

# SEMCAD X NEWS

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## Gaining more insights into electromagnetic problems at all radio frequency ranges

by SEMCAD X Team

### Our Customer

Plextek Consulting, one of the largest independent electronics design consultancies in Europe, helps customers around the globe to solve problems and develop innovative solutions covering a wide variety of technologies, including medical telemetry systems, stolen vehicle recovery systems, smart metering, consumer wireless systems, and ground surveillance radar systems.



**Figure 1:** Headquarters of Plextek Consulting, Great Chesterford, United Kingdom.

Dr Marcus Walden, Senior Technology Consultant at Plextek Consulting for 16 years, explains how SEMCAD X has helped the company gain deeper insights into numerous and diverse electromagnetic (EM) problems. The work undertaken by Plextek Consulting covers a wide frequency range, effectively from 'DC to daylight'. "Being able to visualize the EM fields and antenna radiation patterns offers so much more insight than is obtained simply from looking in a text book", he says and continues, "SEMCAD X helps us to solve most of our EM-related problems and does it very well".

Marcus belongs to the Radio Group at Plextek, where his main area of expertise

covers antennas and propagation. He has used SEMCAD X for nearly 10 years now, and the good agreement he has obtained between simulations, measurements, and standard theory makes him feel very confident about the capabilities of the software.



**Figure 2:** Dr Marcus Walden, Senior Technology Consultant at Plextek Consulting.

### The User Experience

His introduction to SEMCAD X was by way of SEMCAD Light. Although the functionality of the Light version is reduced compared to that of the full-license version, it nevertheless offers a very cost-effective and capable implementation of the finite-difference time-domain (FDTD) simulation method, as well as the opportunity for the user to learn and explore the capabilities of SEMCAD X.

The full upgrade to SEMCAD X was a natural progression for Plextek Consulting, because the type and complexity of EM problems found in some internal and external client projects demanded the capability of the full version. That hardware acceleration is included as a standard feature with SEMCAD X impressed Marcus. "Having a GPU card for simulations is so enabling. It can deal with much larger EM problems in a time-efficient manner. And the fact that it comes bundled with the software is for me a bonus, since other companies charge for this as an optional extra", he explains.

### Real-world Applications

Plextek Consulting has been involved in a variety of interesting and technically challenging projects, including some related to the integration of wireless systems into medical devices. For example, Plextek Consulting developed a medical telemetry system that has now been deployed in about 50% of North American hospitals. This system operates in a dedicated medical frequency band to provide ECG monitoring of up to 200 patients as they roam across a wide indoor area.

Another interesting telemetry project is based on ultra narrow band (UNB) technology developed by Plextek Consulting. This technology forms the basis of the Telensa PLANet street-lighting control system, which monitors the energy consumption and enables control of street lamps. The technology takes advantage of some advanced signal processing techniques that shift complexity from low-cost, high-volume control modules at the street lights to high-performance base stations to significantly reduce control-module costs.

In the automotive sector, Plextek Consulting provides leading-edge technology in areas such as dashboard systems, navigation, and communications. Plextek Consulting has been responsible for the design and manufacture of over 5 million stolen vehicle recovery tracking units sold in over 30 countries; the Plextek system continues to be the leading product in this market segment.

Plextek Consulting has also developed the Blighter™ radar system, which is a state-of-the-art electronic-scanning (e-scan) ground-surveillance radar (GSR) system. The antennas form a crucial part of the radar

system, and SEMCAD X was an essential tool used during the antenna design phase.

### SEMCAD X in Action

Recently, Marcus presented two publications at the 2013 IEEE International Symposium on Antennas and Propagation held in Orlando, Florida. His first paper, "A Ku-Band, low sidelobe waveguide array employing radiating T-junctions"[1], discussed the development of the latest



Figure 3: Two 5° beam-width antennas deployed on radar.

N5S antenna for the Blighter B400 series radar (depicted in Fig. 3). The new antenna design makes use of a corporate feed structure that is physically short and provides increased gain and reduced elevation beamwidth while maintaining low sidelobe levels. The antenna, which consists of a 16-element waveguide array, was designed with the help of SEMCAD X.

The simulated RMS electric field strength is shown in Fig. 4. This new antenna benefits the Blighter radar system by providing extended radar coverage up to 15 km for detection of a person over flat terrain.

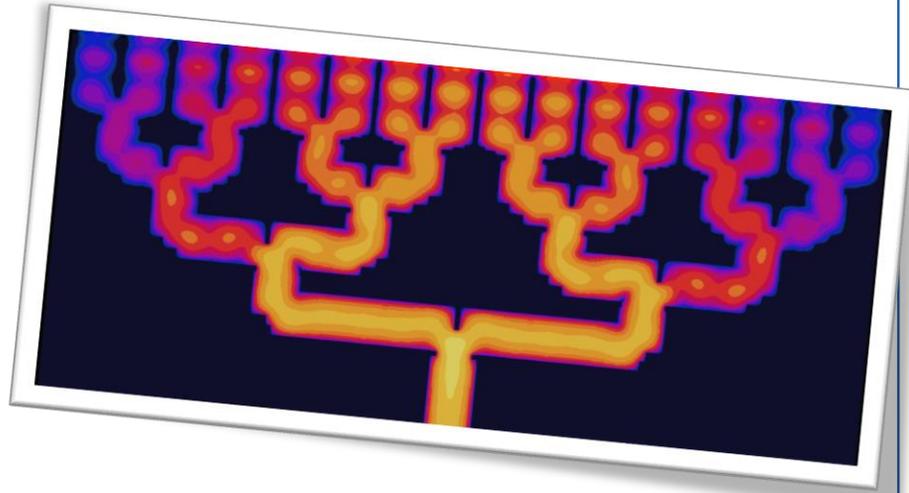


Figure 4: SEMCAD X model of 16-element waveguide array with simulated RMS electric field at 16.5 GHz.

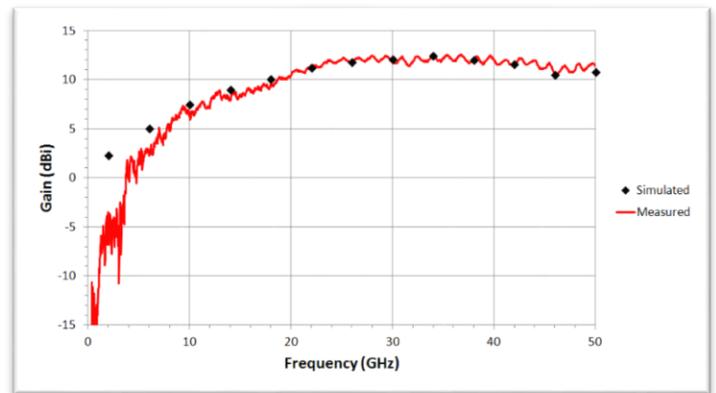
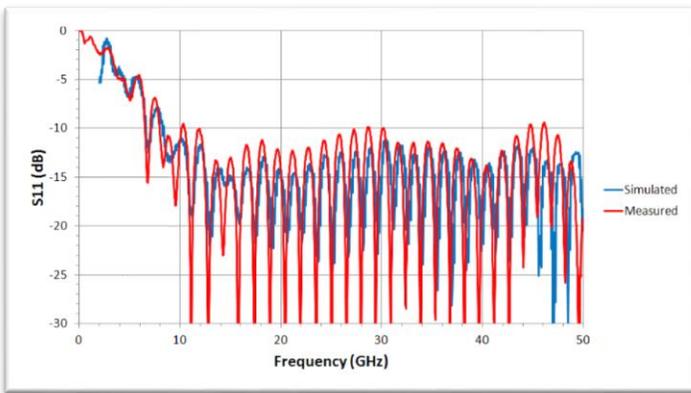


Figure 5: Comparison between simulation results obtained with SEMCAD X and experimental results for reflection coefficient (left) and forward gain (right) of the 'Vivaldi' antenna.

In the second paper, "A wideband, 5-50+ GHz tapered-slot antenna for use in handheld test equipment"[2], the design of a wideband printed antenna that is both lightweight and cost-effective was presented. This 'Vivaldi' antenna was designed to replace a heavy and costly waveguide horn for use in handheld test equipment.

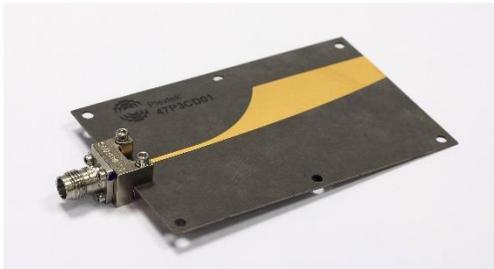


Figure 6: Picture of the final product of the 'Vivaldi' antenna designed with SEMCAD X.

The antenna's wide frequency coverage enables it to be exploited for other applications including test and measurement, radar and communications. The design and simulation was carried out with SEMCAD X. Simulation results compared with experimental measurements made with the fabricated antenna are shown in Fig. 5.

Excellent agreement was obtained between simulation and measurement, proving the competence of SEMCAD X in this field.

### The Future

Plextek Consulting has used SEMCAD X extensively for a wide variety of EM problems, including antenna design, placement and evaluation, radar cross-section (RCS) modelling, and complex wave propagation. It is envisioned that Plextek Consulting will continue to use SEMCAD X for many new and novel applications, including body-worn antennas, electromagnetic bandgap (EBG) antennas, medical implants, SAR validation, to name only a few. To date, Plextek views the purchase of SEMCAD X as having been a worthwhile investment that has opened many doors of opportunity and helped raise the capabilities and profile of Plextek Consulting in the antennas and propagation arena.

### References

[1] Walden, M.C., "A Ku-band, low-sidelobe waveguide array employing radiating T-junctions," *Antennas and Propagation Society International Symposium (APSURSI)*, 2013 IEEE, vol., no., pp.47,48, 7-13 July 2013  
 [2] Walden, M.C., "A wideband, 5-50+ GHz tapered-slot antenna For use in handheld test equipment," *Antennas and Propagation Society International Symposium (APSURSI)*, 2013 IEEE, vol., no., pp.430,431, 7-13 July 2013