

Practical Ideas from Professors: Standards Education in Your Courses

# Teaching Standards in Wireless Communications



## About the School of Electrical Engineering, Information Technology, and Physics at Technische Universität Braunschweig

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Technische Universität Braunschweig, founded in 1745, is one of the oldest Universities of Technology in Germany. Electrical Engineering and Information Technology at Technische Universität Braunschweig are taught in three 3-year bachelor and five 2-year master programs to approximately 1600 students, many of whom are studying toward joint degrees with computer science, mechanical engineering, or industrial engineering. The school has a long-standing tradition in standardization, as demonstrated by the technical leadership in the development of Digital Video Broadcast (DVB) by TU Braunschweig faculty member, Professor Ulrich Reimers. The school is also closely cooperating with the Braunschweig-based Physikalisch-Technische Bundesanstalt (PTB), Germany's national metrology institute and highest authority when it comes to correct and reliable measurements.



Prof. Dr.-Ing. Thomas Kürner

I am a university professor specializing in mobile radio systems at the Institute for Communications Technology at Technische Universität Braunschweig in Germany. My research areas are: indoor channel characterisation and system simulations for high-speed short-range systems including future terahertz communications systems; propagation, traffic and mobility models for automatic planning and self-organization of cellular radio networks; vehicle-to-X communications; as well as accuracy of satellite navigation systems. Currently, I am chair of the IEEE 802.15 Task Group 3d, chair of the IEEE 802.15 Interest Group THz, and vice-chair of the IEEE 802.15 Task Group 3e.

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## Using Standards in Wireless Communications Courses:

Typically, communication systems are set up by a huge number of components and entities, which are provided by a large number of different manufacturers. Interworking of all these components does not work without standardization. Furthermore, requirements coming from the economy of scale make it mandatory to have the same *standardized* systems globally wherever possible. As a consequence, when teaching communications engineering, education covering the overall design of communications systems is impossible without considering the standards behind these systems.

Teaching about standards is an integral part of my lectures: “Principles in Wireless Communications” and “Advanced Topics in Mobile Radio Systems.” The first lecture considers in its second half complete wireless communications systems. The teaching on these systems covers the most relevant standards developed by 3GPP and IEEE 802®. The latter lecture includes systems at 60 GHz and beyond, where a lot of especially in IEEE 802 is ongoing. Each year, the lecture is updated with recent developments in IEEE 802.11™ and IEEE 802.15.3™. Master theses are often related to standards and include the implementation of

standards into simulation tools. For example, the IEEE 802.11p™ standard has been implemented into the physical layer simulator developed by my group.

The market success of a specific wireless communications system does not only depend on its specific scientific and technical merits but is also significantly influenced by economic, political, and regulatory factors. These factors also heavily impact the standardization process. From my point of view, education on the interplay of these aspects is essential in order to prepare the students for the “real life” that is awaiting them after their time at the university. In my professional career, I have participated in many decisions in the area of standardization and regulation, which enables me to provide students with first-hand experience and information about how and why certain decisions have been made.