BRNO UNIVERSITY OF TECHNOLOGY
FACULTY OF ELECTRICAL ENGINEERING AND COMMUNICATION

# Opponent Review of Doctoral Dissertation

**Applicant: Ing. Jan Špůrek**

**Title of Dissertation: SIW – based circularly polarizes antenna arrays**

**Opponent: prof. Ing. Miloš Mazánek, CSc**

**Opponent's Department: ČVUT v Praze, fakulta elektrotechnická, katedra elektromagnetického pole**

*In accordance with the Study and Examination Rules of BUT, in his/her review the opponent will mainly comment on:*
*a) the topicality of the dissertation,*
*b) whether the dissertation achieved its given objective,*
*c) the problem-solving procedure and the results of the dissertation along with the concrete contribution of the doctoral student,*
*d) the significance for practical application or the progress in the field,*
*e) formal and language qualities of the dissertation,*
*f) whether the dissertation fulfils the conditions of Section 47 (4) of the Act,*
*g) whether the student proved his/her creative abilities in the given research field and whether the work does or does not comply with the standard requirements placed on the dissertations in the given field. The review is not valid without this conclusion.*
*It is necessary to add a concise commentary to each of the points below.*

## Ad a) Topicality of the dissertation

The topic of the dissertation is topical.

Sometimes it is quite difficult to find the border between the good engineering work and topical scientific ideas and results. I studied the whole text and the contributions for the scientific area very responsibly. For my final decision it was important to study the part of „ state of the art “, especially the part of circularly polarized patch antennas and modular (plane and stacked concepts structure(s). This topic is really the never-ending antenna story and I found this part from the point of circularly polarized and broadband promises always new and interesting for both, scientists and designers, still interesting. (question).

What are the possibilities to include the study of the left and right polarization (switching between them) ?

What are the steps of freedom you can finally achieve (not only flat/plane arrangement of modules), maybe is it direction for the next development/research?

**Ad b) Objective of the dissertation**

The objective of the dissertation was achieved.

Formally I am not too satisfied by the written goals and methods in the dissertation.
The definitions of the objectives are not well formulated to give the clear imagine of the scientific orientation of the goals, (but the dissertation fulfils the scientific methods and final progress.
objective 1: basic module 2x2,
objective 2: increasing the bandwidth).
I hope that during the defence the author will be able to reformulate it towards the real final goals and his results of dissertation.

Could you define the new results of your work and find the real scientific parts (results) from them?

**Ad c) Problem-solving procedure**
**and the results of the dissertation and the concrete contribution of the doctoral student**

The problem-solving procedure and the results of the dissertation are above average.

I am still able to recommend to find the level of dissertation above the average because I still feel the scientific potential of the work.

**Ad d) Significance for practical application or progress in the field**

The significance for practical application or progress in the field is excellent.

To see what is a goal of dissertation generally from the engineering point of view, there is/are a final result/s for application with scientific background. The 2x2 module, parasitic broadband process to achieve the broadband results (tolerance study) are close to the application level.

**Ad e) Formal and language qualities of the dissertation**

Formal and language qualities of the dissertation are average.

The dissertation is written in the formal level which is usable for scientists and people working in the field of antenna arrays. I believe that results are possible to repeat and continue the topic e.g. for the next doctoral students. The topic is not completely concluded and is open for the future?

**Ad f) The dissertation fulfils the conditions of Section 47 (4) of the Act**

The dissertation fulfils the conditions of Section 47 (4)*) Act No. 111/1998 Sb. Higher Education Act: YES

The dissertation brings new results in the theoretical as well as practical levels. Important parts of the work were independently published.

I am waiting that author will specified partly results and new ideas how to continue during the defence.

*(*(4) Studies are duly finished with a doctoral state exam and dissertation defence, which prove the ability and readiness to work independently in the field of research or development, or in theoretical and creative arts. The dissertation must comprise original and published results or results accepted for publication.*

**Ad g) Creative abilities of the student in the given research field. Compliance with the standard requirements placed on the dissertations in the given field.**

The doctoral student did prove his/her creative abilities in the given research field and the work does comply with the standard requirements placed on the dissertations in the given field.

Dissertant presented his ability to use scientific methods based on the theoretical results and simulations. The results (written) were presented in a proper form and I hope that they bring an interesting oral part of the defence.

Overall evaluation:
V posudku se prosím vyjádřete zejména k těmto bodům (koncept posudku najdete na stránkách FEKT)

1) Odpovídá námět práce oboru disertace a je aktuální z hlediska současného stavu vědy?
Yes, antennas and their arrays will stay interesting for research and development in the future. Antennas are the only element which stays analogue in the future of communication.

2) Vykazuje práce původní přínosné části? Konkretizujte prosím, v čem spatřujete originální přínos.
Yes. There are new results which open next areas of developent in the chosen fields of research and development. New or partly new scientific results I see:

A - waveguide - SIW transmission concept with lower unwantes radiation

B - different sensitivity analysis for manufacturing technique

C - partly new design of the array

D - using the parasitic patches for extension of bandwidth (axial ratio)

3) Bylo jádro disertační práce na potřebné úrovni publikováno? (Vyžaduje se zahrnutí reprintů resp. kopií se všemi bibliografickými údaji do disertační práce, výjimečně lze akceptovat jako náhradu potvrzení o přijetí k publikaci na renomovaném fóru.
Yes, important parts of work were published in the scientific journal of the good standard and different parts were presented at the three international conferences. Basic conditions of the doctoral study were fulfilled.

4) Vyplývá ze seznamu vědecké činnosti uchazeče, že se jedná o pracovníka s vědeckou erudicí.
Yes. Dissertant is able to use scientific metods as well as engineering processes.

5) Případné další skutečnosti, které by dokreslily osobnost uchazeče.
I am only the opponent without personal knowledge of author so I am not able to specify dissertant end his work more.

Opponent's questions and comments:

Q1 What are the possibilities to include the study of the left and right polarization (e.g. switching between them) ?

Q2 What are steps of freedom you can finally achieve (not only flat/plane arrangement of modules), maybe direction for the next development/research?

Q3 Could you define the new results, (your scientific) of your work and find the scientific value from them?

Q4 There is quite difficult to follow the text and description of the element of array. Could you interduce 4.2 part in more careful way?

Q5 Are you able to explain the tolerance analyses and individual sensitivity of them. In Fig. 4.3 - what is R). Where is the Table 1 (dimensions) from (experiment, simulation) ?

Q6 Where are the realistic properties of substrate for fabricated array from? What parameters we need to study the tolerance of dimensions (0,01mm) compare the tolerance of permittivity. Where are the losses? Why the measured parameters are in Fig. 4.7 are better then simulation?

Q7 What is the influence of parasitic patches on other parameters of single radiator and on the basic modular structure(s) 2x2, 4x4. Are there the other possible shapes of the parasitic elements to improve the properties of antenna?

**I ☒ recommend the dissertation for the defence.**

Date: 15.11.2021

Signature: ……..

Miloš Mazánek