Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: [Reference simulation scenarios for major usage models]

Date Submitted: January 15, 2007]

Source: [Yozo Shoji[1], Shuzo Kato[1], Ryuhei Funada[1], Hirokazu Sawada[1], Hiroshi Harada[1], Ming lei[1], Yoshinori Nishiguchi[1], Chang-soon Choi[1], Masahiro Umehira[1], Ichihiko Toyoda[2] , Kenichi Kawasaki[3] , Kazuaki Takahashi[4] , Hiroyuki Nakase[5], Yasuyuki Oishi[6]]

Company [NICT[1], NTT[2], SONY[3], Panasonic(Matsushita)[4] , Tohoku University[5] , FUJITSU[6]]

Address[1][3-4 Hikari-no-oka, Yokosuka-shi, Kanagawa 239-0847, Japan][2][1-1 Hikari-no-oka, Yokosuka-shi, Kanagawa 239-0847, Japan][3][6-7-35 Kitashinagawa, Shinagawa-ku, Tokyo 141-0001, Japan] [4][4-12-4, Higashi-Shinagawa, Shinagawa-ku, Tokyo 140-8587, Japan] [5][2-1-1 Katahira, Aoba-ku, Sendai-shi, Miyagi 980-8577, Japan] [6][5-5 Hikari-no-Oka, Yokosuka-shi, Kanagawa 239-0847, Japan]

Voice:[+81-46-847-5295[1], +81-46-859-2366[2], +81-3-5795-7879[3] , +81-3-6710-2029[4] , +81-22-217-5531[5] , +81-46-839-5373[6]]

FAX: [+81-46-847-5440[1], +81-46-855-1497[2], +81-3-5795-7385[3] , +81-3-6710-3915[4] , +81-22-217-5533[5] , +81-46-839-5560[6]]

E-Mail:[shoji@nict.go.jp[1], cschoi@nict.go.jp[1], sawahiro@nict.go.jp[1], shu.kato@nict.go.jp[1], toyoda.ichihiko@lab.ntt.co.jp[2] , Kenichi.Kawasaki@jp.sony.com[3] , takahashi.kazu@jp.panasonic.com[4] , nakase@riec.tohoku.ac.jp[5] , yasu@labs.fujitsu.com[4]]

Re: []

Abstract: [Suggesting simulation scenarios for major usage models]

Purpose: [To be considered in 15.3c Usage Model Document]

Reference simulation scenarios
for major usage models

Yozo Shoji, <u>Shuzo Kato</u>, Ryuhei Funada, Hirokazu Sawada, Hiroshi Harada, Ming lei, Yoshinori Nishiguchi, Chang-soon Choi, Masahiro Umehira (NICT)
Ichihiko Toyoda (NTT) , Kenichi Kawasaki (SONY) ,
Kazuaki Takahashi (Panasonic), Hiroyuki Nakase (Tohoku University)

Background & Purpose

■ The selection criteria document (05-0493) requires TG3c PHY proposers to evaluate so many items by simulation, as well as to report many items

■ There are huge number of possible simulation scenarios (assumptions for simulation) even when only major usage models (UM1 and UM5) are covered

■ Desirable to agree on and share reference simulation scenarios for UM1 and UM5 among PHY proposers to reduce simulation burden with fair comparison

Evaluation items related to simulation scenarios in the Selection Criteria

1. System Performance
2. Link Budget
3. Sensitivity
4. Co-Channel and Cross-Channel Interference
5. Signal Acquisition
6. Interference and Susceptibility
7. Coexistence

If PHY proposers cover all the items for each proposed PHY mode, considerable simulation time will be required.

Available channel models for the major usage models

Channel model	UM 1		UM 5	
	LOS residential	Tx=15 (Rx=30)	LOS Office	Tx=30 (Rx=30)
		Tx=30 (Rx=30)		
		Tx=60 (Rx=30)		
		Tx=360 (Rx=30) Provided by NICT		Tx=60 (Rx=30) Provided by NICT
		Tx=360 (Rx=30) Provided by NICTA		Proposer-defined antenna
		Proposer-defined antenna		
	NLOS residential	Tx=15 (Rx=30)	N/A	
		Tx=30 (Rx=30)		
		Tx=60 (Rx=30)		
		Tx=360 (Rx=30)		
		Proposer-defined antenna		

Total 6 available channel models

Combinations of simulation conditions

	UM1	UM5
RF impairment model	No impairment is considered	
	Only PA model is considered	
	Only phase-noise is considered	
	PA+phase-noise is considered	
PHY transmission mode	Mandatory (> 2Gbps) and optional (> 3Gbps) modes	
Interferers model	No interferers	
	TG3c interferer exists with co- or cross-channel scenario	
	Non-TG3c interferer exists with co- or cross-channel scenario	

4 conditions

At least 2 conditions

At least 5 conditions

- 240 (= 6 x 4 x 2 x 5) possible simulation scenarios for UM1 and UM5
- It is too time consuming to simulate all scenarios.

Proposed simulation scenarios derived from the evaluation items in the Selection Criteria

1. System Performance
2. Link Budget   } Scenario A
3. Sensitivity
4. Co-Channel and Cross-Channel Interference ⟶
5. Signal Acquisition ⟶ Scenario C   Scenario B
6. Interference and Susceptibility
7. Coexistence

Evaluation items can be grouped into 3 scenarios considering the priority and the complexity in simulation

Recommended scenario A for "System Performance", "Link Budget", and "Sensitivity"

- ■ Recommended simulation scenarios are shown below.
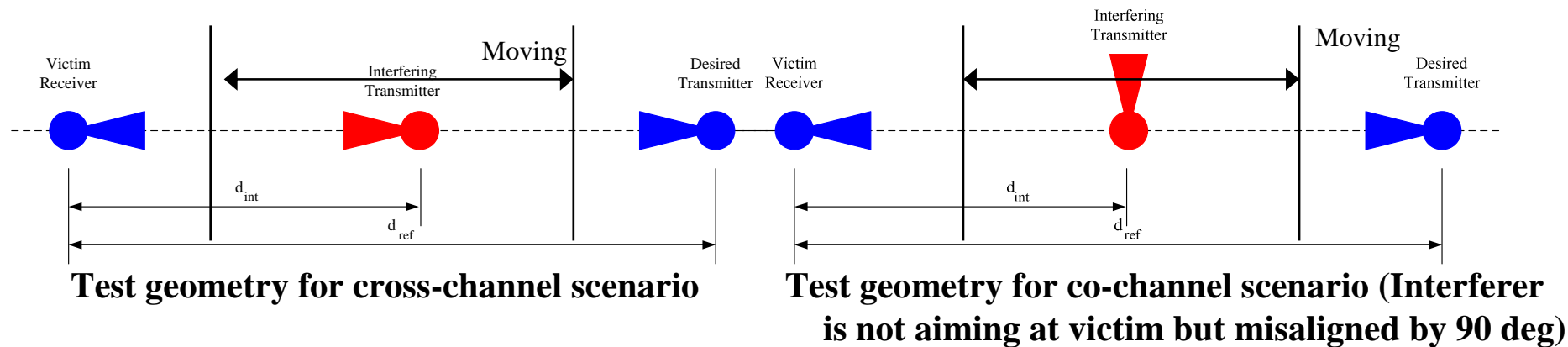- ■ CNR vs. PER performances will be evaluated for each proposed PHY mode.

Scenario #	UM	Channel model (type of Tx antenna & distance) [*1]	Rx Antenna model[*2]	RF impairments to be considered [*3]
A1	UM1	LOS Residential (30 deg. at 5 m)	30 deg. Gaussian with side-lobe	PA+phase-noise
A2		NLOS Residential (30 deg. at 5 m)		
A3	UM5	LOS Office (30 deg. at 1 m)		

*1: refer to doc. "06-0195"

*2: refer to doc. "06-0474"

*3: refer to doc. "06-0477"

Detailed simulation scenario based on the test geometry in the Selection Criteria

Test geometry for cross-channel scenario

Test geometry for co-channel scenario (Interferer is not aiming at victim but misaligned by 90 deg)

- CNR vs PER performances will be evaluated using DU ratios derived from the geometry shown above.
- Recommended distance: d_{int}=2.5 m@UM1(d_{ref}=5 m), and D_{int}=0.5 m@UM5(d_{ref}=1 m)
- Cross channel scenario: One upper channel and one lower channel are assumed.

Recommended simulation scenario B for "Co-Channel and Cross-Channel Interference"

■ Recommended simulation scenarios are shown below

■ CNR vs. PER performances for different DURs corresponding to different interferer locations will be evaluated for each proposed PHY mode to show the degradation due to interference

Scenario #	Interference	Victim device	Interferer device	Location of interferer	Other assumptions
B5	Co-channel interference	UM1 device	UM1 device	Shown in the previous slide	follow A1
B6					follow A2
B7		UM5 device	UM5 device		follow A3
B8	Cross-channel interference	UM1 device	UM1 device		follow A1
B9					follow A2
B10		UM5 device	UM5 device		follow A3

Recommended simulation scenario C for "Signal Acquisition"

- Recommended simulation scenarios are shown below
- CNR vs. PER corresponding to the false and miss detection probability performance will be evaluated for each proposed PHY mode

Scenario #	UM	Channel model (type of Tx antenna & distance) *1	Antenna model*2	RF impairments to be considered *3
C1		AWGN	30 deg. Gaussian with side-lobe	None
C2	UM1	LOS Residential (30 deg. at 5m)		PA+phase-noise
C3		NLOS Residential (30 deg. at 5m)		
C4	UM5	LOS Office (30 deg. at 1 m)		

*1, *2 and *3 shown in slide 8

Recommendation regarding "Interference and Susceptibility" and "Coexistence"

■ No discussion about reasonable geometry on this simulation scenarios so far at TG3c meetings, and actual commercial products are not widely deployed

■ Recommend not to include the evaluation of "Interference and Susceptibility" and "Coexistence" as mandatory simulation scenario at this moment

Summary and conclusion

- Reference simulation scenarios for UM1 and UM5 have been suggested

- 240 possible simulation scenarios have been reduced to 13 (=A3+B6+C4) simulation scenarios for each PHY mode

Appendix: Table of the recommended simulation scenarios in this document

Scenario A for "System Performance", "Link Budget", and "Sensitivity"				
Scenario #	**UM**	**Channel model (type of Tx antenna & distance) *1**	**Rx antenna model*2**	**RF impairments to be considered*3**
A1	UM1	LOS Residential (30 deg. at 5 m)	30 deg. Gaussian with side-lobe	PA+phase-noise
A2		NLOS Residential (30 deg. at 5 m)		
A3	UM5	LOS Office (30 deg. at 1 m)		

Scenario "B" for "Co-Channel and Cross-Channel Interference"					
Scenario#	**Interference**	**Victim device**	**Interferer device**	**Location of interferer**	**Other assumptions**
B5	Co-channel interference	UM1 device	UM1 device	Shown in the slide 9	follow A1
B6					follow A2
B7		UM5 device	UM5 device		follow A3
B8	Cross-channel interference	UM1 device	UM1 device		follow A1
B9					follow A2
B10		UM5 device	UM5 device		follow A3

Appendix: Table of the recommended simulation scenarios in this document (Cont')

Scenario C for "Signal Acquisition"				
Scenario #	**UM**	**Channel model (type of Tx antenna & distance) *1**	**RX antenna model*2**	**RF impairments to be considered *3**
C1		AWGN	30 deg. Gaussian with side-lobe	None
C2	UM1	LOS Residential (30 deg. at 5m)		PA+phase-noise
C3		NLOS Residential (30 deg. at 5m)		
C4	UM5	LOS Office (30 deg. at 1 m)		

*1: refer to doc. "06-0195"   *2: refer to doc. "06-0474" *3: refer to doc. "06-0477"