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

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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

MAC Performance Evaluation of Multiple BAN Coexistence Under TG6ma Channel Model

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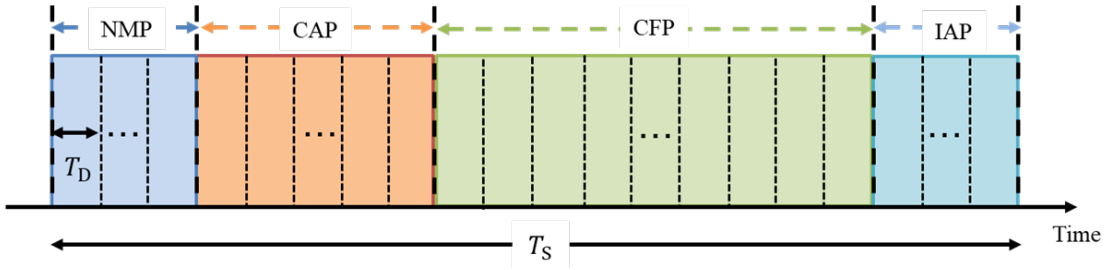
Introduction

- 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

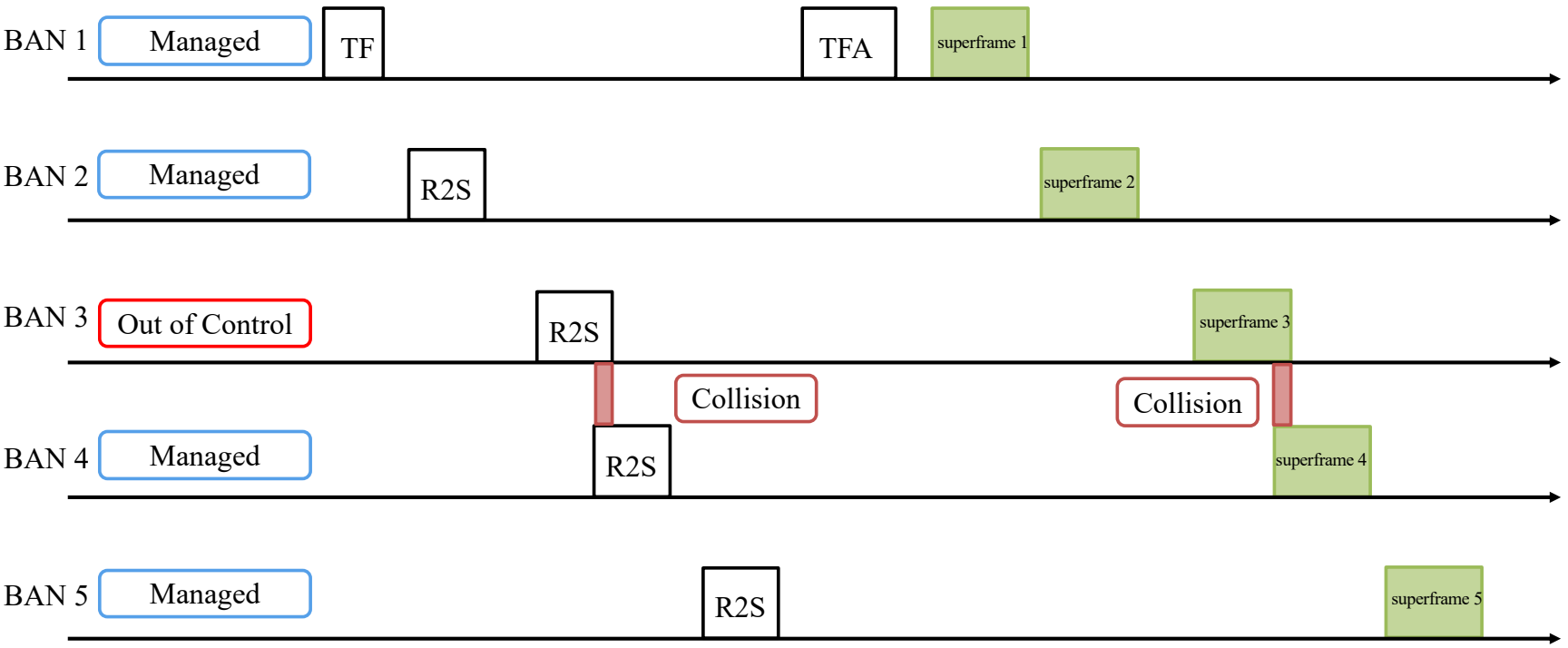
- The forward error-correcting code (**concatenated code with LDPC and RS**) is considered for the performance evaluation

MAC simulation parameters

T_S	4 ms	Number of BANs	5
T_D	40 μs	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

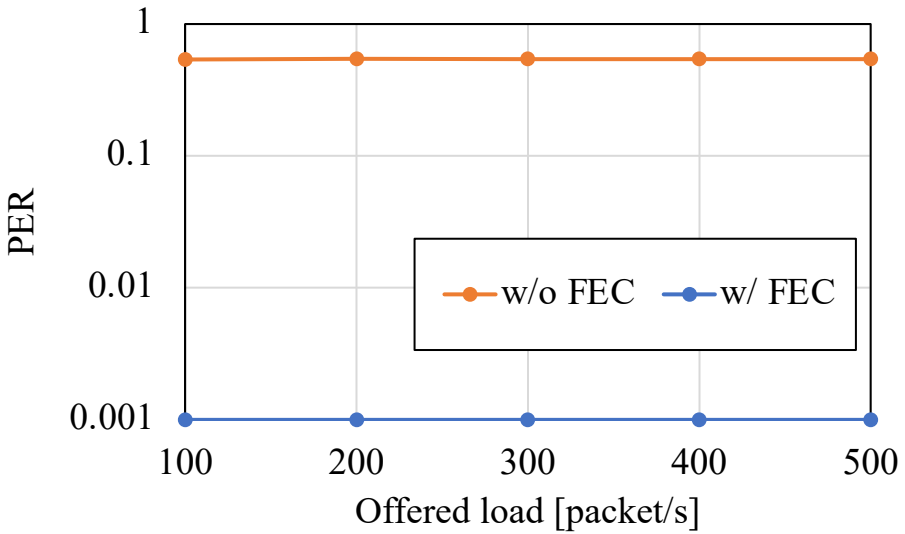


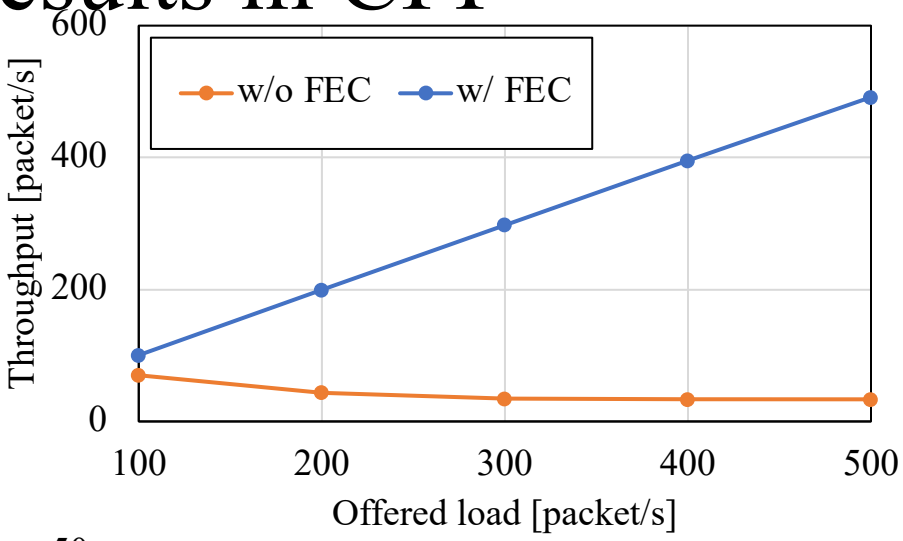
Simulation scenario with one interference BAN

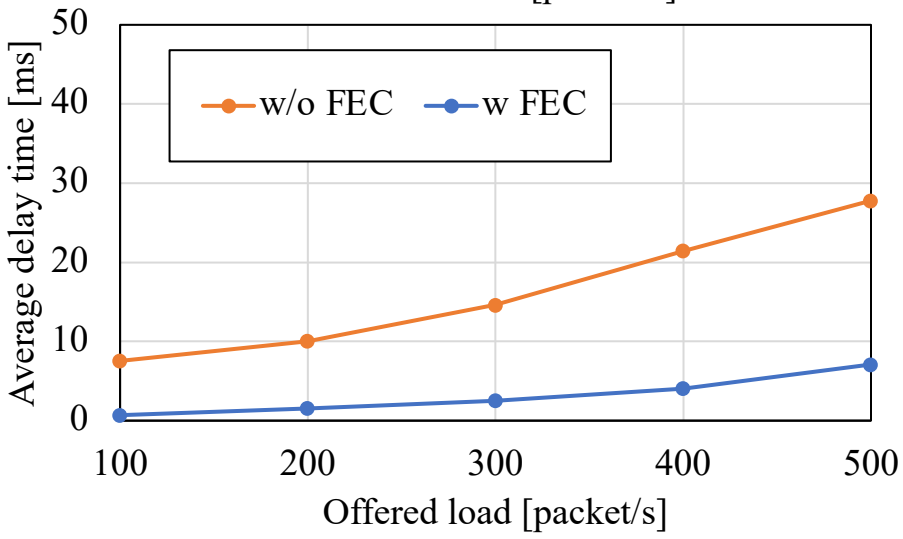


Evaluation results in CFP

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

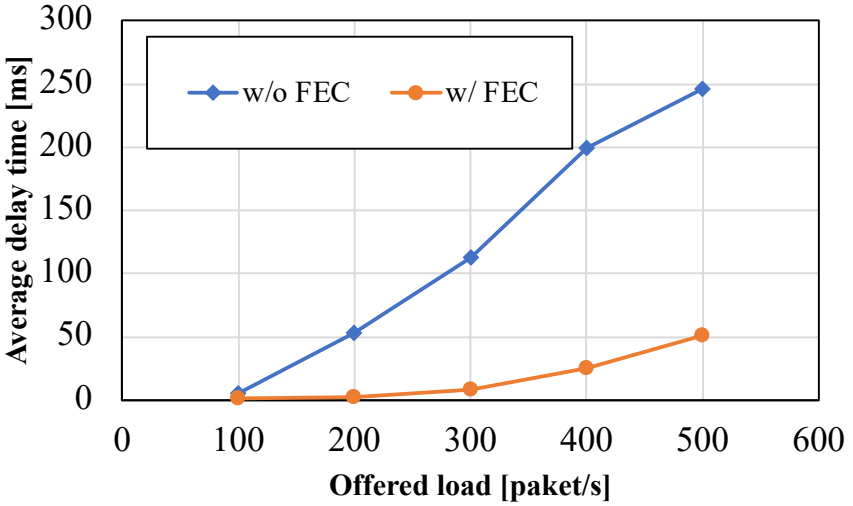




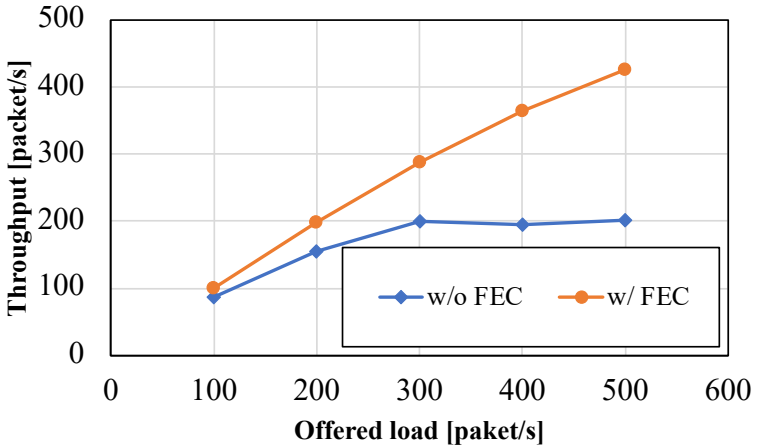


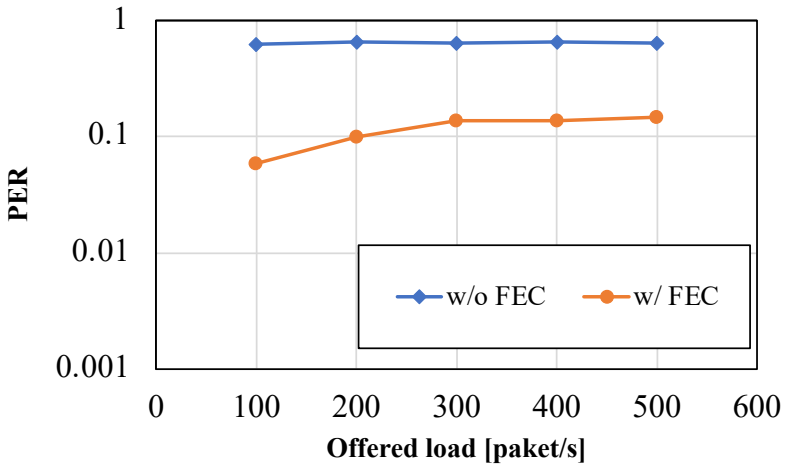
Evaluation results in CFP

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

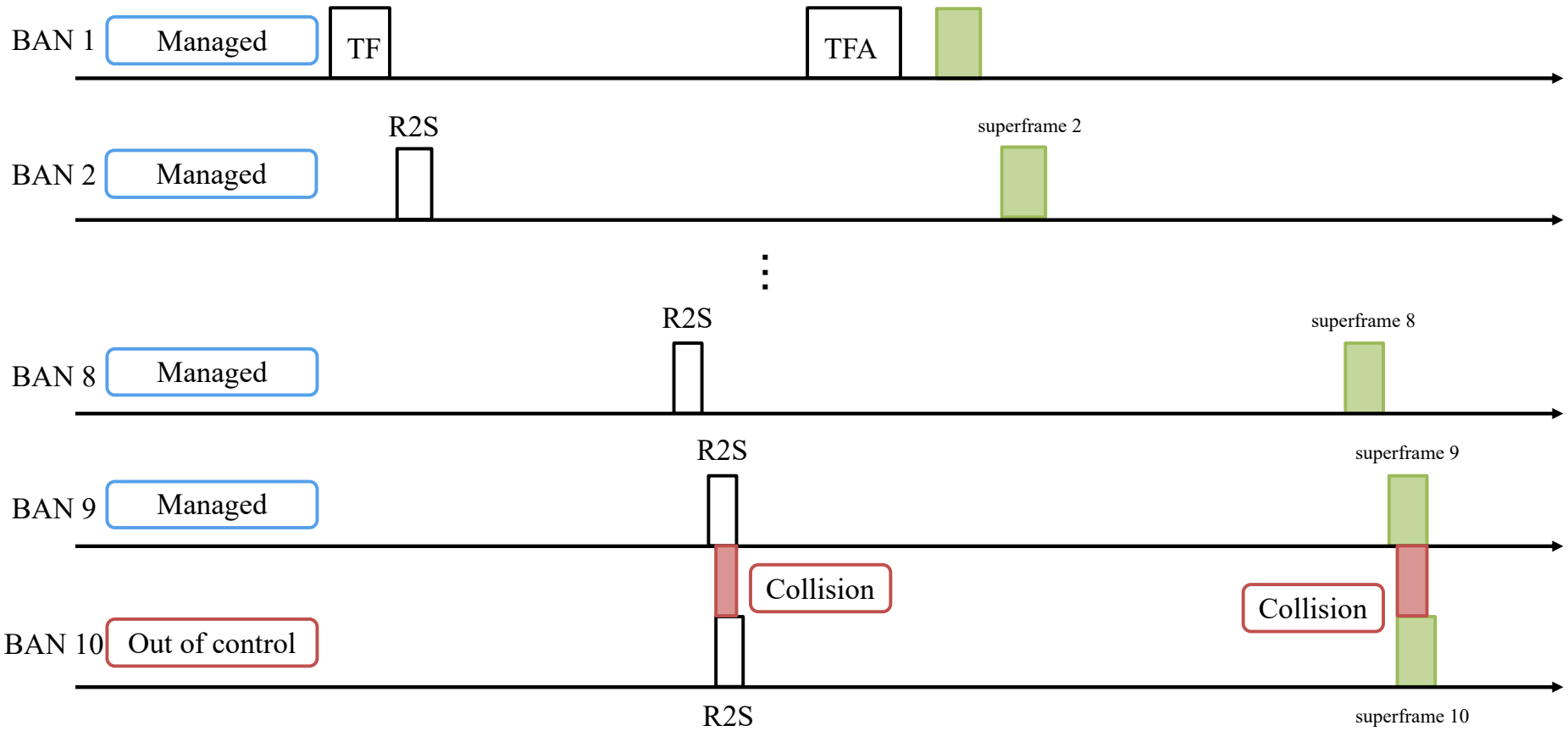


CAP Offered load = 300 packet/s



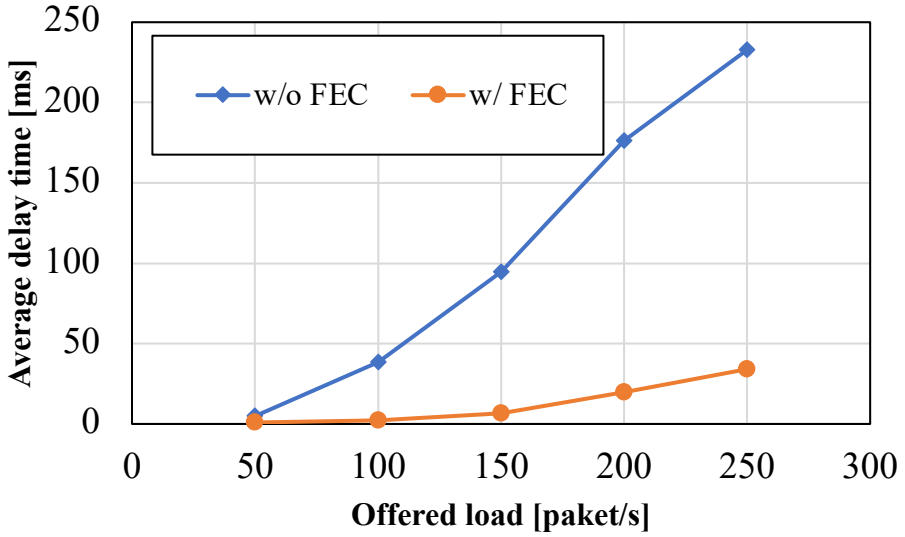


Simulation scenario with 10 BANs

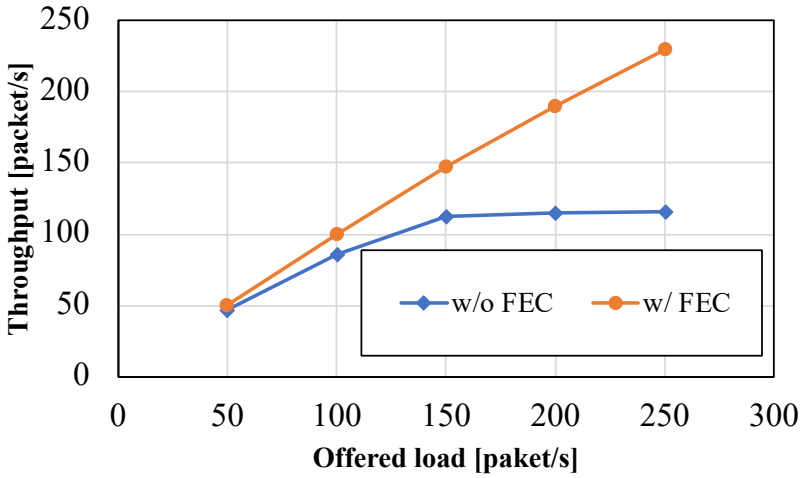


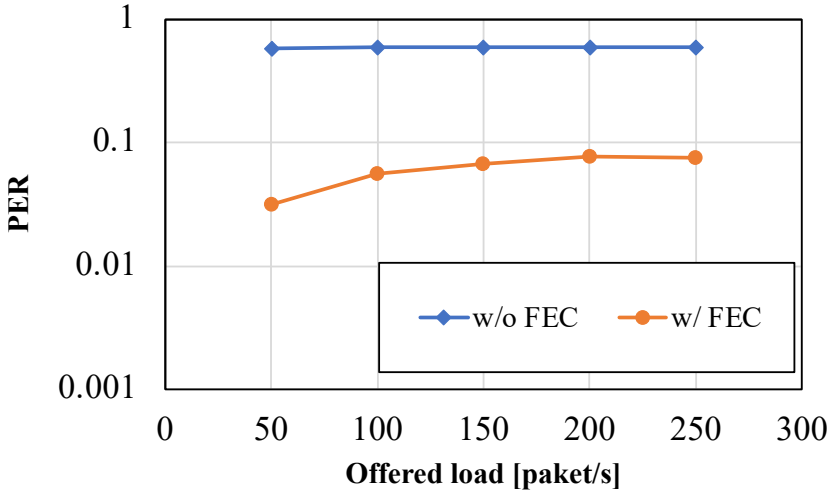
Evaluation results in CFP

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



CAP Offered load = 150 packet/s





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.