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

Submission Title: [Path Loss due to Human Body Between Antennas]
Date Submitted: [12 July 2008]
Source: [Noh-Gyoung Kang(1), Chihong Cho(1), Seung-Hoon Park(1), Eun Tae Won(1), Jeong-Wook Kim(2), Joon-seong Kang(2) and Seong-Cheol Kim(2)]
Company: [(1) Samsung Electronics Co. Ltd., (2) Seoul National University]
Address: [416, Maetan-3dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, 443-742, Korea]
Voice: [+82-31-279-7325] **FAX:** [+82-31-279-5130] **E-Mail:** [gyoung.kang@samsung.com]

Re: [ ]

Abstract: [This document presents the information about the path loss due to human body between antennas in wearable BAN systems]

Purpose: [To provide some measurement results for wearable BAN]

Path Loss due to Human Body Between Antennas

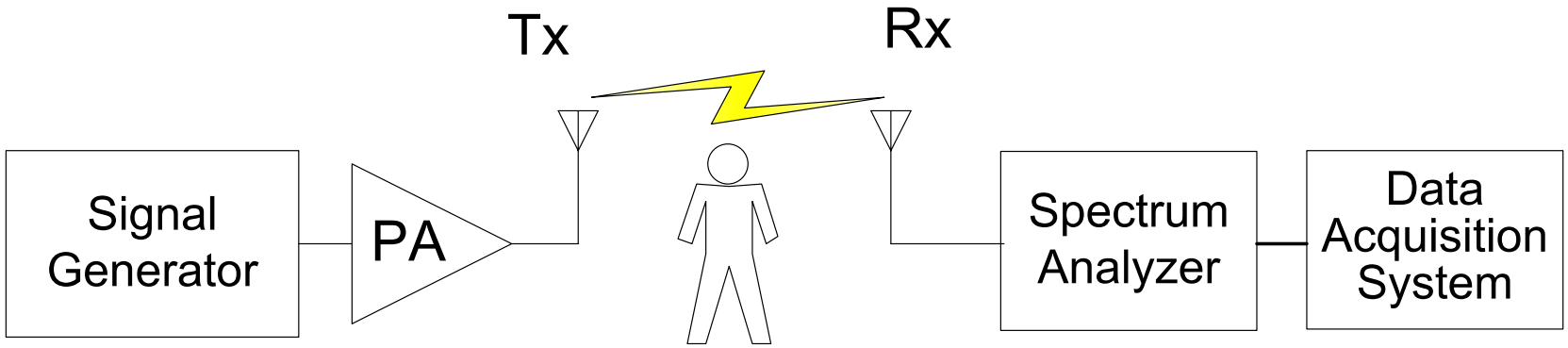
Noh-Gyoung Kang

Samsung Electronics Co. Ltd.

Introduction

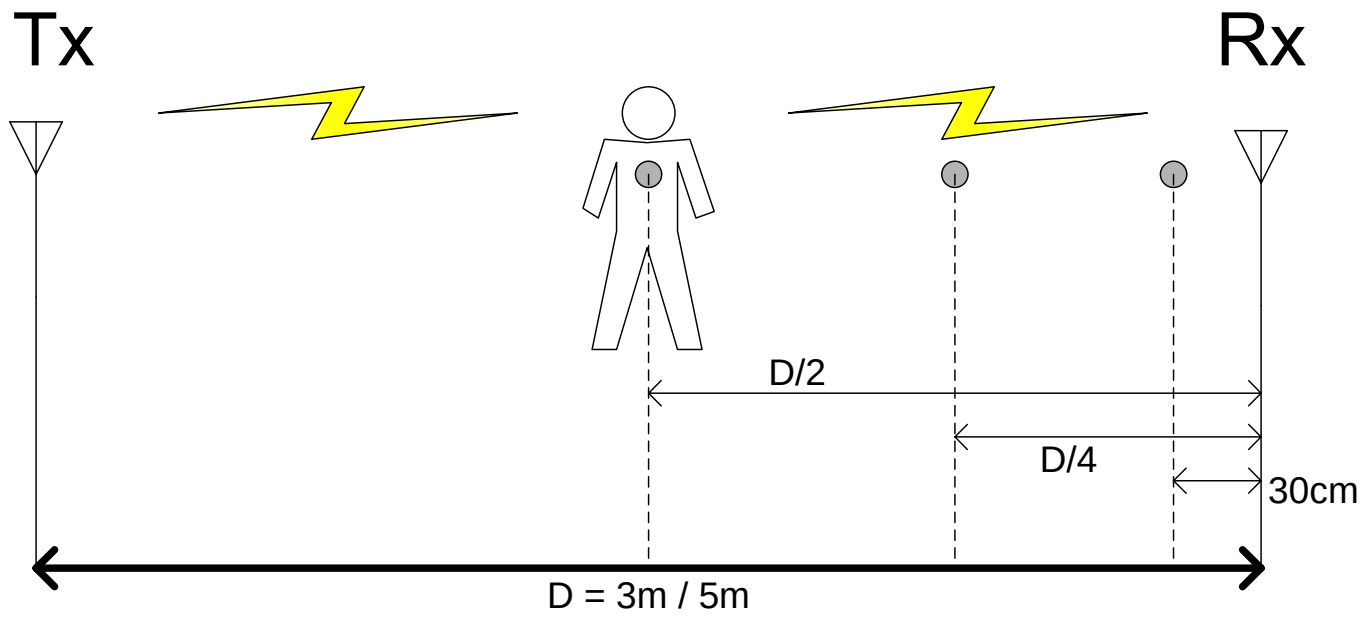
- Wearable BAN
  - Consider human body shadowing effects
  - One's own body and the others
- Distance between body and receiver antenna
  - Reciprocity of transmitter and receiver
  - Near case : crowded place
  - Apart case : general usage cases

Measurement Systems



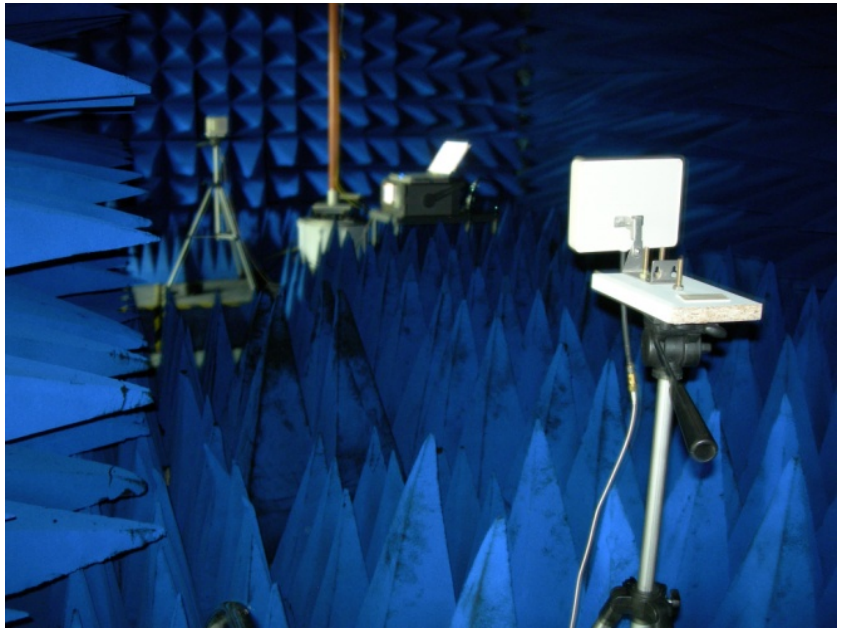
- Measurement Systems
  - Center Frequency : 2.4 GHz
  - Antenna Types : Patch Antennas
  - Environments : Anechoic Chamber (@SNU)
  - Measure and save received signal strength using signal generator, power amplifier, spectrum analyzer and data acquisition system

Measurement Scenarios

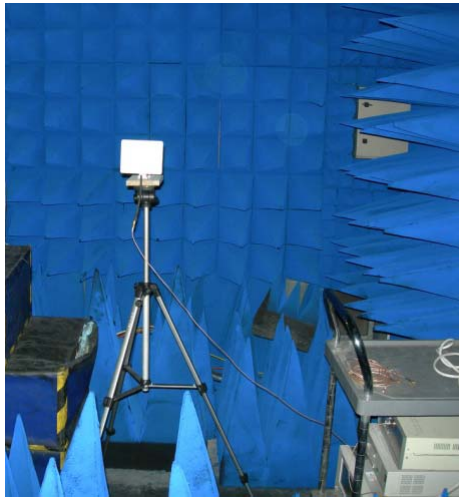


- Tx-Rx antenna distance (D) : 3m / 5m
  - Human position : 30cm, D/4 and D/2 apart from Rx antenna
  - Human direction : front and side direction between antennas

Measurement systems and Environments



Measurement Systems



Transmitter

Receiver

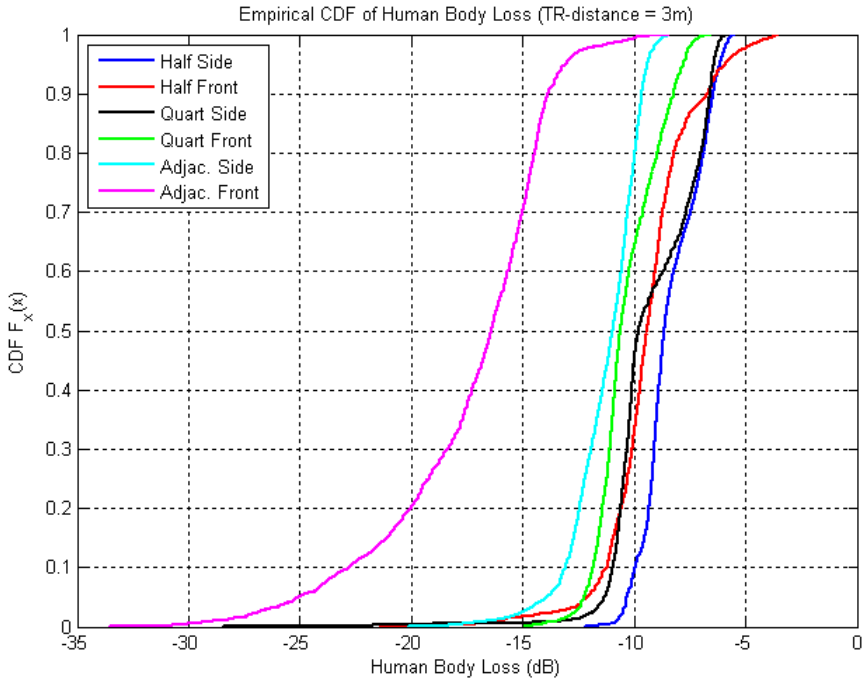
Measurement systems and Scenarios

Front direction

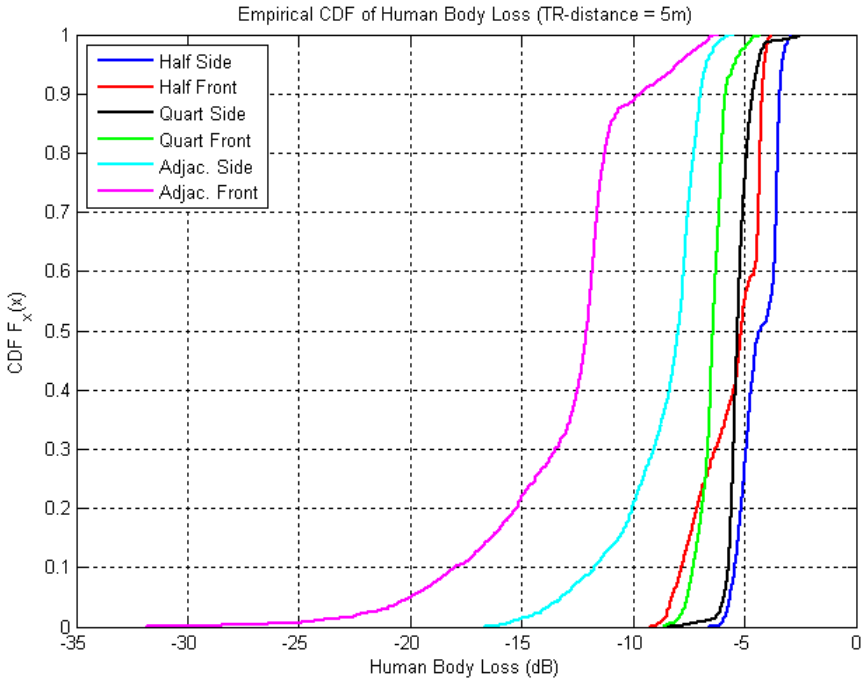
Side direction

Measurement Results (1)

- CDF plot of human body losses



Tx-Rx distance = 3 m



Tx-Rx distance = 5 m

Measurement Results (2)

- Body losses

TR separation	Distance from Rx	Body orientation	Loss (dB)		
			Median	Worse (2σ)	Worst (5σ)
3 m	Adjacent (0.3m)	Front	17	24	34
		Side	11	15	21
	Quarter (0.75m)	Front	11	14	16
		Side	10	14	29
	Half (1.5m)	Front	10	14	22
		Side	9	12	13
5 m	Adjacent (0.3m)	Front	13	19	32
		Side	8	12	17
	Quarter (1.25m)	Front	7	8	9
		Side	6	7	9
	Half (2.5m)	Front	6	8	10
		Side	5	6	7
Probability			50 %	4.56 %	0.000233 %

Conclusion

- Wearable BAN
  - Measure human body shadowing effects
    - Position from Rx antenna
    - Direction to LOS line
- Future Works
  - Channel measurements in office environments
  - Frequency bands : 2.4GHz ISM band, UWB band
  - Four possible scenarios
    - From on-body to air
    - From one man to another
    - From on-body to on-body
    - Body in motion
- The results and models will be reported in next F2F meeting

Thank You !!!

Q & A