VIETNAM NATIONAL UNIVERSITY, HANOI
VNU UNIVERSITY OF ENGINEERING AND TECHNOLOGY

SOCIALIST REPUBLIC OF VIETNAM
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INFORMATION ON DOCTORAL THESIS

1. Full name : Pham Huu Tung 2. Sex: Male

3. Date of birth: 08/09/1980 4. Place of birth: Hai Duong Province

5. Admission decision number: 841/QĐ-CTSV Dated 04/09/2018

6. Changes in academic process:

Decision No. 344/QĐ-ĐT dated June 9, 2020 on changing the title of the doctoral dissertation and adding an additional co-supervisor: Dr. Tran Hung, Malarden University, Sweden.

7. Official thesis title: Performance Analysis of Physical Layer Security in NOMA Networks

8. Major: Computer Networks and Data Communication 9. Code: 9480102

10. Supervisors: Prof Nguyen Dinh Viet; Doctor Tran Hung

11. Summary of the **new findings** of the thesis:

1. Proposed and evaluated a security strategy for cooperative NOMA networks on α-μ fading channels to defend against eavesdropping attacks, utilizing the secrecy outage probability metric in scenarios with non-protection scheme and active protection scheme strategies. Simulation results indicated a significant improvement in system security when employing an active protection scheme.
2. Proposed and assessed the security performance of a NOMA network model with an proactive eavesdropping strategy based on closed-form expressions for the successful legitimate eavesdropping probability metric. Derived a power control policy in scenarios with known and unknown channel state information, ensuring eavesdropping performance while satisfying constraints on the illegal communication outage probability. Theoretical analysis and simulations demonstrated a substantial increase in system security with an increased number of antennas at the relay device.
3. Proposed and evaluated the information security capability of a single-input, single-output NOMA network model under various eavesdropper scenarios. Security performance was analyzed and evaluated through secrecy outage probability metric for each user and the entire system in scenarios where eavesdropper employs successive interference cancellation (SIC) and parallel interference cancellation (PIC)

techniques to process received signals, with eavesdropper equipped with either a single or multiple antennas. Theoretical analysis and simulations revealed that the system's security performance was degraded when eavesdropper used PIC compared to SIC. Furthermore, the system’s security improved when eavesdropper was equipped with a single antenna compared to scenarios where the eavesdropper had multiple antennas.

4. Investigated and assessed the relationship between security performance and the reliability of a underlay cognitive NOMA network model under constraints on the interference level of the primary network and the maximum transmit power of the secondary network. Results indicated an inverse proportional relationship between security and reliability. Proposed power control policies for the secondary network aimed to ensure information security while maintaining the performance of the primary network. The system's performance was evaluated based on closed-form expressions of secrecy outage probability and intercept probability metric.

12. Practical applicability, if any:

The research results of the thesis serve as a reference for researchers interested in the field of evaluating physical layer security performance in NOMA networks. Additionally, the thesis results can be used to assess the security performance of similar systems in practice, helping managers with guidance and solutions in proposing secure and safe NOMA network design plans.

13. Further research directions, if any:

Continuing research in the field of physical layer security in NOMA networks on various fading channel models, proposing solutions to enhance physical layer security in NOMA networks integrated with key technologies in 5G and 6G networks such as Massive MIMO, mmWave,...

14. Thesis-related publications:

[1] "Secrecy Performance Analysis of Cooperative NOMA Networks With Active Protection under α - μ Fading", *2019 International Conference on Advanced Technologies for Communications (ATC)*, Hanoi, Vietnam, 2019, pp. 215-22.

[2] "Secrecy Outage Probability and Fairness of Packet Transmission Time in a NOMA System", *IEEE Access*, vol. 8, pp.79637-79649, 2020.

[3] "Performance Analysis of an Energy-Harvesting IoT System Using a UAV Friendly Jammer and NOMA Under Cooperative Attack," in IEEE Access, vol. 8, pp. 221986-222000, 2020.

[4] "Proactive Eavesdropping via Jamming inNOMANetwork", *IEEE Access*, vol. 9, pp.168121-168133, 2021.

[5] "Security and Reliability Performance Analysis of CognitiveNOMA Network Under Outage Constraint of Multiple Primary Users", *12th International Symposium on Information and Communication Technology (SoICT 2023)*, Ho Chi Minh City, Vietnam, 2023.

[6] "Secure Conversation: A View From Physical Layer", *The 12th International Conference on Computational Data and Social Networks*, Hanoi, Vietnam, 2023.

[7] "Packet Timeout Probability of CRN under Security Constraints of Multiple Primary Users", *12th International Symposium on Information and Communication Technology (SoICT 2023)*, Ho Chi Minh City, Vietnam, 2023.

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