

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

**Submission Title:** MAC Performance Evaluation of Multiple BAN Coexistence Under TG6ma Channel Model

**Date Submitted:** January 14th, 2025

**Source:** Daisuke Anzai<sup>1</sup>, Kosei Nagai<sup>1</sup>, Takumi Kobayashi<sup>1</sup>, Marco Hernandez<sup>2</sup>, Ryuji Kohno<sup>2</sup>

**Company:** <sup>1</sup>Nagoya Institute of Technology (NIT), Japan; <sup>2</sup>Yokosuka Research Park International Alliance Institute (YRP-IAI), Japan

**Address:** Gokiso-cho, Showa-ku, Nagoya, 466-8555, Japan

**Voice:** +81-52-735-5389, **FAX:** +81-52-735-5389, **E-Mail:** anzai@nitech.ac.jp

**Re:** In response to call for technical contributions

**Abstract:** This provides preliminary MAC performance evaluation results in a case of multiple BAN coexistence under the TG6ma channel model.

**Purpose:** Material for discussion in P802.15.6a TG corresponding to comments in EC Meeting

**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 contributor acknowledges and accepts that this contribution becomes the property of IEEE and may be made publicly available by P802.15.

# MAC Performance Evaluation of Multiple BAN Coexistence Under TG6ma Channel Model

Daisuke Anzai, Kosei Nagai, Takumi Kobayashi, Marco  
Hernandez, Ryuji Kohno

Nagoya Institute of Technology (NIT),  
YRP International Alliance Institute (YRP-IAI)

# Introduction

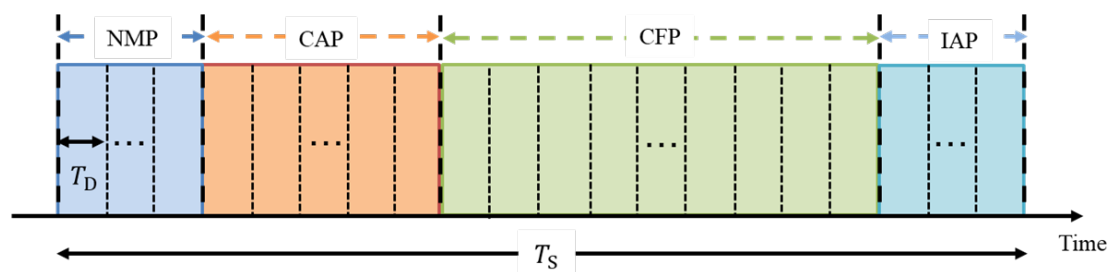
- In multiple BAN coexistence, we propose a **synchronous BAN coordination** to avoid packet collisions even between different BANs, which is **optimally managed** under multiple BAN coexistence situations
- We carry out fundamental MAC performance evaluation to demonstrate the importance of the proposed structure based on **the TG6ma channel model**



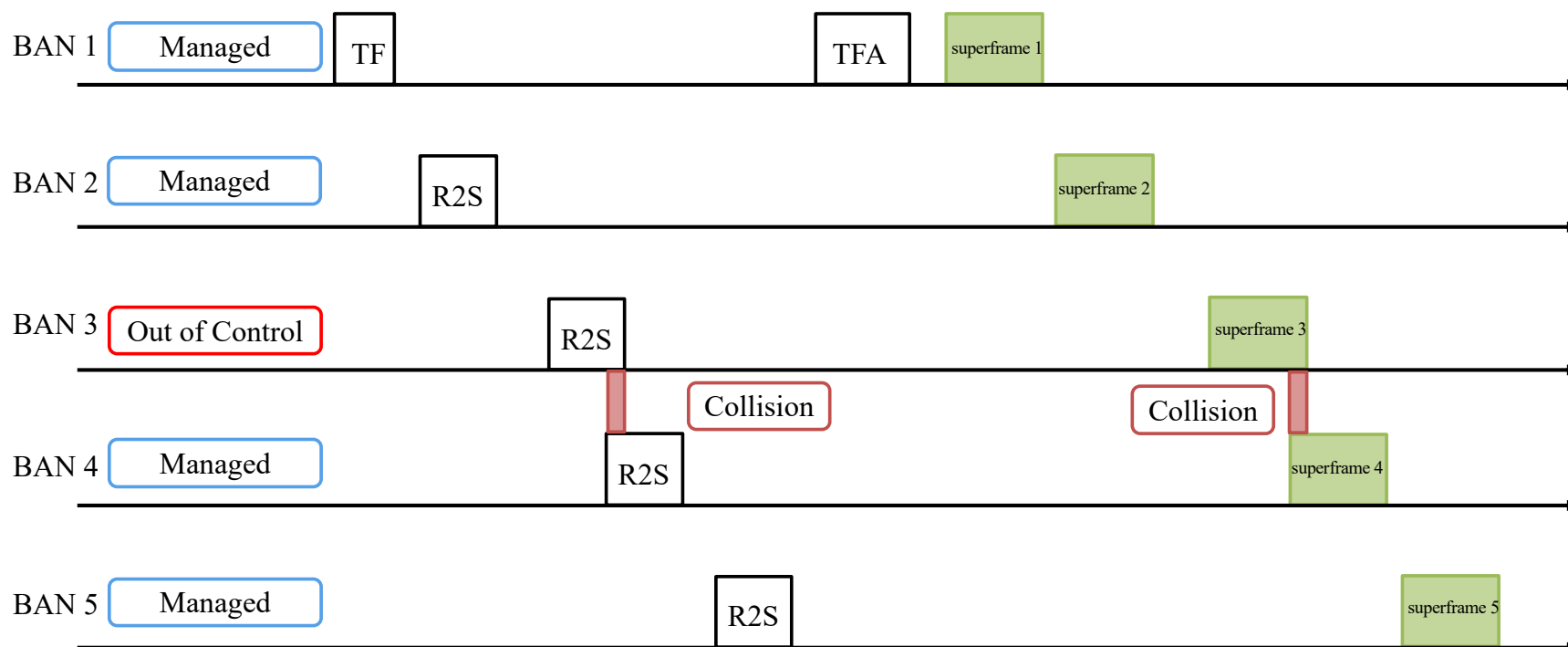
- The forward error-correcting code (**concatenated code with LDPC and RS**) is considered for the performance evaluation

# MAC simulation parameters

$T_S$	4 ms	Number of BANs	5
$T_D$	40 $\mu$ s	Number of Nodes (/BAN)	5
Number of superframes	250	Maximum number of retransmission (CFP) times	5
Number of NMP slots	5	Maximum number of retransmission (CAP) times	5
Number of CFP slots	60	Maximum number of random waiting slots (CAP)	10
Number of CAP slots	30	Normal packet (CFP)	Poisson distribution
Number of IAP slots	5	Normal packet (CAP)	Poisson distribution
Gap	0 ~ 499	Packet length	2000 bit

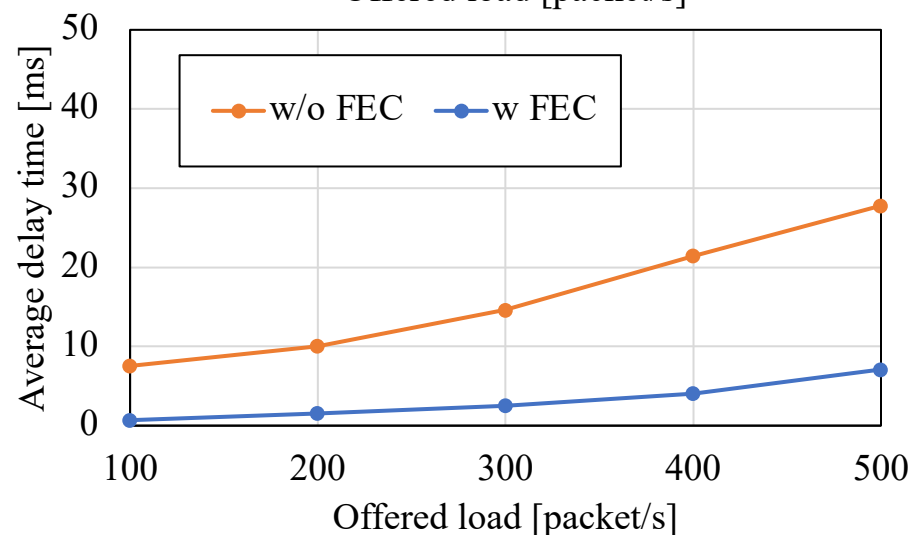
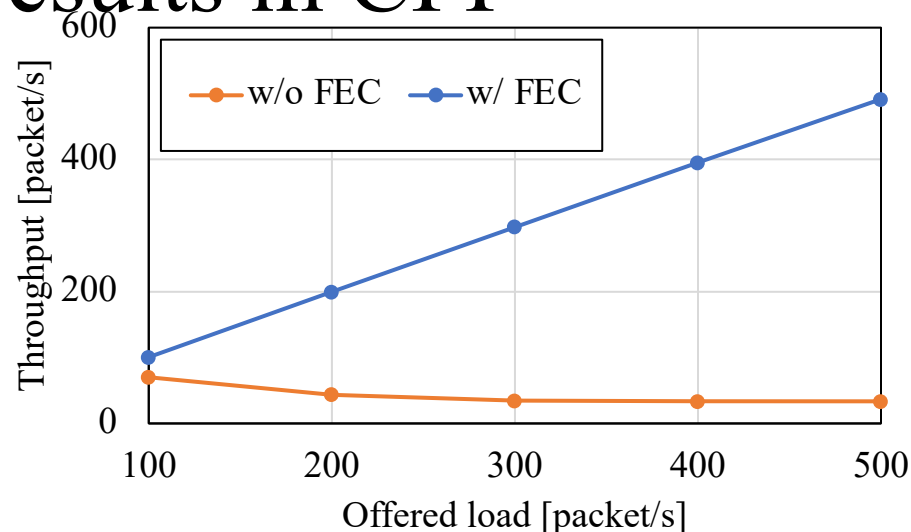
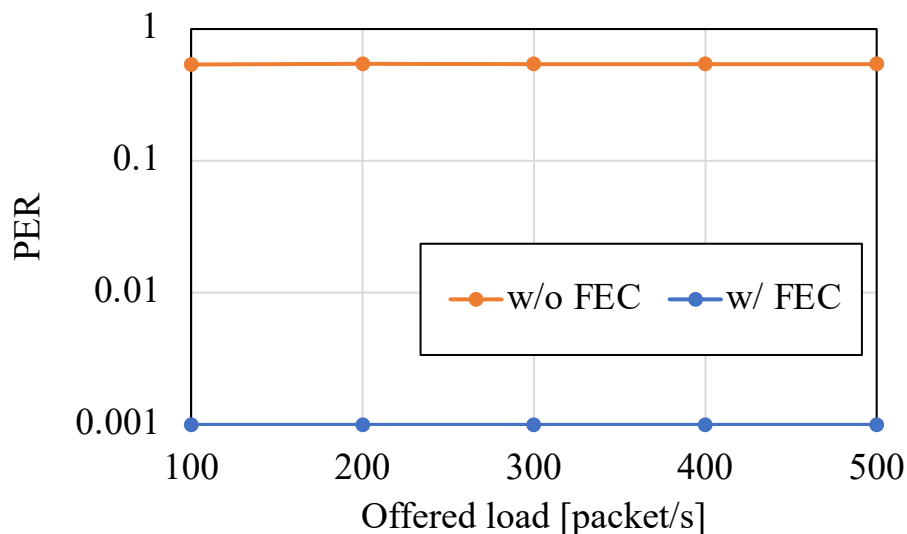


# Simulation scenario with one interference BAN



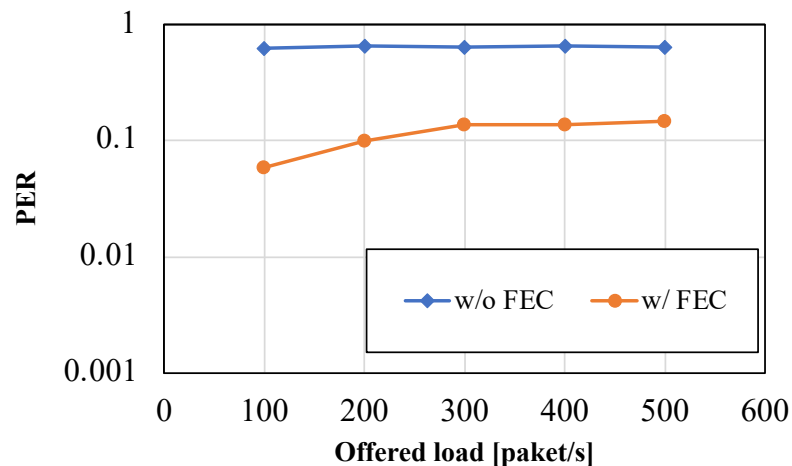
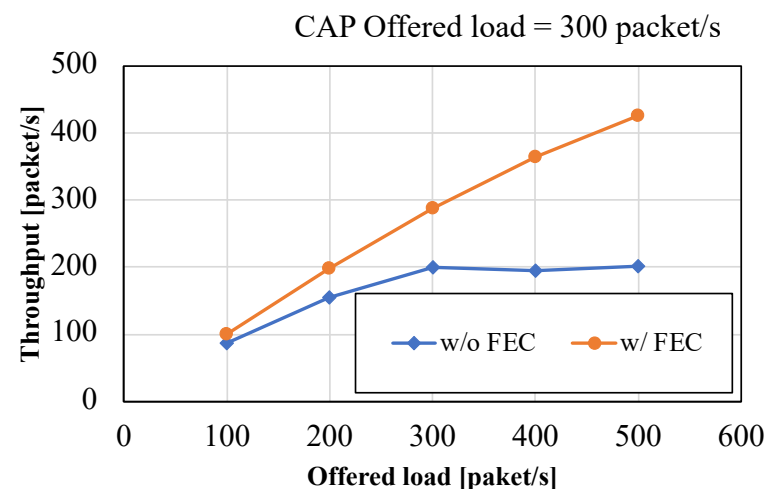
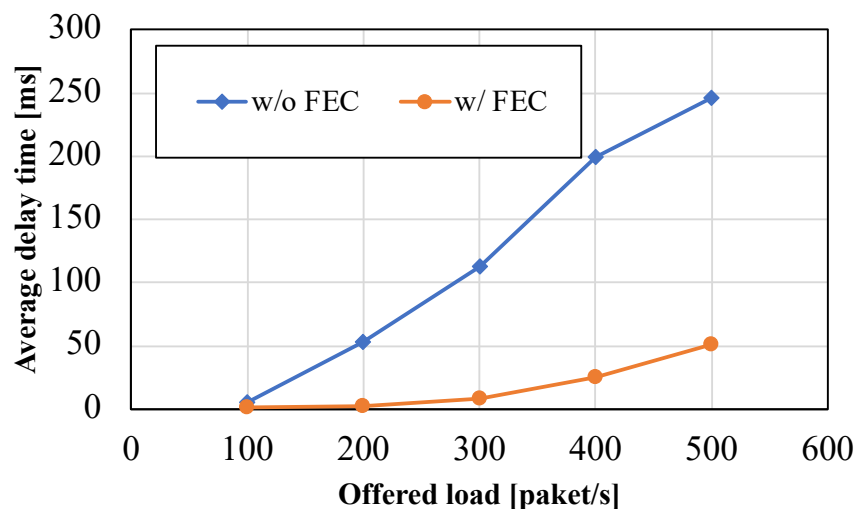
# Evaluation results in CFP

- Five managed BANs  
(no interference BAN existence)
- Concatenated code (LDPC+RS) applied

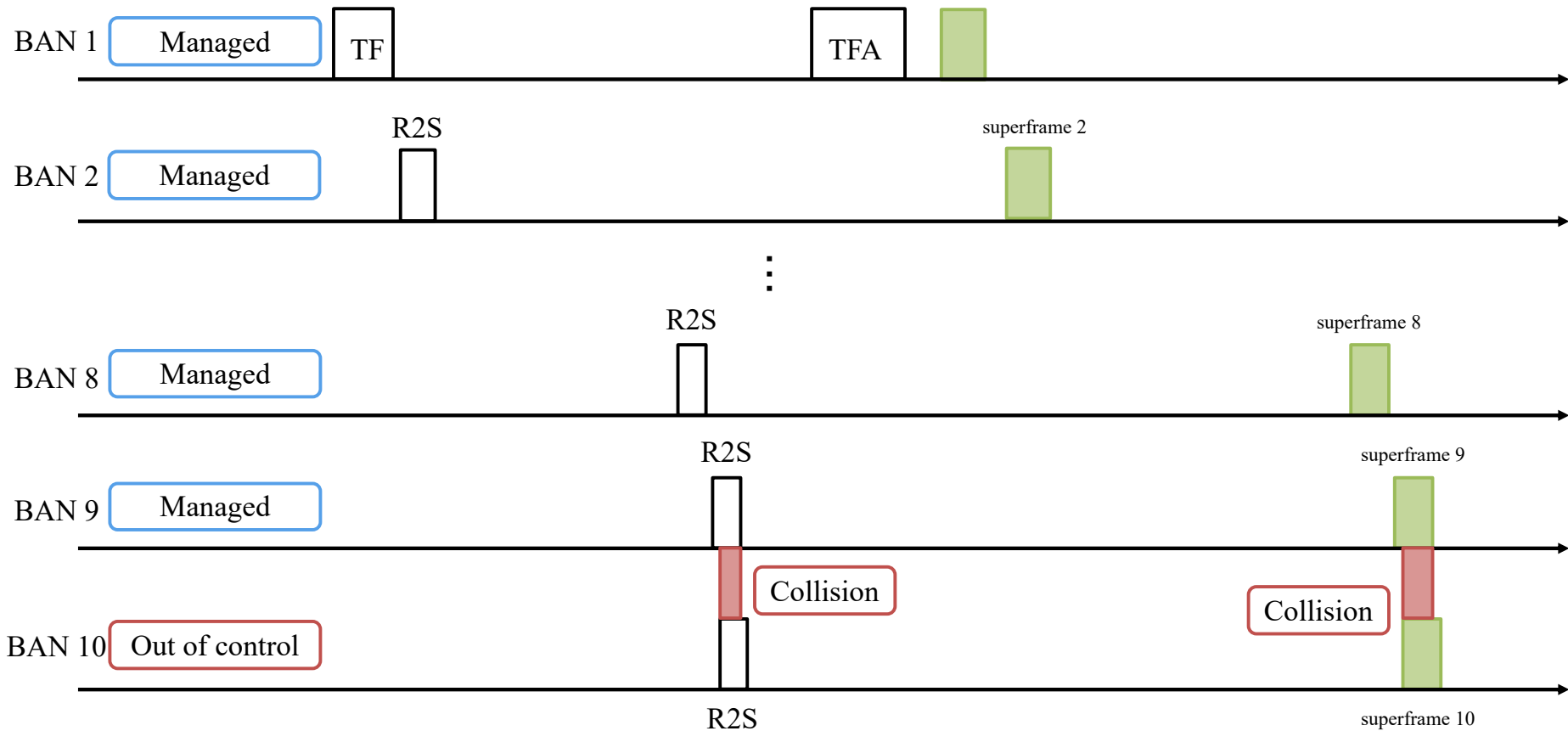


# Evaluation results in CFP

- Four managed BANs and one interference BAN
- Concatenated code (LDPC+RS) applied



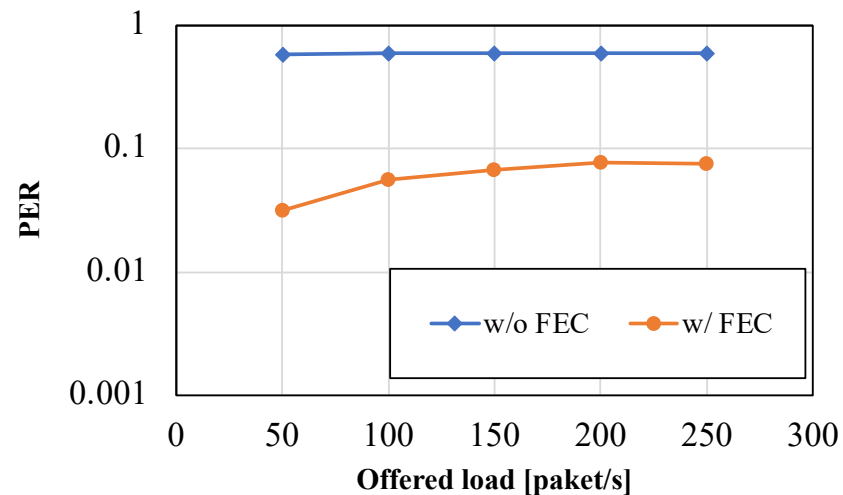
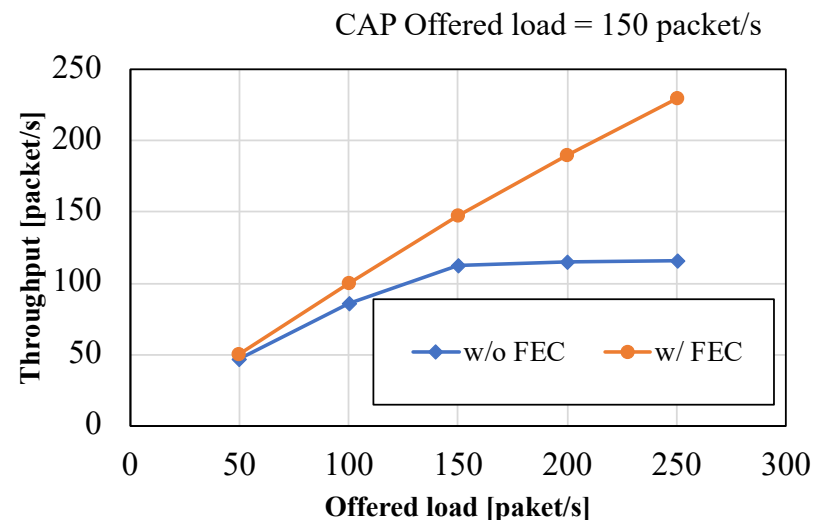
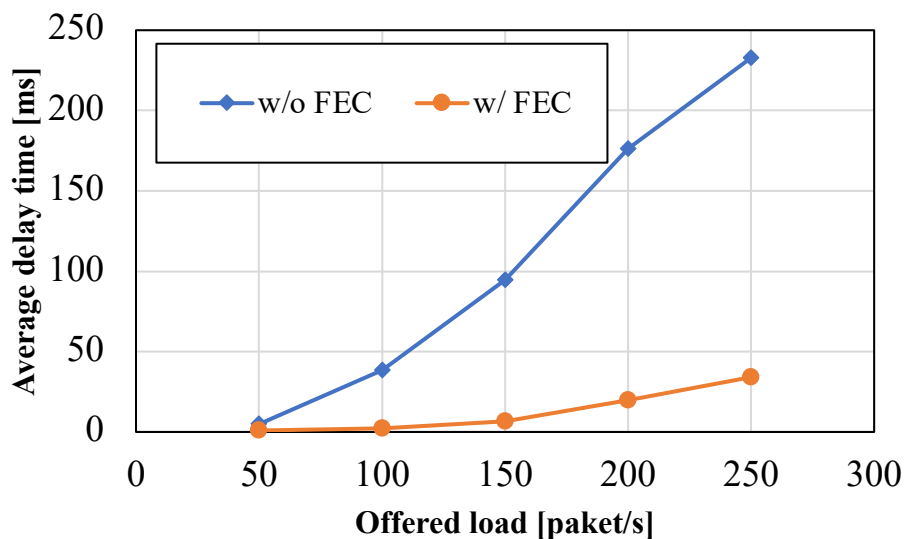
# Simulation scenario with 10 BANs





# Evaluation results in CFP

- [Nine managed BANs and one interference BAN](#)
- Concatenated code (LDPC+RS) applied



# References

1. D. Anzai, R. Inuzuka, M. Kim, T. Kobayashi, M. Hernandez, R. Kohno, “Fundamental MAC Performance Evaluation under Multiple IEEE802.15.6ma BAN Co-Existence,” in Proc. IEEE ISMICT 2023, Lincoln, USA, Mach 2023.
2. D. Anzai, I. Balasingham, G. Fischer, J. Wang, “Reliable and High-Speed Implant Ultra-Wideband Communications with Transmit–Receive Diversity,” EAI/Springer Innovations in Communication and Computing, pp. 27-32, March 2020.
3. Y. Shimizu, D. Anzai, R. C-Santiago, P. A. Floor, I. Balasingham, and J. Wang, “Performance evaluation of an ultra-wideband transmit diversity in a living animal experiment” IEEE Trans. Microw. Theory Tech., vol. 65, no. 7, pp. 2596-2606, July 2017.
4. D. Anzai, K. Katsu, R. Chavez-Santiago, Q. Wang, D. Plettemeier, J. Wang, and I. Balasingham, “Experimental evaluation of implant UWB-IR transmission with living animal for body area networks,” IEEE Trans. Microw. Theory Tech., vol. 62, no. 1, pp. 183-192, Jan. 2014.
5. J. Shi, D. Anzai, and J. Wang, “Channel modeling and performance analysis of diversity reception for implant UWB wireless link,” IEICE Trans. Commun., no. E95-B, vol. 10, pp. 3197-3205, Oct. 2012.