## **DEDICATION**

This thesis is compiled with the support of my family and my friends. The author dedicates the work to my beloved parents, Amrin Rangkuti and Ade Ummy Kalsum. Finally, this work is also dedicated to the development of Indonesia's technology, especially on recovery networks technologies, and the advancements of wireless communication and engineering technology in general.

## ACKNOWLEDGMENTS

This thesis is compiled with the effort, help, and support from both lecturers and students. The author would like to express the deepest gratitude and thanks to:

- 1. Allah Subhanahu wa ta'ala, we praise Him, seek His help and ask for His forgiveness.
- 2. My beloved parents, for endless love, prayers, and supports, Mr. Amrin Rangkuti and Mrs. Ade Ummy Kalsum.
- 3. My beloved brother, M. Al Hafidz Rangkuti for being author's biggest supporter that makes the author struggling to finish this thesis.
- 4. Dr. Eng. Khoirul Anwar, S. T., M. Eng., as the supervisor, who had guided and assited the author in writing and finishing the research, taught the author regarding a whole thing about research, espesially the importance of priotizing quality of every research.
- 5. Dr.-Ing. Fiky Y. Suratman, as the co-supervisor, for the cooperation, contribution, help, and guidance in this thesis.
- 6. My beloved friend, Novia Intan Maharani, who always encourage and remind the author for finishing this thesis.
- 7. The Center for Advanced Wireless Technologies (AdWiTech) family, which has become the second author's family in campus. Thanks for all the happiness, the sadness, the craziness, many helps and support in undergoing to finish the thesis.
- 8. The entire faculty and employees of the Department of Electrical Engineering, Master Program of Telkom University, on the knowledge, guidance and assistance for the author to finish composing this thesis.
- 9. All the lecturer in Telkom University, especially for Mr. Nachwan Mufti A., Mr. A. T. Hanuranto, Mr. Budi Syihabuddin, and Mr. Agus Dwi P., for every knowledge, advice and motivation that you have given to the author.