REVIEW

of a dissertation
for the acquisition of the educational and scientific degree "Doctor" in

field of higher education – 5 Technical Sciences
professional field – 5.3 Communication and Computer Engineering
doctoral program – "Communication Networks and Systems"

Author: Eng. Michail Georgios Angelakis
Topic: "Methods and Means for the Intelligent Monitoring and Control of Radio Channels in Wireless Communication Networks"
Reviewer: Prof. Stanimir Mihaylov Sadinov, PhD, Technical University – Gabrovo

1. Topic and relevance of the dissertation work

Methods and means for monitoring and controlling radio channels in wireless communication networks are important for several key reasons, which cover both the state of the physical infrastructure and the network efficiency and reliability. Mechanisms and tools for analyzing the state of wireless communication channels are part of more complex systems solving optimization problems such as optimal allocation of available resources, optimizing spectral efficiency and data loss, and increasing the overall capacity and Quality of service without physical expansion of the network.

The dissertation work deals with the issues related to the introduction of new generation wireless communications and the growth of the ecosystem of wireless devices, which leads to a significant increase in the load on radio channels. Methods are considered that ensure the need for intelligent monitoring and dynamic management of the used frequency resources. Their goal is the effective use of the available frequency resource, which requires continuous analysis of channel occupancy, detection of interference and automatic selection of the most suitable frequencies for communication. At the same time, stable wireless connectivity with minimal delays and high reliability is ensured.

All of the above indicators are critical for wireless communication networks. The considered modern intelligent algorithms can automatically analyze parameters of the radio environment, predict the load, detect anomalies and optimize channel selection without human intervention. This significantly increases the efficiency of wireless network management.

The topic combines areas such as computer networks, radio communications, signal processing and machine learning. The development of new methods for intelligent monitoring and control has both scientific value and wide practical application in telecommunications, industry and the public sector.

Based on the analysis of the current state of the field of research in the dissertation work and its correspondence with the goal and main tasks formulated by the doctoral student, I believe that the topic of the dissertation and the theses developed in it are relevant and challenging for scientific and applied development.

2. Overview of the cited literature

A total of 95 literary sources were used in the development of the dissertation work. Eighty-two (82) of the sources are in English, and three (3) are in Bulgarian. A total of ten (10) sources from the Internet were used. A large part of the literary sources are publications, predominantly referenced and indexed in the well-known databases.

The dissertation work contains a review, including sources and materials published mainly in the last 10 years. I believe that the doctoral student has entered the essence of the researched subject area and I can conclude that through the analysis of the literary sources, a correct formulation of the purpose of the dissertation and the main tasks related to its achievement has been achieved.

3. Research methodology

The structure of the dissertation includes an introduction, four chapters, a conclusion, a list of abbreviations used, a list of contributions to the dissertation, a list of publications on the dissertation, and a list of references. The dissertation has a volume of 126 pages.

The overview in the First Chapter of the dissertation shows a good knowledge on the part of the dissertation author of the current state and areas of research and development in wireless communication networks and monitoring and control systems. This knowledge has allowed the dissertation author to correctly assess the state of the problem and to formulate the research objectives in the dissertation.

In Chapter Two of the dissertation, a generalized approach for analyzing signal attenuation and interference in wireless radio channels is presented and a wireless channel model is developed and studied for communication with a proposed innovative integrated intelligent interference suppression algorithm. The proposed algorithm is analyzed, and its effectiveness is proven through a study with synthetically generated input data for training the model and a comparative analysis of the results obtained with classical algorithms.

In Chapter Three of the dissertation, software planning and construction in a real environment of a wireless P2MP communication network for test purposes have been carried out. An experimental study and analysis of the behavior of the radio channels have been carried out through monitoring and control of the wireless radio coverage of the built test network. As a result, an approach for optimal planning and optimization of the parameters of the wireless radio channels in wireless communication networks has been synthesized.

In the Fourth Chapter of the dissertation, a conceptual design, practical implementation and research of an experimental model of a universal system for intelligent monitoring and control of wireless communication networks are presented. The software architecture of the system, the configuration of its key components and its effective implementation in a real environment for a site – the village of Vodoley are presented. Functional testing of the system in various scenarios and conditions has been carried out, and the experimental results of the measurements carried out are duly presented, discussed and analyzed.

4. Contributions of the dissertation work

A reference is attached to the dissertation work, containing 3 scientific-applied and 3 applied contributions. In general, I accept the proposed wording of the contributions in the dissertation, as follows:

А) Scientific-applied contributions:

1) A complex methodology for multi-criteria analysis and assessment of the state of wireless radio channels and an architectural model for proactive monitoring of wireless networks has been developed, based on the effective combination of standard telemetry protocols with algorithms for dynamic monitoring of parameters in a heterogeneous hardware infrastructure.
2) Criteria and algorithmic rules have been formulated for automatic identification of anomalies and emergency conditions, which allow mathematically based prediction of connection degradation before an actual communication breakdown occurs.
3) An innovative wireless channel model with an integrated intelligent noise and interference suppression algorithm is proposed and investigated. The model successfully solves the critical problem of the lack of correct channel state information (CSI) by implementing a specialized training module for filtering. This allows for more accurate reconstruction of CSI and achieving significantly lower mean square error in prediction compared to the implementation of traditional algorithms.

Б) Applied contributions:

4) A specialized platform for intelligent monitoring has been designed, software implemented and experimentally verified, which provides reliable collection and processing of real-time data on the status of the wireless infrastructure.
5) Software solutions have been developed to increase situational awareness, including interactive logical maps on a real geographical background and optimized visualizations for video walls in dispatch and network operations centers (NOCs).
6) A specialized signaling and event management module has been developed to automate the process of detecting and localizing problems in the radio channel of wireless communication networks. Through a series of tests conducted in real conditions and simulated critical scenarios, the solution's high accuracy, speed, and fault tolerance have been verified.

5. Publications and citations of publications on the dissertation work

The validation of the results obtained in the dissertation work is ensured by the 8 scientific publications presented from participation in national and international scientific conferences. All publications present the different aspects of the research on the dissertation work.

The analysis of the presented publications and the attached reference with scientometric data shows that 76.64 points were obtained for the group of indicators Г, which is twice as high as the minimum of 30 points according to the minimum national requirements. In addition, of the 8 publications presented, 2 are single-authored, which also exceeds quantitatively and covers the additional minimum requirements of TU – Gabrovo (5 publications, of which 1 is single-authored).

From the above facts it follows that the candidate meets the minimum national requirements for acquiring the educational and scientific degree "doctor" under Art. 2b, para. 2, 3 and 5 of the Law on the Development of the Academic Staff in the Republic of Bulgaria (LDASRB) and the minimum quantitative requirements of TU - Gabrovo.

No data on known citations of publications on the dissertation is presented.

6. Authorship of the obtained results

With regard to the materials submitted for defense and after checking in accordance with the Rules for checking plagiarism in the scientific production of students, doctoral candidates and lecturers at the Technical University of Gabrovo, no evidence of plagiarism has been identified.

The attached publications, including two single-authored ones, as well as the manuscript of the dissertation, give me reason to believe that the main share of the research conducted and the compiled analyses of the results are entirely the personal contribution of the doctoral student.

7. . Author's abstract and author's reference

The Author's abstract is developed in a volume of 40 pages and fully corresponds in structural and content terms to the dissertation manuscript reviewed by me. The requirements for layout are met and all necessary attributes are included in accordance with the Regulations for the Acquisition of Scientific Degrees and Holding Academic Positions at TU-Gabrovo. The Author's abstract provides an unambiguous, clear and complete picture of the key aspects of the research, analyses and contributions of the dissertation work. The author's reference presents summaries of the publications on the dissertation work, the subject of which covers the individual scientific research tasks defined in the dissertation work.

8. Comments, recommendations and remarks on the dissertation work

I believe that the dissertation work of Eng. Mihail Angelakis, the research and the results achieved on it, have been fully and completely presented and promulgate. The doctoral student has demonstrated the necessary in-depth technical knowledge and level of scientific work, research skills, analytical, critical and creative thinking and focus on results in the development of the dissertation work.

I could not highlight any more significant critical remarks regarding the content of the scientific materials submitted for review on the dissertation work. However, I would take the liberty of noting the need for greater precision and accuracy in the terminology imported from foreign languages, as well as more attention to detail in terms of style, when preparing scientific works.

In future, I recommend that the doctoral student's research and development on this topic be expanded to include the application of machine learning and artificial intelligence to mechanisms for effective traffic processing and protection of radio channels, new methods for predictive and proactive management and control of wireless communication channels, as well as in terms of technological innovations in the field of wireless communications in general. It would be of great interest for the results obtained to be directed for presentation and publication in international scientific forums and publications, indexed and referenced in global databases.

9. Conclusion

I consider that the presented dissertation meets the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria and the Regulations for Acquiring Scientific Degrees and Holding Academic Positions at the Technical University – Gabrovo.

The results achieved and presented in the dissertation give me reason to propose that the educational and scientific degree "Doctor" be acquired by Eng. Michail Georgios Angelakis in the field of higher education - 5. Technical Sciences, professional field - 5.3. Communication and Computer Engineering, doctoral program – “Communication Networks and Systems”.

31.07.2026 **Reviewer**:

/Prof. Stanimir Sadinov, PhD/