

I. IDENTIFICATION DATA

Thesis title:	Design and Optimization of Multi-port Antenna
Author's name:	Vojtech Neuman
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Electromagnetic Field
Thesis reviewer:	D. Sc. (Tech.) Anu Lehtovuori
Reviewer's department:	School of Electrical Engineering, Aalto University, Finland

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	extraordinarily challenging
<i>How demanding was the assigned project?</i>	
<p>This work focuses on the optimization of mobile phone antenna in the vicinity of frequency 700 MHz. The main task is on optimization of a defined structure with respect to total active reflection coefficient by modifying feeding positions and feeding voltages in case of multiple ports. Also matching elements are determined.</p> <p>The topic discusses many difficult concepts and it is challenging from mathematical and theoretical point of view. Advanced mathematical methods and tools are applied. Furthermore, fluent coding skills are necessities for successful completion of the thesis. The work is wide including a prototype and measurements, too.</p>	

Fulfilment of assignment	fulfilled
<i>How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.</i>	
<p>The work consists of many phases including port optimization, bandwidth consideration, determination of matching network, and studying practical aspects. The work is well planned, and workflow is clearly described. The expectations for the results are not given, but the assignment tasks are covered. In addition, many proposals for future study are given and there is room for further discussion and analysis of results later.</p>	

Methodology	outstanding
<i>Comment on the correctness of the approach and/or the solution methods.</i>	
<p>The author has used a great variety of research methods varying from theoretical calculations to numerical codes, electromagnetic simulations, and experiments. The chosen methods are appropriate and they are utilized skillfully.</p>	

Technical level	B - very good.
<i>Is the thesis technically sound? How well did the student employ expertise in the field of his/her field of study? Does the student explain clearly what he/she has done?</i>	
<p>Successful completion of the thesis necessitates a good command of electromagnetic simulations and antenna theory. Also advanced mathematical knowledge is required as well as programming skills. The author has demonstrated to command all these topics well. The author has drawn straightforward conclusions from the obtained results.</p>	

Formal and language level, scope of thesis	A - excellent.
<i>Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?</i>	
<p>The general appearance of the work is excellent. The notations are very professional, although a separate list of symbols is not included. The figures are carefully prepared and clear. The structure of the thesis is logical making it easy to read. The language is clear and convenient.</p>	

Selection of sources, citation correctness	A - excellent.
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Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?

The work includes a reasonable number of references. The selected references are relevant and of very good quality. The citations follow good practices

Additional commentary and evaluation (optional)

Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.

The goals of the thesis are clearly described, and the scope of the thesis becomes evident, but perhaps some motivation for the reader could have been included describing more extensively the relation of the work to general antenna research.

III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

Summarize your opinion on the thesis and explain your final grading. Pose questions that should be answered during the presentation and defense of the student's work.

The thesis has an excellent quality following scientific standards and discussing very interesting questions. The work scopes a challenging and wide topic going through several steps and finally also measurements. This thesis demonstrates that the author commands the field of this thesis at excellent level. The used research methods are well-justified. The results obtained in this thesis are highly relevant and interesting to scientific antenna community. The thesis opens opportunity to study individual questions more precisely later and confirm the observations raised in this thesis.

The following questions can be discussed:

- Could the proposed method be applied to such cases, where amount of losses is remarkable e.g. if a large dielectric block is near an antenna?
- What are the optimal feeding voltages for a two-port antenna (e.g. Fig 3.6)? Is the both amplitude variation and phase variation needed to get the optimal results?

The grade that I award for the thesis is **A - excellent**.

Date: **28.5.2021**

Signature: