This report presents an overview of the convened session of the European Association on Antennas and Propagation (EuRAAP) Working Group (WG) on Software and Modeling Tools at the European Conference on Antennas and Propagation (EuCAP) 2018 in London, which was held 9–13 April. It briefly discusses the general topic of this year—small-antenna design and modeling tools—by summarizing the four invited papers in the first part of the session and recaps the improved benchmarking effort in response to the benchmarking results of 2016, which was discussed in the second portion of the meeting.

SESSION OVERVIEW
Since the start of the EuCAP in 2006, EurAAP’s Software WG has organized yearly or biannual convened sessions at this symposium. A thorough overview of the WG’s activities covered in the last six meetings can be found in the corresponding “Meeting Reports” columns in IEEE Antennas and Propagation Magazine [1]–[6].

This year, the WG’s main topic was explored in two parts. The first was a traditional convened session, where four papers were invited representing different activities in the small-antenna research community. These papers covered
- implantable small antennas, presented by Anja K. Skrivervik [7]
- a user-friendly MATLAB-based design tool developed in the Czech Republic, offered by Miloslav Capek [8]
- a measurement postprocessing technique for small antennas, given by Per Iversen [9]
- a new paradigm to design small antennas, presented by Mats Gustafsson [10].

The second part of the session was a so-called scientific workshop, which dealt with this year’s benchmarking efforts. Benchmarking has always been a core activity of the Software WG. As a result of the efforts from 2006 to 2016, we have a good idea of how far benchmarking can actually bring us. The most recent step in this process was set in 2016, when high-quality software results produced by software vendors were compared with measurements performed by measurement experts (i.e., the EuRAAP WG on Measurements and vendors of measurement equipment). This was carried out for three selected antennas. The results of this work can be found in [5]. This year’s benchmarking effort is a follow-up on that of 2016 in terms of trying to improve the agreement between simulations and measurements.

At the height of the session, approximately 60 people were in attendance [Figure 1(a)].

BENCHMARKED ANTENNA
In 2016, one of the three benchmarked antennas was the GSM antenna, with triple-frequency-band operation and coplanar waveguide feeding [11], [4]–[6] (Figure 2). The surprising conclusion of the 2016 run was that, while all of the simulations agreed quite well with each other and all of the measurements also agreed quite well with another, there was a large discrepancy between the simulations and the measurements (Figure 3).

The goal of benchmarking this year was to further upgrade the results to...
reach even better agreement. Therefore, the remaining possible causes of the discrepancies were tackled.

- The physical/topological model of the structure was thoroughly triple-checked to avoid any errors there. Several small inaccuracies were found and corrected—but they did not have any drastic effect on the results, and they did not explain the 2016 discrepancies.
- The presence of the cable while measuring this small antenna was an issue. To take its effect into account, Katholieke Universiteit Leuven (KUL) not only created a single SAT file describing the antenna structure but also included a piece of the feeding cable. This SAT file was used by the five software vendors taking part in this year’s effort to perform new simulations. The vendor participants were Ansoft–Ansys, with high-frequency structure simulator (HFSS) software; CST with its CST Studio tools; Altair, with the FEKO application; IMST, with its Empire software; and WIPL-D, with the WIPL-D application.
- A new measurement campaign was performed. In the 2016 run, only the antenna was sent to the participating laboratories. This year, not only the antenna but a well-defined piece of semirigid coaxial feeding cable and two ferrites were presented to the different sites, and the measurement setup was fully specified. I would like to thank Vladimir Volski of KUL; Thomas Gemmer of the Rheinisch-Westfälische Technische Hochschule (RWTH), Aachen, Germany; Bu Van Ha of the Université Catholique de Louvain (UCL), Louvain-la-Neuve, Belgium; and Ad C.F. Reniers of the Eindhoven University of Technology (TUE), The Netherlands, for performing the measurements.
The new comparison of simulations and measurements is shown in Figure 4. It is immediately apparent that the agreement among the simulations and the measurements are both excellent. All measurements coincide and all simulations coincide around the low and high resonance. Only around the middle resonance is there some discrepancy. This is a clear indication that the quality of the simulations and measurements has improved greatly compared to 2016. It has to be noted that, for the measurements, this result was reached with two ferrites. Using only one ferrite delivered a slightly worse agreement.

However, the agreement between simulations and measurements was not that much better compared to 2016, and the cause of this is truly a mystery. One remaining possible reason, suggested by the software vendors, is the internal structure of the connector. The exact internal topology and internal dimensions of the connector are the intellectual property of the connector manufacturers and are extremely difficult to acquire. They are thus not fully specified in the data sheets and had to be estimated based on the condition that a 50-Ω transition should be obtained from input to output. However, after EuCAP, KUL performed several additional simulations, where we used a general quasistatic model for the connector to fit the simulations to the measurements. This was unsuccessful, indicating that this is probably not the main cause for the discrepancy. A second possible reason is a resonance occurring in the feeding cable, something which is still not fully covered in the simulation model.

CALL FOR PARTICIPATION

Considering that this antenna has proven to be the most challenging topology ever considered within the context of the benchmarking effort of EuRAAP’s Software WG, KUL would like to launch a call for participation. Anyone interested in performing simulations and/or measurements to unravel the mystery of the disagreement may contact me at guy.vandenbosch@kuleuven.be. I can provide the SAT file being used in the simulations and, if necessary and appropriate, the antenna to perform additional measurements.

CONCLUSIONS

The GSM antenna that has already been benchmarked several times was revisited, involving both simulations and measurements. The results were surprising. Although the simulations agreed extremely well and the measurements agreed almost perfectly, there was still too large a disagreement between them. Currently, the reason for this is still not fully understood.

REFERENCES