Ph.D. theses review

Reviewer: Doc. Dr. Ing. Pavel Kovář

Student: Ing. Josef Vychodil

Topic: MILLIMETER WAVE BAND WIRELESS CHANNEL MEASUREMENT TECHNIQUES IN AUTOMOTIVE APPLICATIONS

The Ph.D. theses address the topic of the measurement of the millimeter wave band radio channel for communication purposes. The theses are written in the English language. The length of the theses is 98 pages including 6 scientific papers, which are an integral part of the theses. The theses contain obligatory parts required for this type of work.

The topic of the dissertation fully corresponds to the field of study of the candidate. At the same time, it can be stated that it is very current and applicable in practice that evidences the papers enclosed papers.

The scientific results of the dissertation were sufficiently published in impact journals and conferences.

The student proved skills in scientific communication, mathematical formulation of the problem and its solution, and supports his statements with relevant references. However, some of my comments are summarised in the following paragraphs:

1. The primary goal of the Ph.D. thesis is to design and build a channel sounding system, which will be optimized for measuring those complicated channels. The secondary goal is to perform actual measurements with the developed system. The goals are not well defined. The design of the system based on the existing knowledge is not a standard goal of scientific work. The scientist should develop a new method, improve an existing method, or realize some unique measurements, etc.

2. The author used a special very expensive hardware for the realization of the channel sounder. It is clear that there is a lot of limitations like the processing bandwidth and sampling frequency of the applied instrument which must be taken into account during the technical analyses. This fact leaves a mark in chapter 3, in which the theory of data processing is discussed. Instead of the clear presentation of the theory, the student tries to substitute the numbers for the presented formulas. The problem of these parts of the text is that the sounds as technical descriptions of the system realization not the presentation of the scientific theory.

3. The same approach is in subsection 3.8. in which the author presents the modeling of the nonlinear behavior of the system based on Volterra series. Then the measured SFDR of the concrete PRN sequences is presented. The conclusion of this is that the m-sequence is worse than the inverted m-sequence or Galoy pair (Figure 3.3). The delay of the problematic spur is more than 100 ns. Spur of such delay cannot arise in the presented system because of the wide bandwidth of the baseband and omission of the RF. The spur can arise by improper implementation of the signal processing or by other phenomena.

4. The discussion concerning the reaching of the scientific goals and highlighting of the scientific contribution is not sufficient.

Conclusions

In my opinion, the submitted Ph.D. theses fulfill all requirements needed for this kind of scientific work. Therefore, I recommend the theses for defense. During the defense, the student should focus on the clear formulation of the scientific goals and their fulfillment.

Questions:

1. Student should explain the spur in figure 3.3.a, especially its delay that exceeds 100 ms.

2. The ideal hardware for implementation of the developed channel sounder is for instance Programmable RFSoC. The author should take a position on this method and compare it with his solution. Let us note, that the latest chips disposed of 4GSPS, 12 bits ADC, and 6GSPS, 14 bits DAC, so the raw dynamic range without the processing gain is much wider than the proposed solution.

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