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

Submission Title: [Empirical channel model for wearable BAN]
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Abstract: [This document presents the information about the empirical channel model for wearable BAN systems]

Purpose: [To provide some channel model for wearable BAN]

Empirical channel model for wearable BAN

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Introduction

- Implant BAN
  - Inside body or on-body device (sensor)
  - Low data rate
  - MICS : 402~405 MHz
- Wearable BAN
  - On-body and air
  - High data rate
  - Frequency bands
    - ISM : 902~928 MHz, 2.4~2.5 GHz, 5.725~5.875 GHz
    - UWB : 3.1~10.6GHz

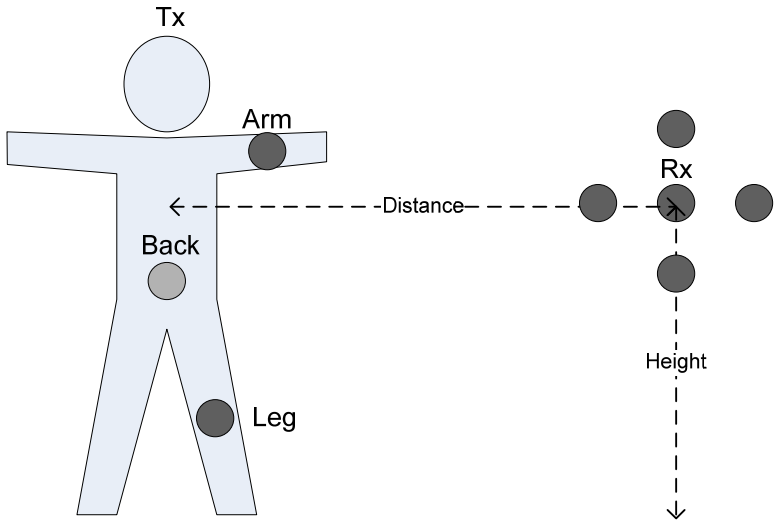
Wearable BAN Channel Modeling

- Scenario 1
  - From on-body to air
- Scenario 2
  - From one man to another
- Scenario 3
  - From on-body to on-body
- Scenario 4
  - Body in motion

- Measurement Places
  - Anechoic chamber
  - Office Environment

Wearable BAN Channel Modeling

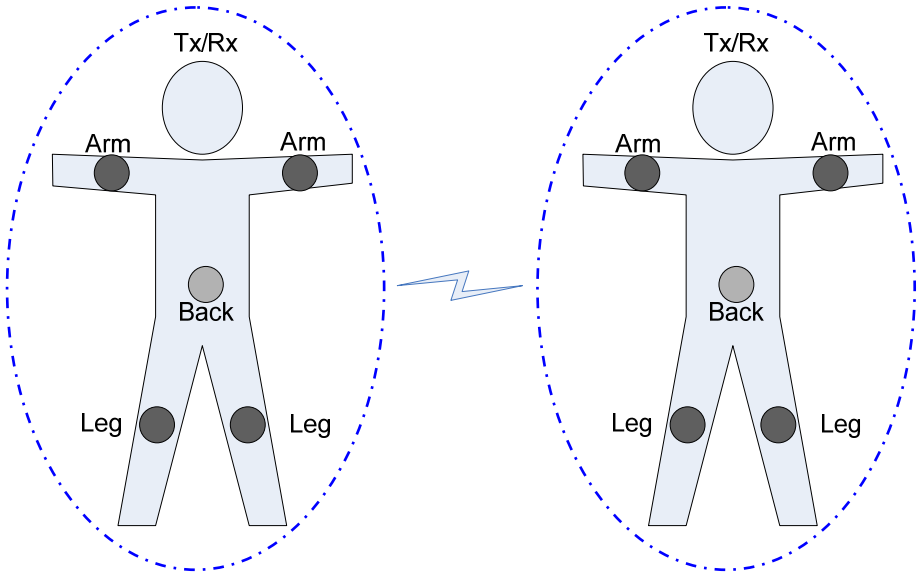
- Scenario 1
  - From on body to air
  - Measurement Places
    - Anechoic chamber
    - Offices



- Goals
  - Anechoic chamber : basic properties
  - Offices : channel models in real environments
  - Body-shadowing effects

Wearable BAN Channel Modeling

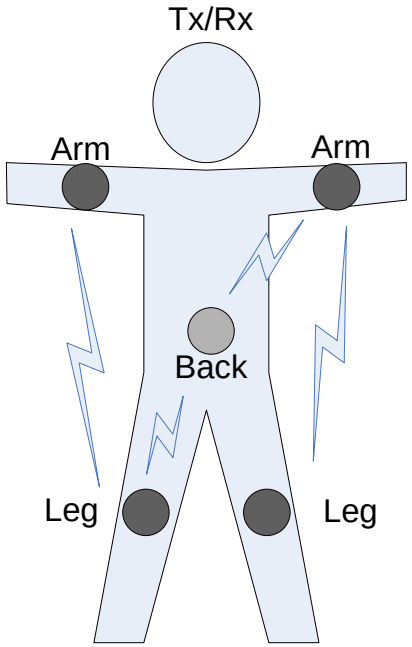
- Scenario 2
  - From one man to another
  - Measurement Places
    - Anechoic chamber
    - Offices



- Goals
  - Reliable channel model for ad-hoc gaming or interference
  - Body-shadowing effects

Wearable BAN Channel Modeling

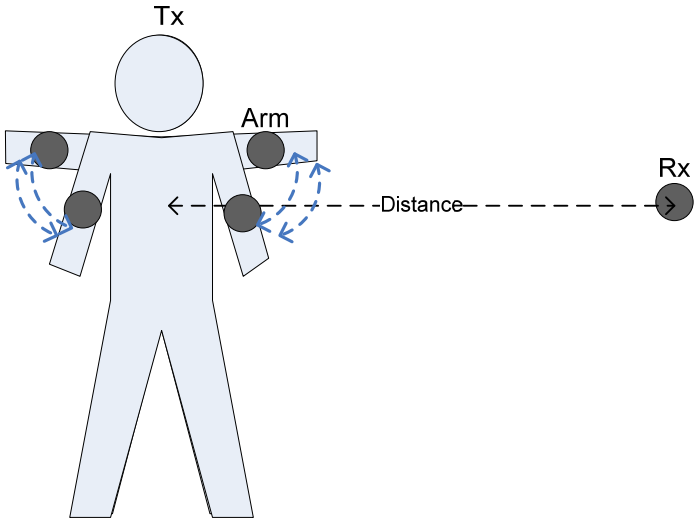
- Scenario 3
  - From on body to on body
  - Measurement Places
    - Anechoic chamber
    - Offices



- Goals
  - Reliable channel model for body motion recognition
  - Accurate channel model
    - With various antenna positions

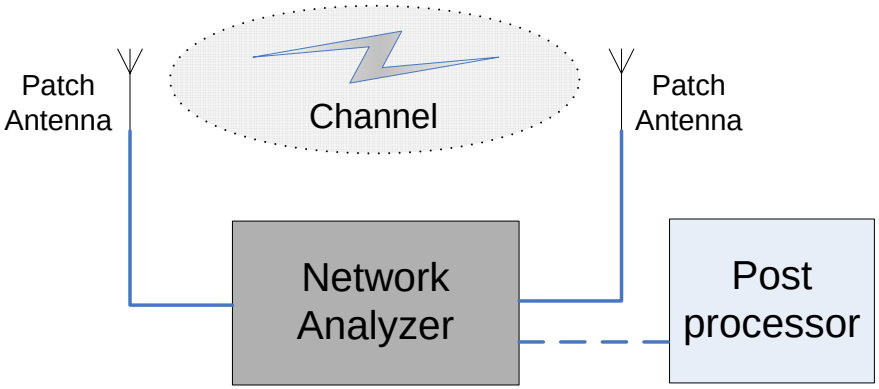
Wearable BAN Channel Modeling

- Scenario 4
  - Body in motion
  - Measurement Places
    - Anechoic chamber
    - Offices

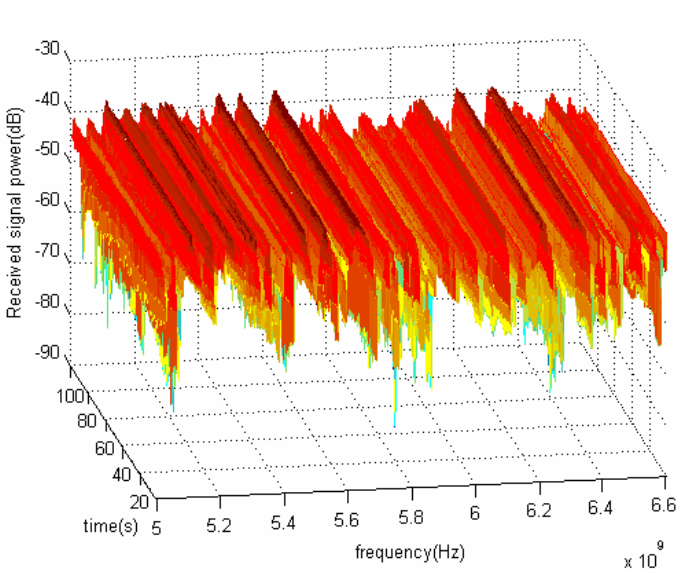


- Goals
  - Robust channel model for body motion game
  - Analyze motion effects in time interval
    - Split time interval to measure time-varying channel properties using network Analyzer

Channel Measurement Systems



System block diagram



Measurement example

- Measure S21 channel parameter using Network Analyzer
- Channel transfer function with channel gain and phase difference

Channel Measurement Systems

- Post process
  - Define channel impulse response using IFFT in Post Processor
  - Analyze channel characteristics using channel impulse response
    - Path loss, maximum excess delay, delay time distribution, etc.
- Antenna, Cable and Calibration
  - Use patch antenna to limit body absorption
  - Use low-loss cable to control other effects
  - Calculate noise margin
  - Determine which level of received signals is valid

Conclusion

- Perform wearable BAN channel measurements
  - Frequency bands : some ISM bands and UWB bands
  - Two environments and four scenarios
- Future Schedule
  - Channel measurements : by July 2008
  - Analysis and modeling : by September 2008
- The results and models will be reported to TG6

Thank You !!!

Q & A