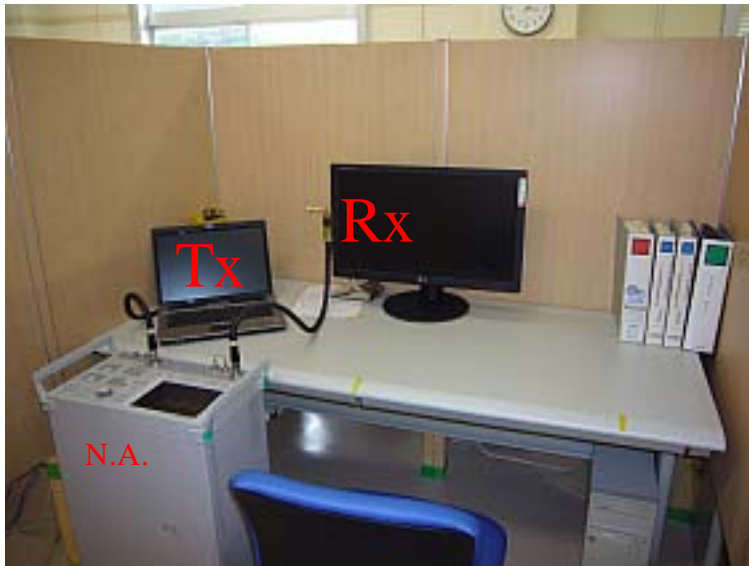
# Conference room environment “defined by TGad”



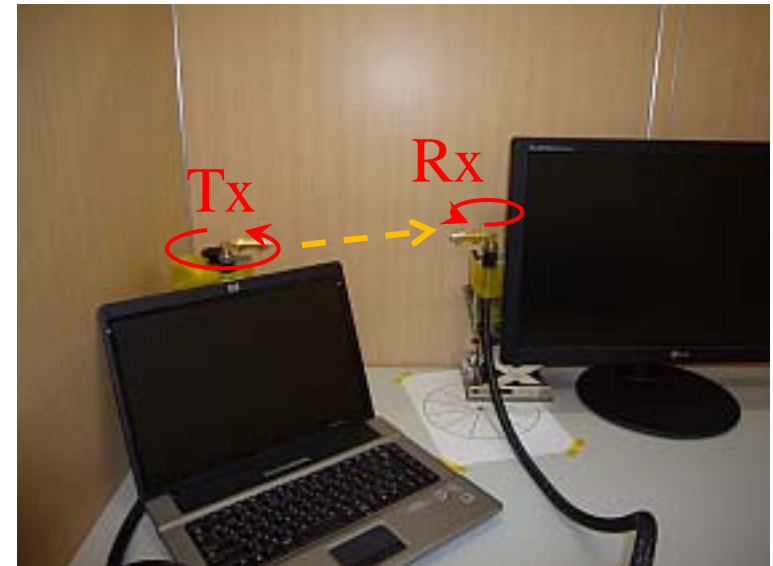
# Floor plan of cubicle office



# STA-STA link



Measurement set up

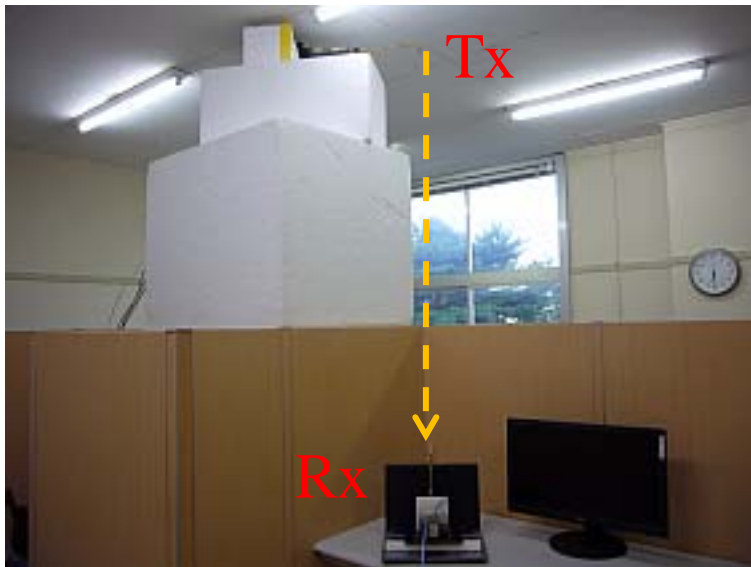


Manually rotation (30deg step)

This is a very short transmission scenario.



# AP-STA link



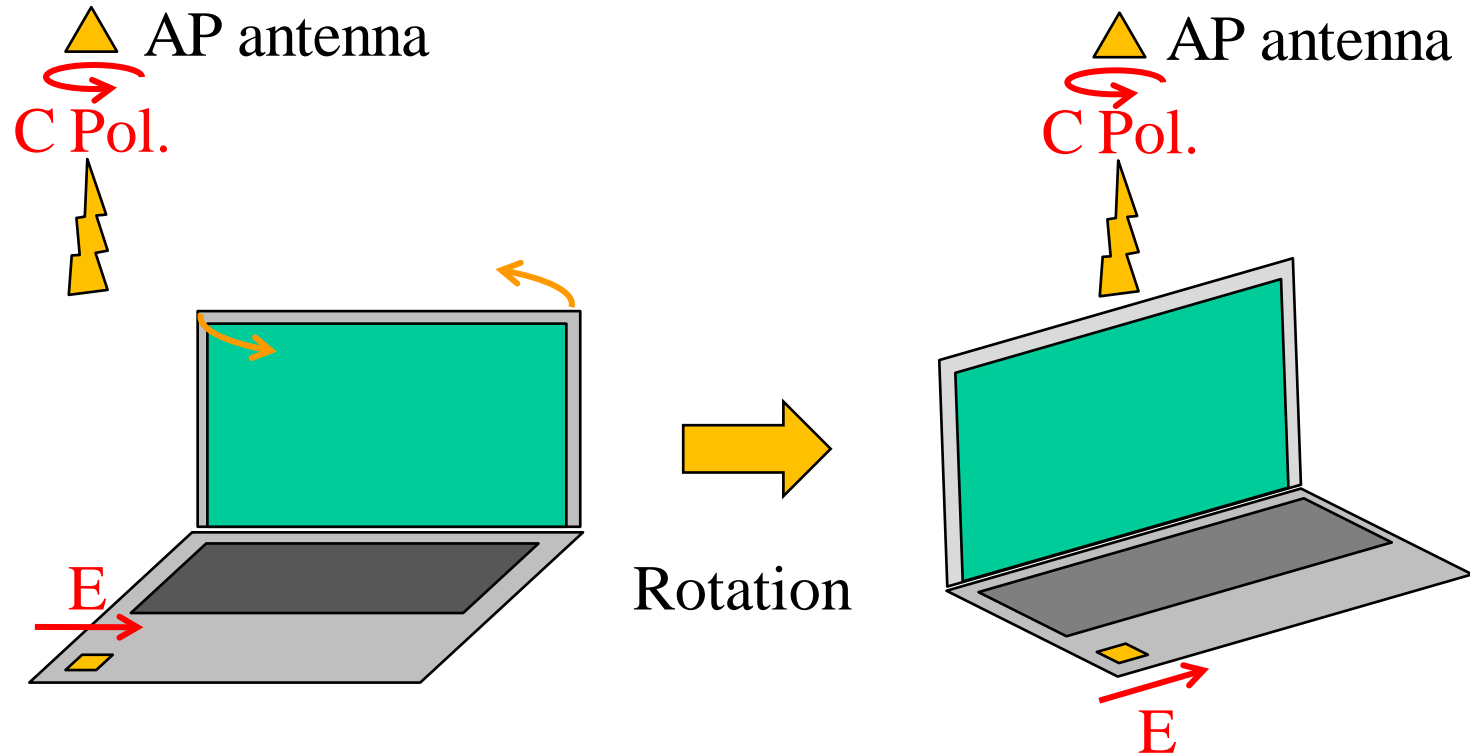
AP-STA Link



Inside of a cubicle

This is a vertical transmission link scenario.

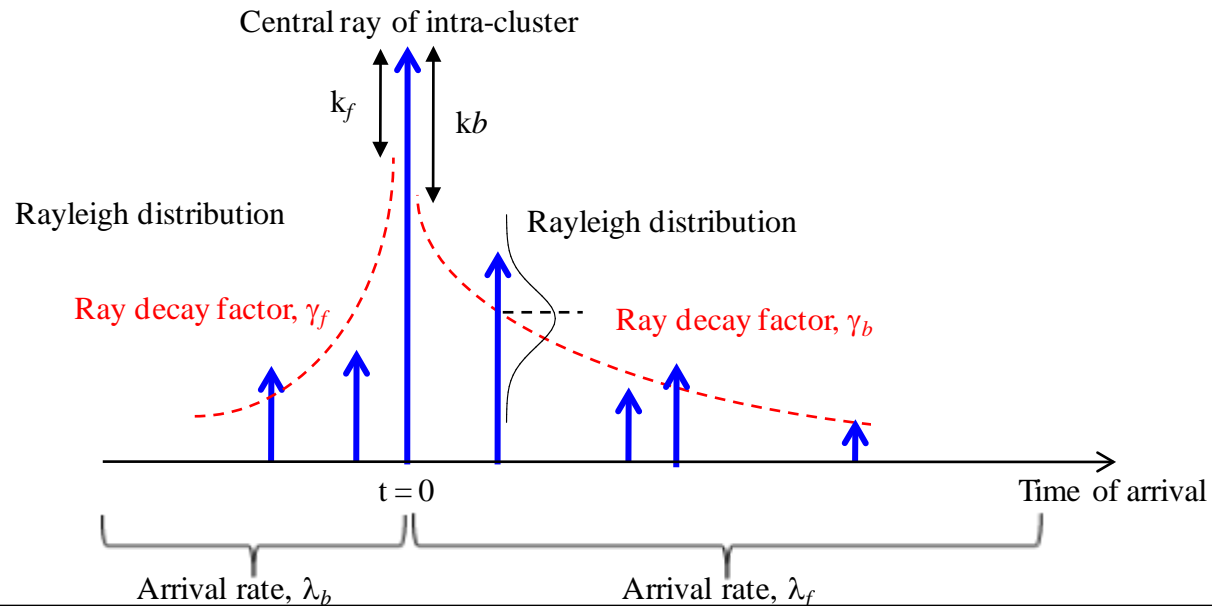
## Circular polarization is adopted for AP antenna



- Polarization mismatch is generated by rotation of PC
- Circular polarized signal wave has adopted for AP antenna

# Intra-cluster parameters for all environments (Ant. HPBW: 30deg, V pol.)

Environments		$k_f$ [dB]	$k_b$ [dB]	$\gamma_f$ [ns]	$\gamma_b$ [ns]	$\lambda_f$ [ns <sup>-1</sup> ]	$\lambda_b$ [ns <sup>-1</sup> ]	Distribution	Distribution
Living room		11.5	10.9	1.25	8.7	0.277	0.996	Rayleigh	Rayleigh
Conference room		16.8	18.4	6.13	6.29	0.547	0.501	Rayleigh	Rayleigh
Cubicle	STA-STA LOS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	AP-STA	N/A	24.5	N/A	0.690	N/A	1.13	N/A	Rayleigh



## Summary of Intra-cluster Parameters for Conference Room Environment

**Proposal; Averaged intra-cluster parameters are used for conference room channel model –two measured environments (Doc.09/433r4 and Doc.10/112r0)**

Parameter	Notation	Value Doc.09/433r4	Averaged Value
Pre-cursor rays $K$ -factor	$K_f$	5 dB	<b>10 dB</b>
Pre-cursor rays power decay time	$\gamma_f$	1.3 ns	<b>3.7 ns</b>
Pre-cursor arrival rate	$\lambda_f$	0.20 ns <sup>-1</sup>	<b>0.37 ns<sup>-1</sup></b>
Pre-cursor rays amplitude distribution		Rayleigh	<b>Rayleigh</b>
Number of pre-cursor rays	$N_f$	2	<b>6</b>
Post-cursor rays $K$ -factor	$K_b$	10 dB	<b>14.2 dB</b>
Post-cursor rays power decay time	$\gamma_b$	2.8 ns	<b>4.5 ns</b>
Post-cursor arrival rate	$\lambda_b$	0.12 ns <sup>-1</sup>	<b>0.31 ns<sup>-1</sup></b>
Post-cursor rays amplitude distribution		Rayleigh	<b>Rayleigh</b>
Number of post-cursor rays	$N_b$	4	<b>8</b>

# Summary of Intra-cluster Parameters for Living Room Environment

## Proposal; Intra-cluster parameters extracted from measured data (Doc.10/112r0)

Parameter	Notation	Value
Pre-cursor rays $K$ -factor	$K_f$	11.5 dB
Pre-cursor rays power decay time	$\gamma_f$	1.25 ns
Pre-cursor arrival rate	$\lambda_f$	0.28 ns <sup>-1</sup>
Pre-cursor rays amplitude distribution		Rayleigh
Number of pre-cursor rays	$N_f$	6
Post-cursor rays $K$ -factor	$K_b$	10.9 dB
Post-cursor rays power decay time	$\gamma_b$	8.7 ns
Post-cursor arrival rate	$\lambda_b$	1.0 ns <sup>-1</sup>
Post-cursor rays amplitude distribution		Rayleigh
Number of post-cursor rays	$N_b$	8

## Conclusion

- **Intra-cluster channel models for two environments are integrated and proposed (Doc.09/433r4 and Doc.10/112r0): 30 degree HPBW antennas for both Tx/Rx and vertical polarization**
- **Ready to merge with inter-cluster channel models**
- **Preliminary intra-cluster parameters for cubicle environment are presented**