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

Submission Title: [Performance degradation due to PDA jitter in UM5 simulation ]

Date Submitted: [November 2, 2006]

Source: [Yozo Shoji1, Chang-Soon Choi1, Hirokazu Sawada1, Shuzo Kato1, Ichihiko Toyoda2, Kenichi Kawasaki3, Yasuyuki Oishi4, Kazuaki Takahashi5, Hiroyuki Nakase6]

Company [NICT1, NTT2, SONY3, FUJITSU4, Panasonic(Matsushita)5, Tohoku University6]


Voice:[+81-46-847-52951, +81-46-859-23662, +81-3-5795-78793, +81-46-839-53734, +81-3-6710-20296, +81-22-217-55316]

FAX: [+81-46-847-54401, +81-46-855-14972, +81-3-5795-73853, +81-46-839-55604, +81-3-6710-39155, +81-22-217-55336]

E-Mail:[shoji@nict.go.jp1, cschoi@nict.go.jp1, sawahiro@nict.go.jp1, shu.kato@nict.go.jp1, toyoda.ichihiko@lab.ntt.co.jp2, Kenichi.Kawasaki@jp.sony.com3, yasu@labs.fujitsu.com4, takahashi.kazu@jp.panasonic.com5, nakase@riec.tohoku.ac.jp6]

Re: []

Abstract: [Suggestion of how to consider the degradation due to PDA jitter in UM5 simulation ]

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

Notice: This document has been prepared to assist the IEEE P802.15. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.

Release: The contributors acknowledge and accept that this contribution becomes the property of IEEE and may be made publicly available by P802.15.
Performance degradation due to PDA jitter in UM5 simulation

Yozo Shoji, Chang-Soon Choi, Hirokazu Sawada, Shuzo Kato (NiCT)
Ichihiko Toyoda (NTT)
Kenichi Kawasaki (Sony)
Yasuyuki Oishi (FUJITSU)
Kazuaki Takahashi (Panasonic (Matsushita))
Hiroyuki Nakase (Tohoku University)
Background

- UM5 (Kiosk file-downloading) was chosen as one of 5 Usage Models at the Melbourne meeting
- It was determined that “degradation due to PDA jitter needs to be considered in the simulation”
- NICT volunteered to investigate PDA jitter characteristics for UM5
Purpose of this document

- To investigate the effect of PDA jitter on millimeter-wave channels

- To show the guideline about how we should consider the PDA jitter effect in UM5
Test setup and condition

Transmitter antenna  | Receiver antenna

![Appearance of test setup to investigate PDA jitter effect](image)

- Appearance of test setup to investigate PDA jitter effect
Test setup and condition (cont’)

- Observed link response between Kiosk-file server and PDA receiver during 20-second test communications by using network analyzer

- Asked 4 volunteers to perform 5 trials
  (4 volunteers x 5 trials = 20 data sets were obtained)

- Did not give any information related to optimum alignment and jitter value to the volunteers at the start of and during the test
Main specifications of test

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>62.5 GHz</td>
</tr>
<tr>
<td>Sweep time / measured points</td>
<td>20 secs. / 801 points</td>
</tr>
<tr>
<td>Beam-width of Tx antenna</td>
<td>60 degree</td>
</tr>
<tr>
<td>Beam-width of Rx antenna</td>
<td>30 degree</td>
</tr>
<tr>
<td>Transmission distance</td>
<td>1 meter</td>
</tr>
<tr>
<td>Number of test results</td>
<td>20 sets (4 volunteers x 5 trials)</td>
</tr>
<tr>
<td>Calibration</td>
<td>Performed with 1 m transmission for Tx and Rx antennas (fixed position)</td>
</tr>
</tbody>
</table>
Examples of test results

- PDA jitter causes small received signal amplitude fluctuation during communications

**Measured data for volunteer “A”**

(Relative received signal amplitude vs. Communicating time)  **Histogram analysis of measured data for volunteer “A”**
Summary of all test results

Maximum received signal amplitude deviation due to PDA jitter was less than 0.7 dB for all measured data sets.
Summary of all test results (cont’)

- PDA jitter results in a 0.45 dB amplitude deviation with 99 % probability
- Effect of PDA jitter on mmW channels can be regarded as a small amplitude modulation effect or negligibly small

CDF vs. Relative received amplitude

Magnified view of CDF vs. Relative received signal amplitude
Summary

- Investigated the effect of PDA jitter on millimeter-wave channels

- PDA jitter resulted in a 0.45 dB amplitude fluctuation with 99% probability

- PDA jitter hardly gives impact on mmW channels from the viewpoint of system design
Motion

We shall include the result of the document 15-06-0440-01-003c in the usage model document with the conclusion that the effect of Jitter on UM5 in document 06-0369-08-003c is negligible. Moved by A. Sadri and seconded by J. Gilb.

- Yes:
- No
- Abstain

Motion passed by Acclamation
Supplementary data

Measured data for volunteer “B”
(Relative received signal amplitude vs. Communicating time)

Histogram analysis of measured date for volunteer “B”
Supplementary data (cont’)

Measured data for volunteer “C”
(Relative received signal amplitude vs. Communicating time)

Histogram analysis of measured date for volunteer “C”

Number of samples

Relative received signal amplitude [dB]

Communicating time [sec]

Relative received signal amplitude [dB]
Supplementary data (cont’)

Measured data for volunteer “D”
(Relative received signal amplitude vs. Communicating time)

Histogram analysis of measured date for volunteer “D”
(Relative received signal amplitude vs. Communicating time)
Supplementary data (cont’)

Spectrum analysis of measured data for all volunteers time data

- Fluctuation speed is about 4 Hz