

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

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

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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]

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Performance degradation due to PDA jitter in UM5 simulation

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Background

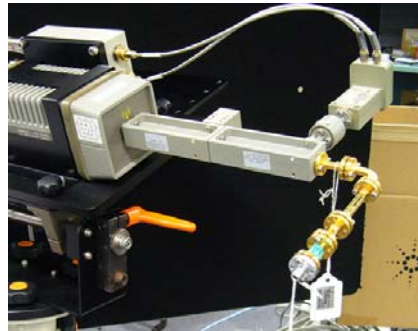
- UM5 (Kiosk file-downloading) was chosen as one of 5 Usage Models at the Melbourne meeting
- It was determined that “degradation due to PDA jitter needs to be considered in the simulation”
- NICT volunteered to investigate PDA jitter characteristics for UM5

Purpose of this document

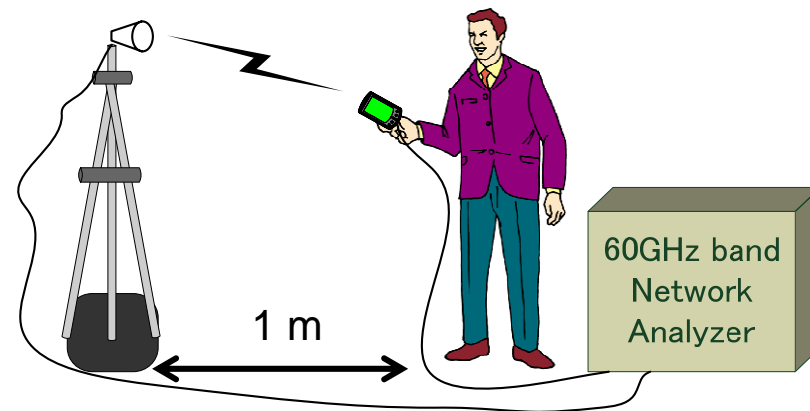
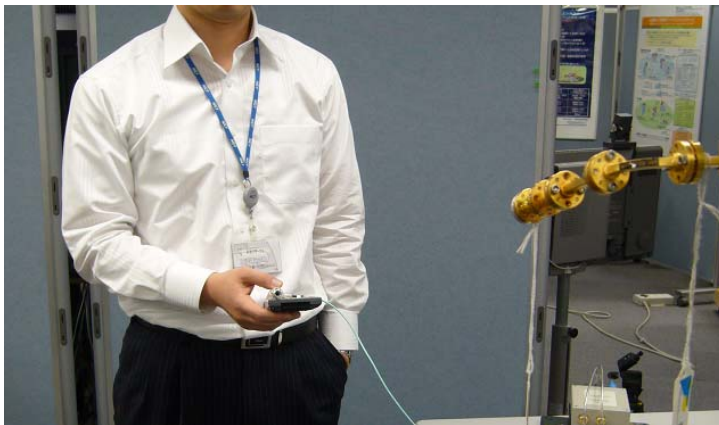
- To investigate the effect of PDA jitter on millimeter-wave channels
- To show the **guideline** about how we should consider the PDA jitter effect in UM5

Test setup and condition

Transmitter antenna



Receiver antenna



■ Appearance of test setup to investigate PDA jitter effect

Test setup and condition (cont')

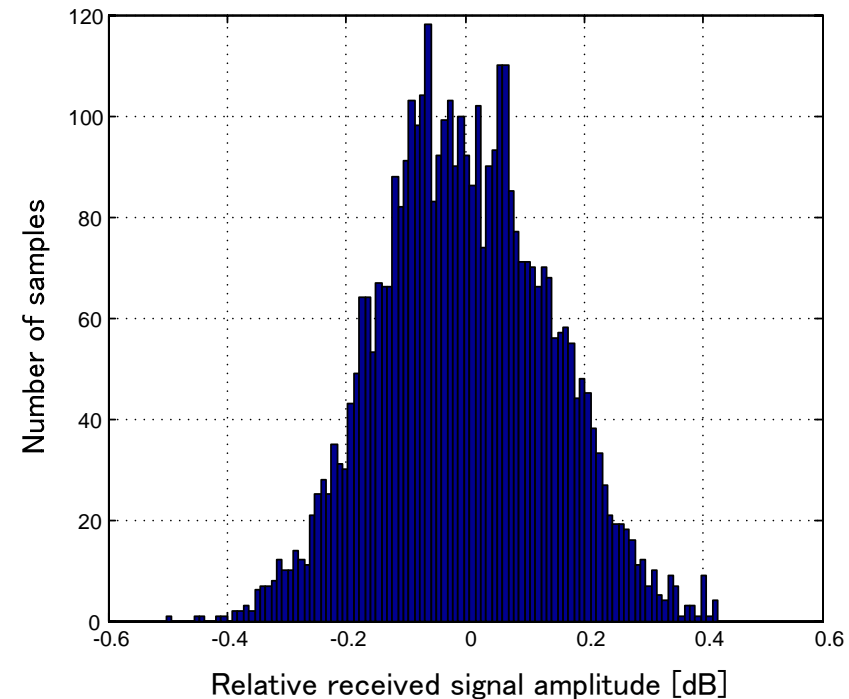
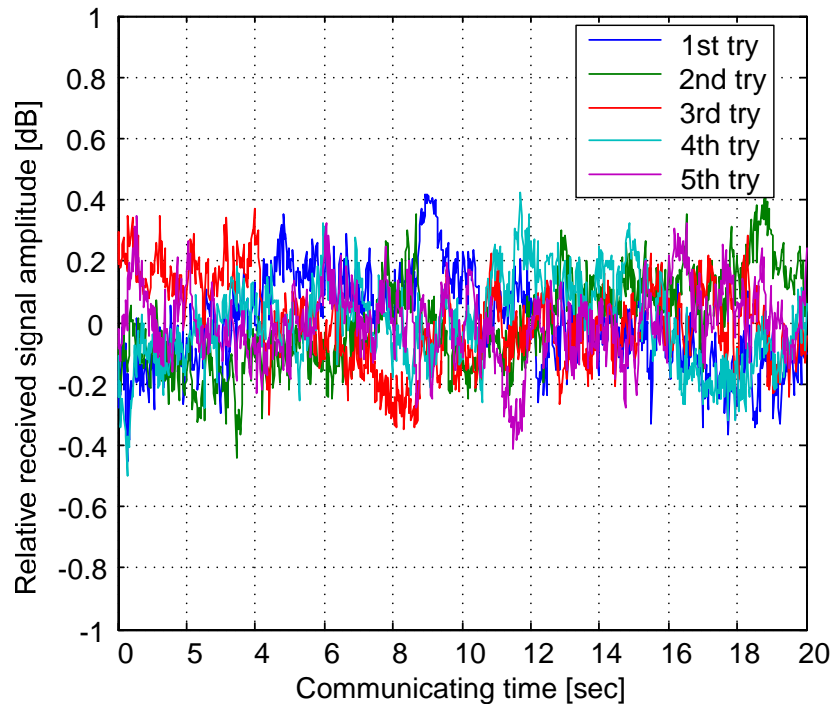
- Observed link response between Kiosk-file server and PDA receiver during 20-second test communications by using network analyzer
- Asked 4 volunteers to perform 5 trials
(4 volunteers x 5 trials = 20 data sets were obtained)
- Did not give any information related to optimum alignment and jitter value to the volunteers at the start of and during the test

Main specifications of test

| | |
|------------------------------|-------------------------------------------------------------------------|
| Frequency | 62.5 GHz |
| Sweep time / measured points | 20 secs. / 801 points |
| Beam-width of Tx antenna | 60 degree |
| Beam-width of Rx antenna | 30 degree |
| Transmission distance | 1 meter |
| Number of test results | 20 sets (4 volunteers x 5 trials) |
| Calibration | Performed with 1 m transmission for Tx and Rx antennas (fixed position) |

Examples of test results

- PDA jitter causes small received signal amplitude fluctuation during communications



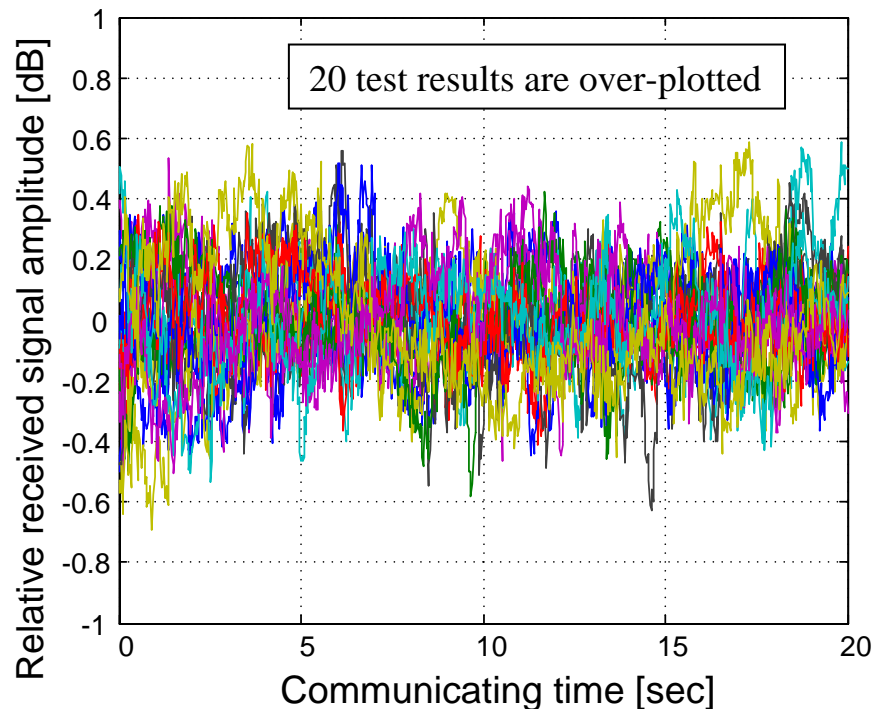
Measured data for volunteer "A"

(Relative received signal amplitude vs. Communicating time)

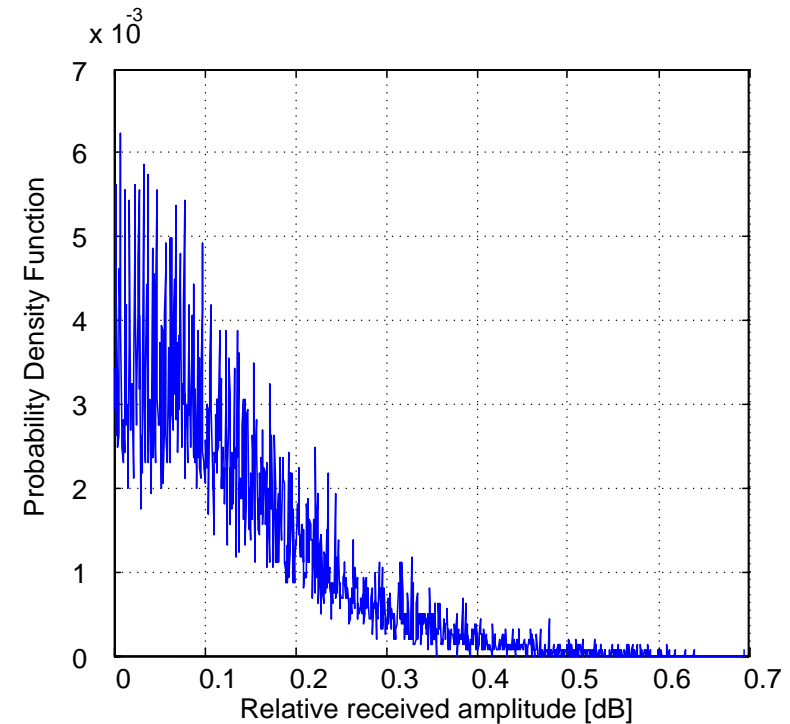
Histogram analysis of measured data for volunteer "A"

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



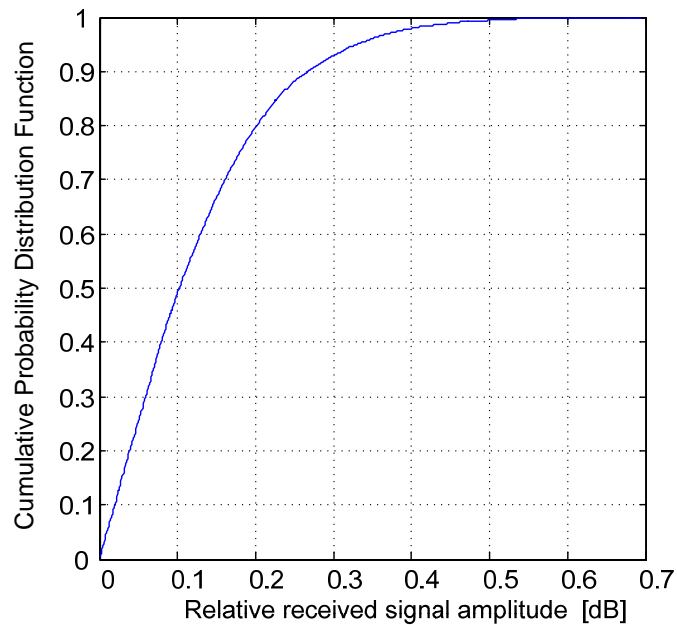
Measured data for all volunteers (Relative received signal amplitude vs. Communicating time)



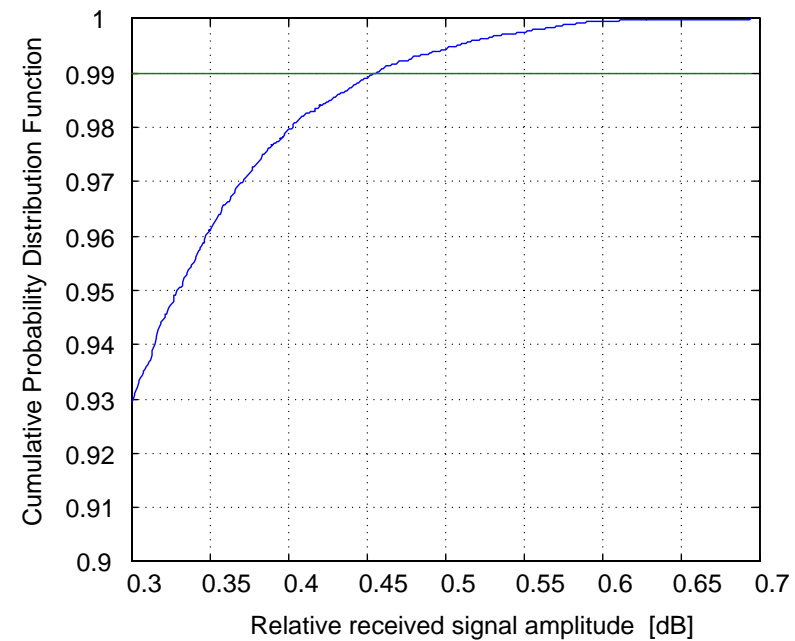
Probability density function vs. Relative received signal amplitude

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

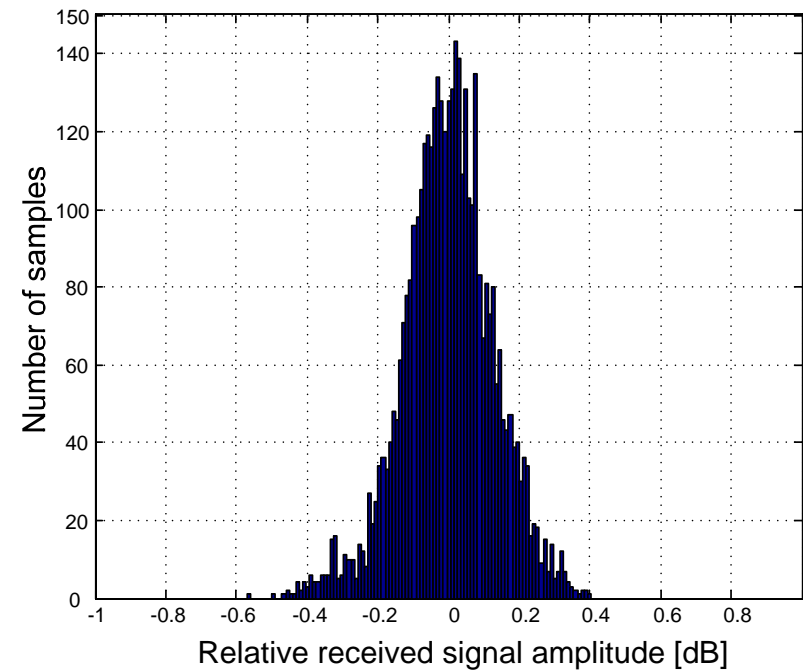
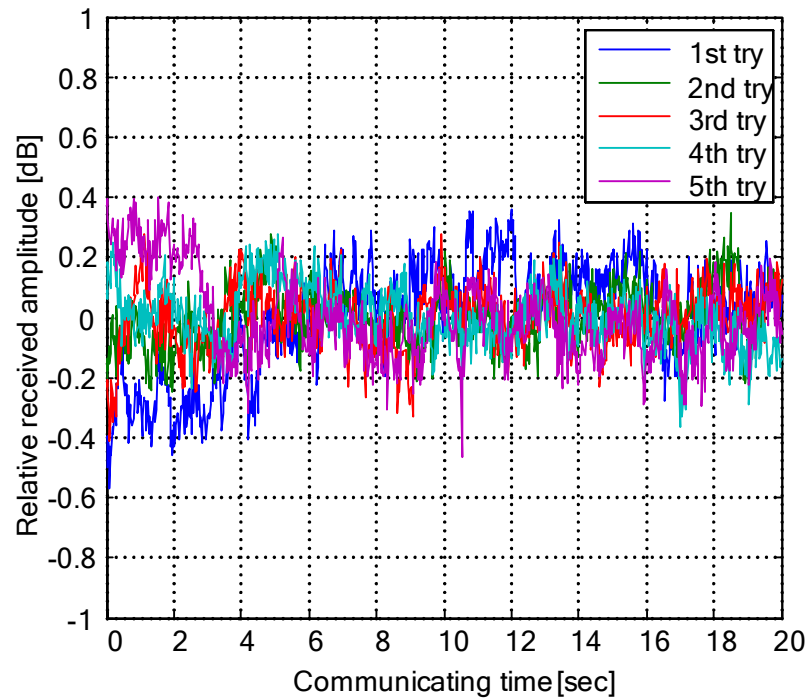
- Investigated the effect of PDA jitter on millimeter-wave channels
- PDA jitter resulted in a 0.45 dB amplitude fluctuation with 99 % probability
- PDA jitter hardly gives impact on mmW channels from the viewpoint of system design

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

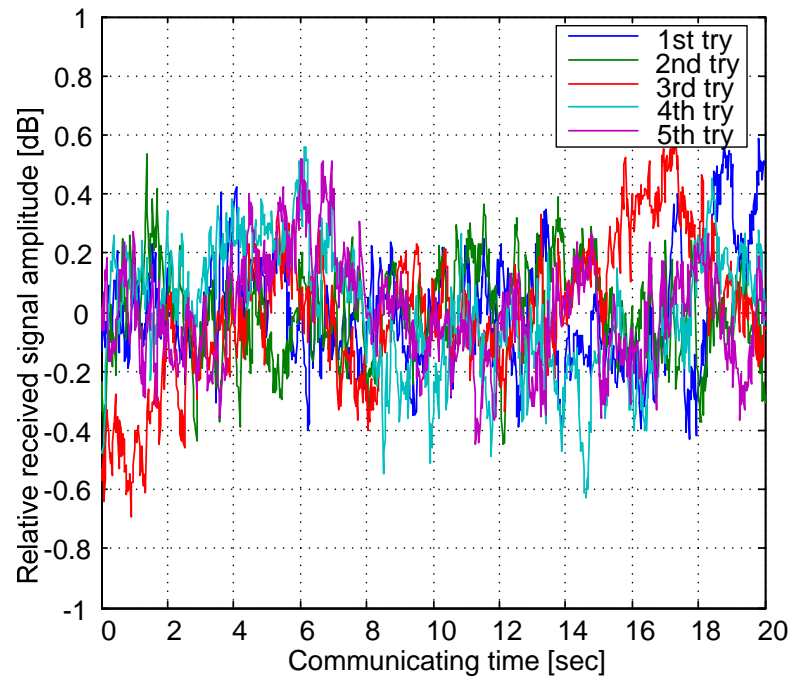
Supplementary data



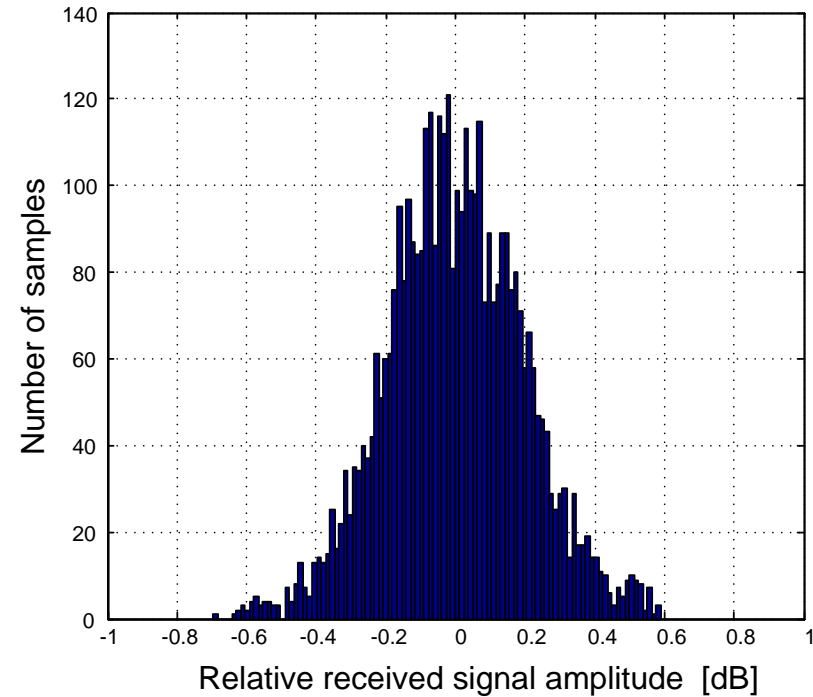
**Measured data for volunteer “B”
(Relative received signal amplitude vs. Communicating time)**

Histogram analysis of measured data for volunteer “B”

Supplementary data (cont')

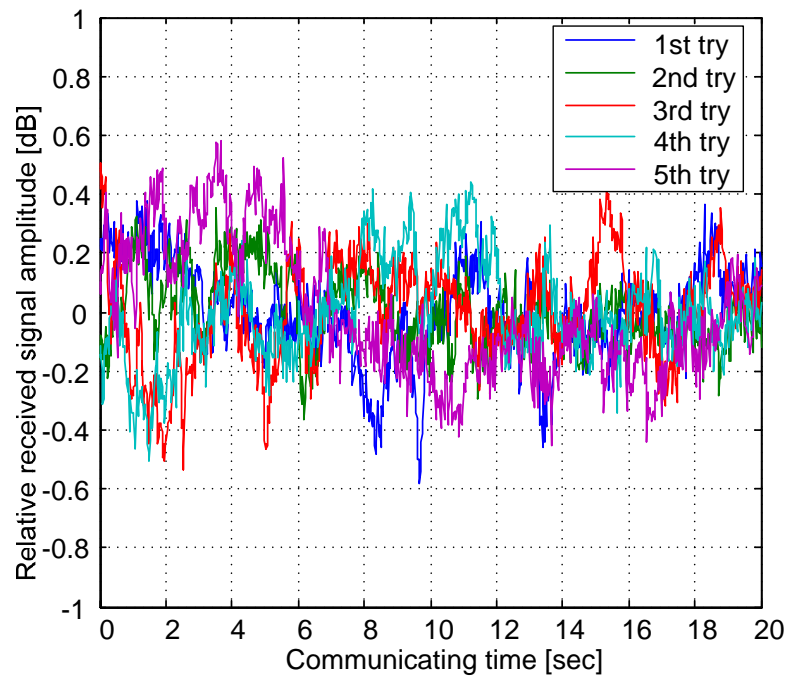


Measured data for volunteer "C"
(Relative received signal amplitude vs. Communicating time)

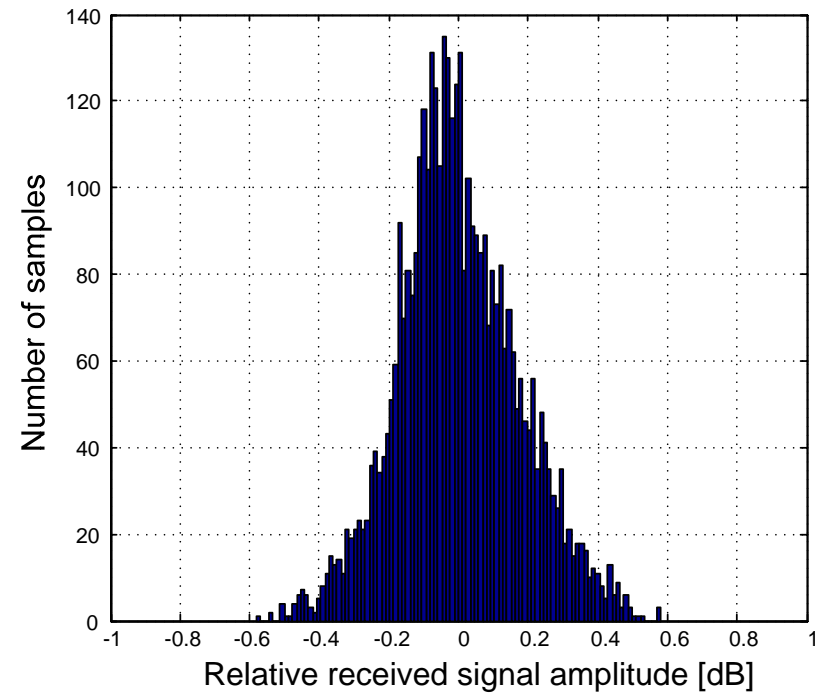


Histogram analysis of measured data for volunteer "C"

Supplementary data (cont')

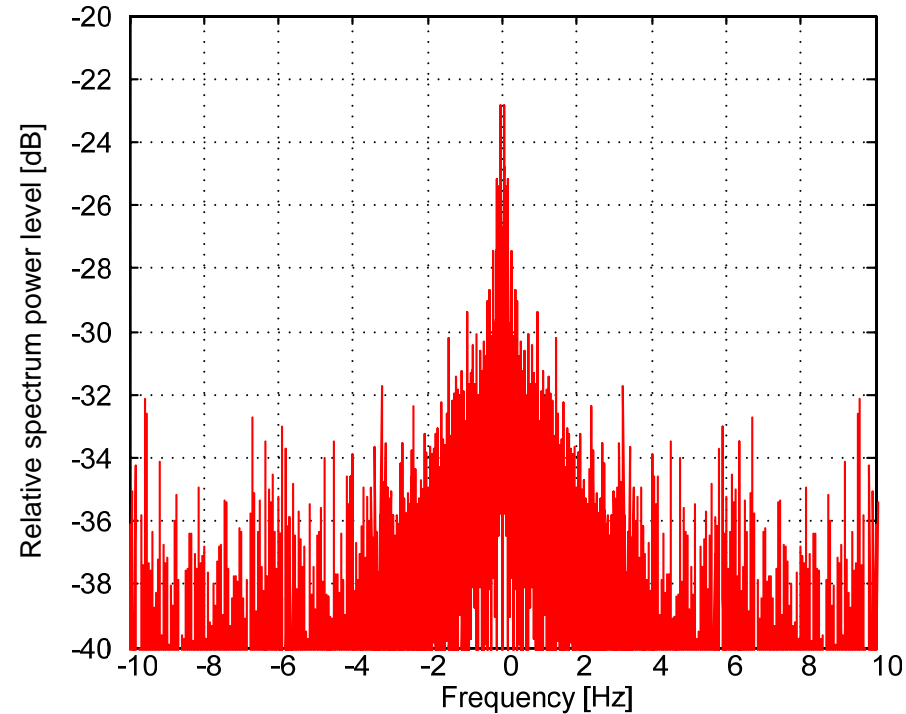


Measured data for volunteer "D"
(Relative received signal amplitude vs. Communicating time)



Histogram analysis of measured data for volunteer "D"

Supplementary data (cont')



Spectrum analysis of measured data for all volunteers time data

■ Fluctuation speed is about 4 Hz