

Practical Ideas from Professors: Standards Education in Your Courses

# Teaching Standards in Electronics & Communication Engineering



## Electronics & Communication Engineering Program at SSN

The Department of Electronics & Communication Engineering at the SSN College of Engineering, located in Tamil Nadu, India, offers an undergraduate program in the area of electronics and communication, and graduate and doctoral programs in the areas of communication systems, applied electronics and VLSI. In their final years, graduate students undertake individual projects, while undergraduate students undertake group projects in these areas. Recently, the department has initiated review of these projects by engineers from industry. Research within the department focuses on electromagnetics and antennas, image and speech processing, wireless communication networks and VLSI and MEMS.

### Using Standards in Technical Field Courses:

Measurements are fundamental to the advancement of technology. The practical requirement that measurement results be widely understandable requires the use of units, and hence standards [1]. This requirement is at a rather fundamental level, and plays an implicit but extremely important role in any measurement, but especially in measurements undertaken to validate engineering designs. This means that standard test procedures are available, so the results can be understood across countries. In antenna measurements, an area of my work, for example, in measuring the gain of a test antenna using the reference antenna method, a standard antenna is always required to be part of the measurement system.



**Dr. Krishnasamy Selvan**

Prior to teaching, Dr. Selvan was with a government microwave research and development organization for seventeen years. He began teaching in 2005 and focuses on electromagnetics and antennas to undergraduate and graduate students, and supervises masters' and doctoral research. As a member of the IEEE Antennas and Propagation Society's Education Committee, he has special interest in electromagnetic education. In his teaching, Dr. Selvan gives particular importance to measurement methods, and emphasizes the importance of developing an understanding of uncertainty in measurements, a key aspect of metrology and standards.

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## Using Standards in Technical Field Courses (continued):

A statement of uncertainty is expected to be included in reporting any professional measurement result. For example, such a statement is required for measurements related to quality control, basic research and calibrating standards [2]. This requirement applies to many fields, including electronics and communication engineering [3]. Therefore, I think it is an important requirement that engineering students develop a good understanding of this topic.

For the courses on radiation systems, both at undergraduate and graduate levels, I discuss the standard antenna gain measurement procedures and the importance of uncertainty estimation in measurements. When possible, I make a short presentation on my work in the area (for example [4]). As part of an assessment, I ask students to submit a written assignment on the topic, discussing the importance and methods of uncertainty estimation in general, and in antenna measurements in particular. I advise project students also to become aware of the importance of this topic.

I think it may be a good idea to ask students

to determine the uncertainty in making their laboratory measurements. While this may not be feasible for every measurement, if they can do it at least for one specific measurement, they can gain a good understanding of the topic.

Given that standards are “documented agreements containing technical guidelines to ensure that materials, products, processes, representations and services are fit for their purpose,” [5] included within their purview are measurement methods and references, among others. In my teaching of antenna measurements, standard methods are covered. These include the so-called reference antenna gain measurement method, where a reference antenna is part of the measurement setup.

### Benefits for Students

As discussed in [5], there is a unique relationship between standards and innovation. Gaining a decent level of understanding of the role standards play in science and engineering will certainly help students to be better engineers and scientists in industry, and in fact in any organization.

#### References:

- [1] K.T. Selvan, “Fundamentals of electromagnetic units and constants,” *IEEE Antennas and Propagation Magazine*, vol. 54, no. 3, June 2012, pp. 100-114.
- [2] “Evaluation of measurement data Guide to the expression of uncertainty in measurement,” JCGM 100:2008, available at [http://www.bipm.org/utis/common/documents/jcgm/JCGM\\_100\\_2008\\_E.pdf](http://www.bipm.org/utis/common/documents/jcgm/JCGM_100_2008_E.pdf), accessed February 18, 2016.
- [3] “Beginners guide to measurements in electronic and electrical engineering,” NPL Good Practice Guide No. 132, available at <http://www.npl.co.uk/upload/pdf/beginners-guide-to-measurement-in-electronic-and-electrical-engineering.pdf>, accessed February 18, 2016.
- [4] K.T. Selvan and S. Sharma, “Uncertainty in antenna measurements,” *Forum for Electromagnetic Research Methods and Application Technologies*, vol. 15, 2016. Available at [http://www.e-fermat.org/files/multimedias/Selvan-MUL-2016-Vol15-May\\_Jun.-10%20Uncertainty%20Estimation%20in%20Antenna...pdf](http://www.e-fermat.org/files/multimedias/Selvan-MUL-2016-Vol15-May_Jun.-10%20Uncertainty%20Estimation%20in%20Antenna...pdf), accessed February 20, 2016.
- [5] R.H. Allen and R.D. Sriram, “The role of standards in innovation,” *Technological Forecasting and Social Change*, vol. 64, 2000, pp. 171-181.