

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

Submission Title: [Channel modeling of human body communication]

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Re: []

Abstract: [Introduction of the channel model of human body communication]

Purpose: [To introduce the channel model of the human body communication]

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Channel modeling of the human body communication

2008. 9. 8.

Human Body Communication SoC Team

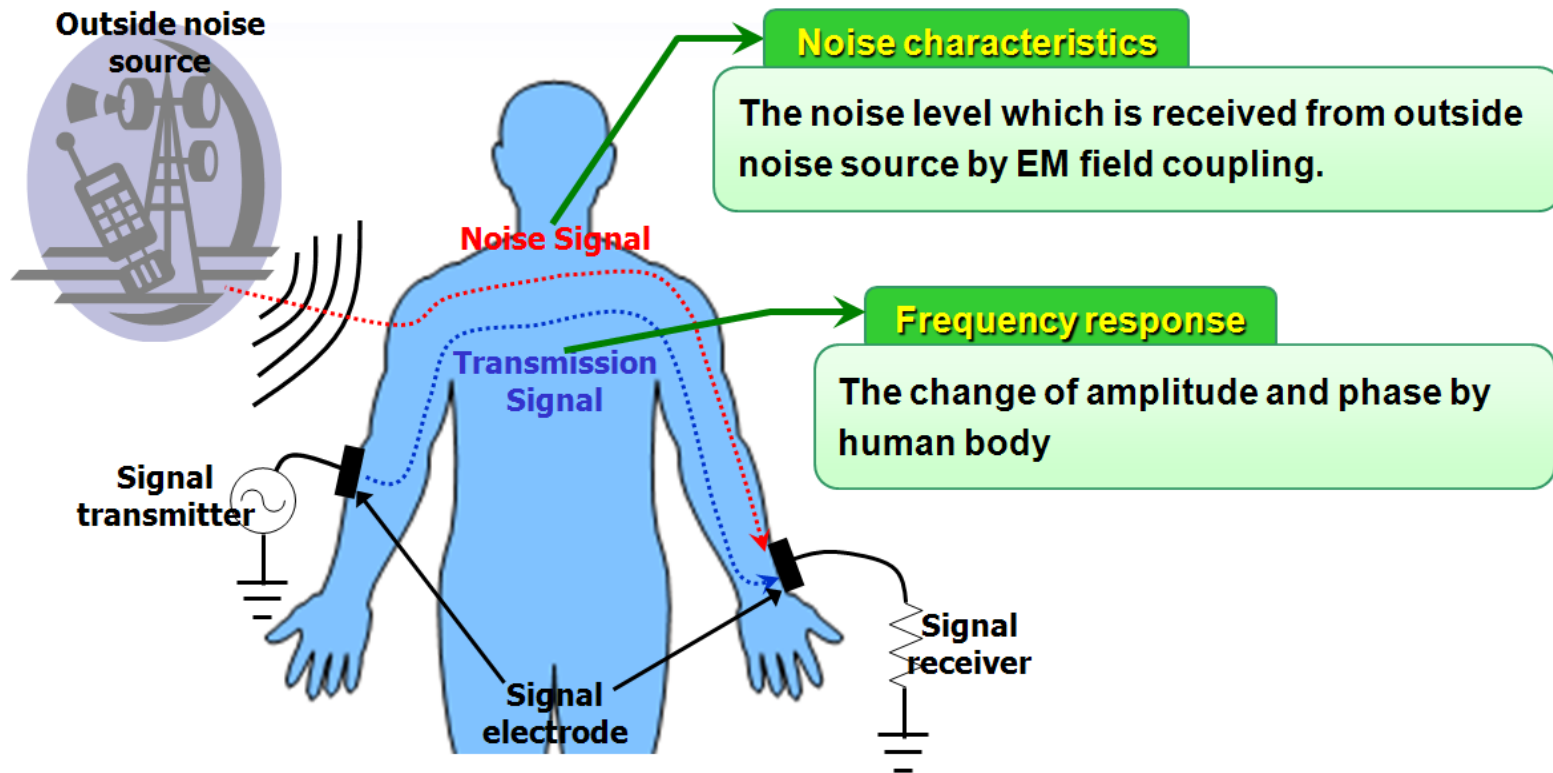
Jung-hwan Hwang / Hyoung-II Park

/ Sung-Weon Kang

ETRI

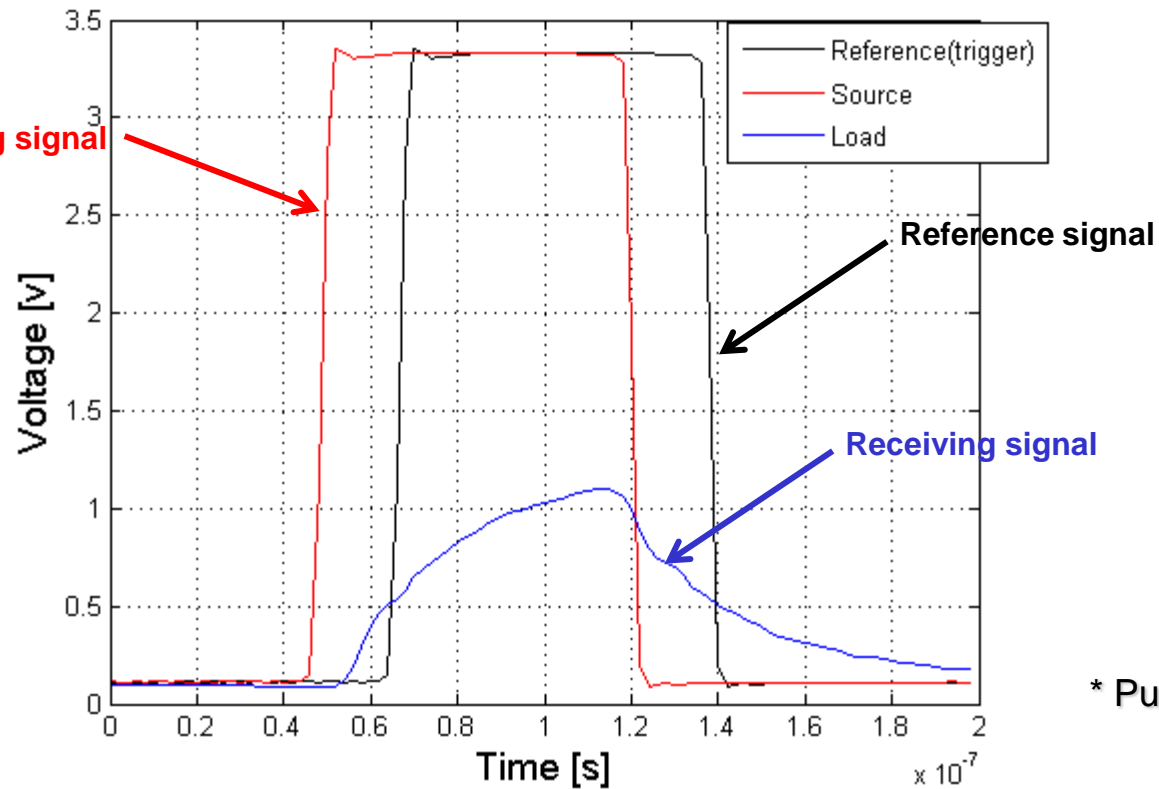
HBC Channel Model

- The channel model is composed of the frequency response and the noise characteristics.

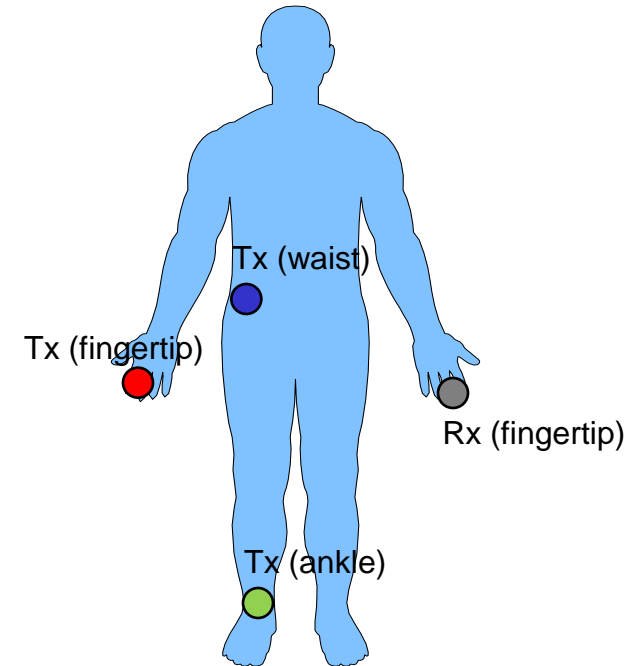
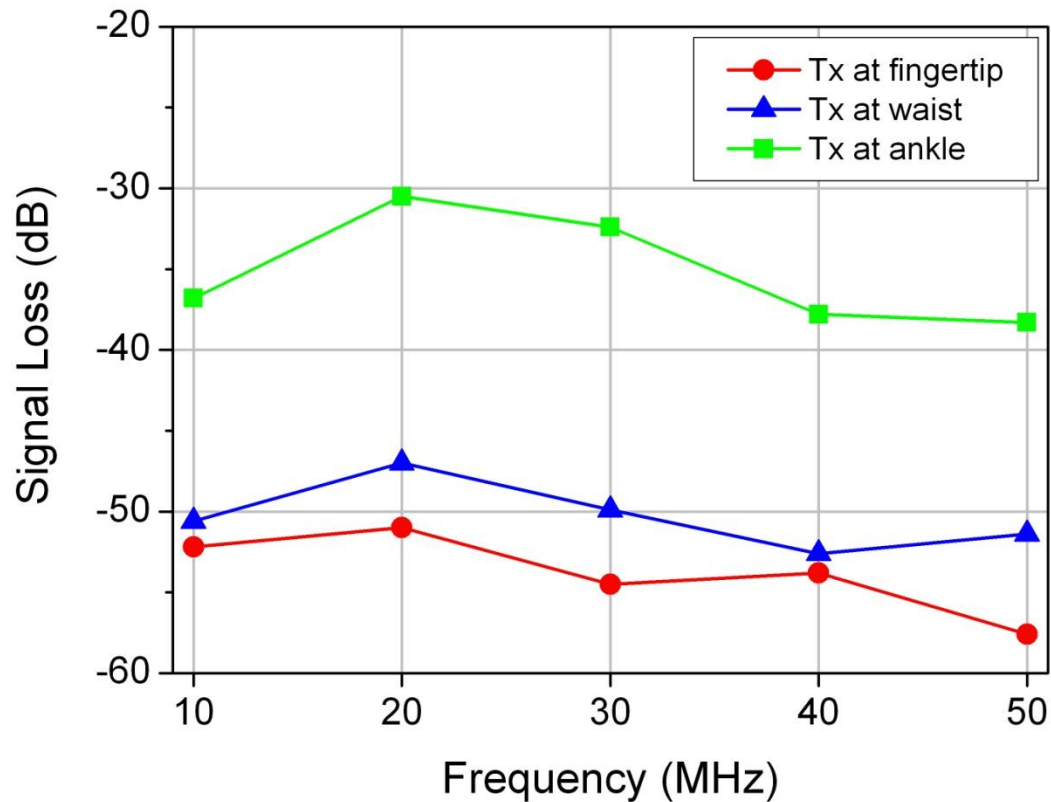


Measurement of Frequency Response

- A pulse signal is used for the frequency response.



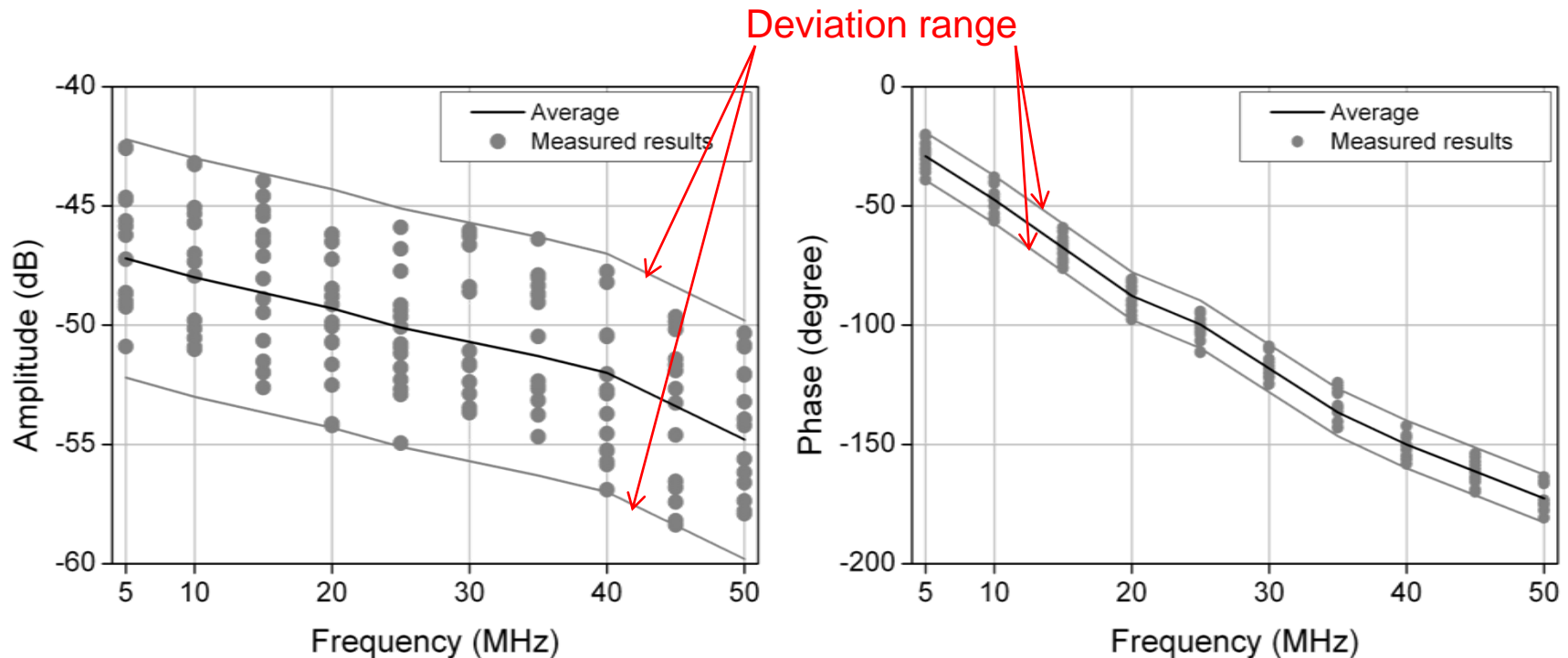
Signal Loss Vs. Tx Location



- The signal loss has maximum value in the case of fingertip.

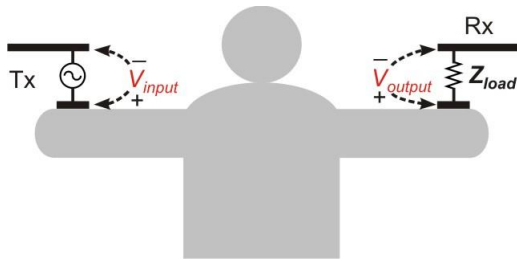
Deviation Range

- Each individual person has different frequency responses.
- The deviation of frequency response can be modeled as uniform distribution in the deviation range.



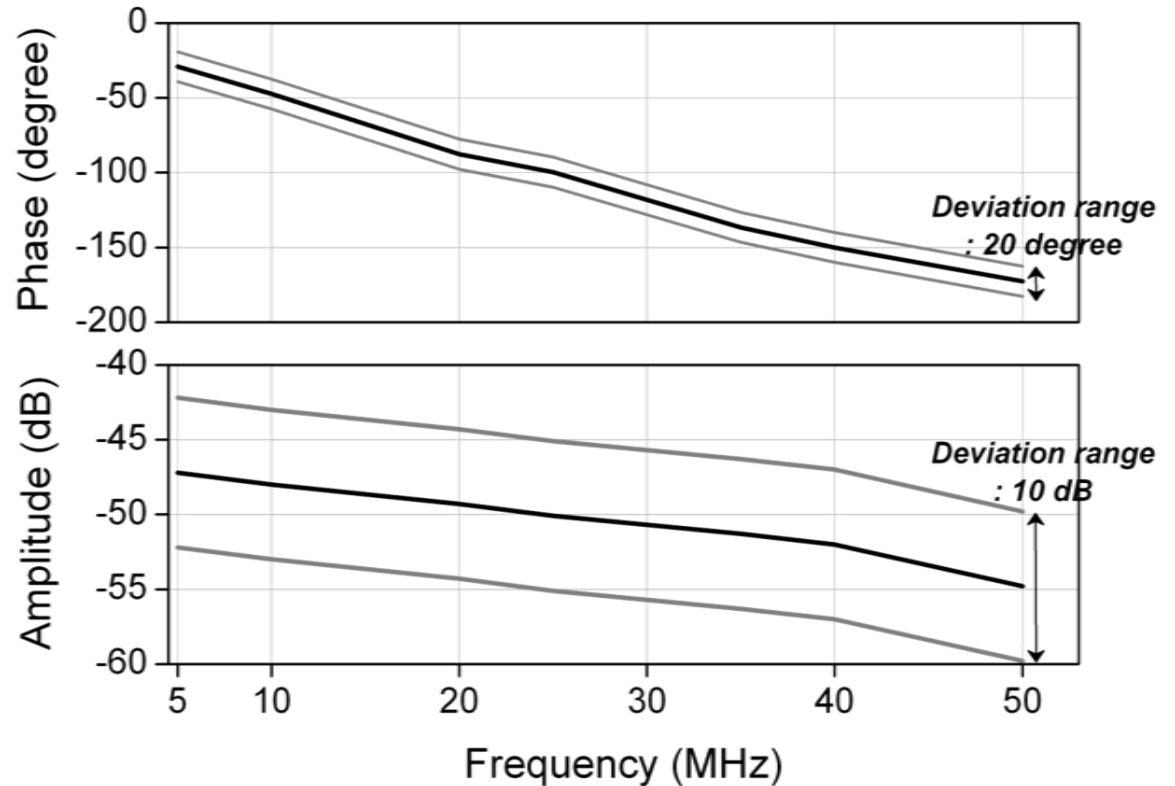
Frequency Response

- The frequency response has been modeled in the frequency range of 5 MHz – 50 MHz.



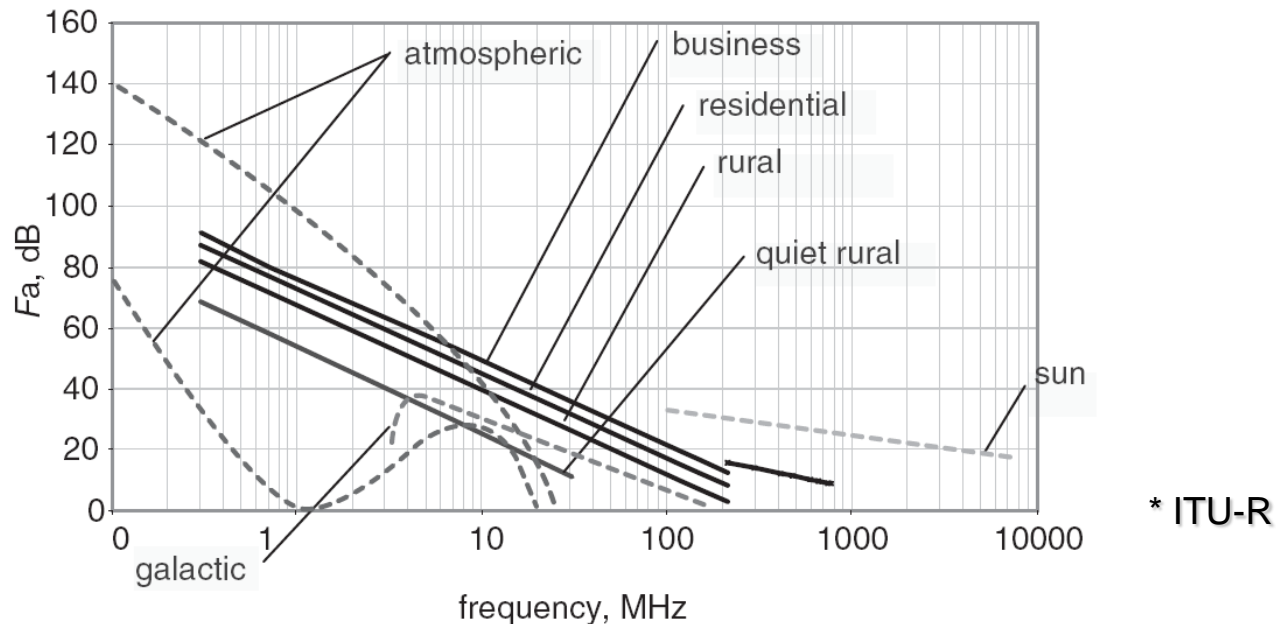
$$\text{Amplitude} = \frac{|V_{\text{output}}|}{|V_{\text{input}}|}$$

$$\text{Phase} = \frac{\angle V_{\text{output}}}{\angle V_{\text{input}}}$$



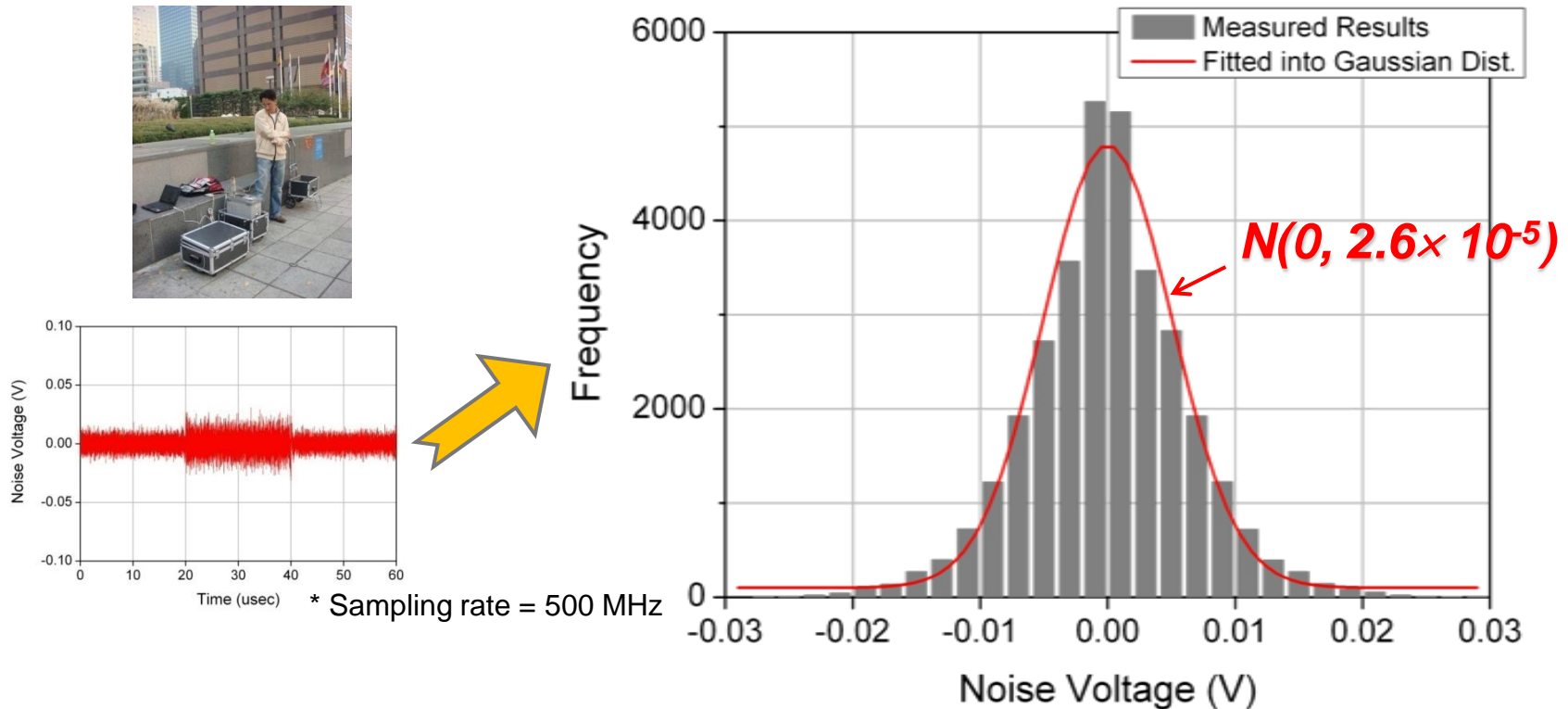
Man-made Noise

- The man-made noise means an unintended radiation from electrical machinery, electrical equipments and power transmission lines.



- In the human body communication, the noise is received through body, not antenna.

Measured Noise



- The measured noise has a Gaussian distribution.
- Considering multiple noise sources, the Gaussian distribution is reasonable.

Noise Characteristics

- The noise has been measured on various sites for a longtime and the maximum variance value has been used in the noise modeling.

Location	Mean	Variance
Myoung-Dong, Pascucci	-1.8×10^{-6}	2.6×10^{-5}
ETRI Laboratory	-2.0×10^{-5}	1.7×10^{-5}
Seoul Station	9.7×10^{-6}	1.4×10^{-5}
Central City	3.0×10^{-5}	3.2×10^{-6}
Dong-Dae-Moon Stadium	4.4×10^{-6}	1.3×10^{-5}
COEX	2.0×10^{-5}	3.4×10^{-6}
Subway 3 rd Line	1.0×10^{-5}	4.9×10^{-6}
Subway 2 nd Line	2.0×10^{-5}	6.2×10^{-6}
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Summary

- The channel model for the human body communication has been presented.
- The frequency response has been measured when the Tx and Rx are on each fingertip, but it covers other cases.
- Each measurement site has different variance values of noise, so the measurement on more various sites is needed.