KYMETA DEVELOPS NOVEL METAMATERIAL ANTENNAS WITH CST STUDIO SUITE

THE IDEA: SATELLITE BROADBAND, FROM ANYWHERE

Satellite broadband promises fast, flexible internet access from anywhere in the world. Although major satellite operators have already begun deploying next-generation satellites with high data throughputs, accessing these currently requires bulky, expensive equipment with high power requirements for the user. Unlocking the full potential of these data links requires an antenna solution that can track satellites while also being portable enough to attach to a vehicle or take into the field.

To enable widespread adoption of satellite broadband, especially for mobile users, Kymeta is developing and marketing mobile satellite communications terminals using a new reconfigurable antenna technology, known as Metamaterials Surface Antenna Technology (MSA-T), shown in Figure 1. This offers the electronic beam-steering performance of a typical phased array, but with much lower power consumption. A dramatic cost reduction is achieved compared to mechanical or phased array products and many of the size, weight and power challenges associated with the existing techniques are alleviated.

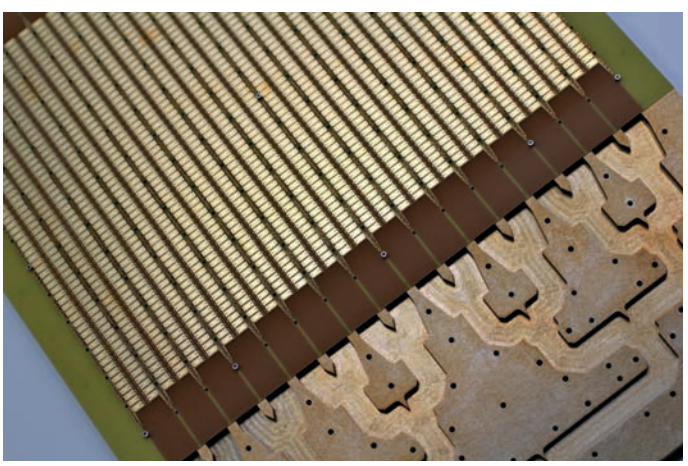


Figure 1 A prototype of the MSA-T antenna array and feed network.

THE CHALLENGE: TUNING AND PROTOTYPING AN ARRAY WITH THOUSANDS OF ELEMENTS

MSA-T uses several thousand sub-wavelength resonators, which are individually activated to shape and direct the beam (Figure 2). This meant that designing a working metamaterials-based antenna required numerous interdependent variables to be optimized. Kymeta used the frequency domain solver in CST MICROWAVE STUDIO® (CST MWS) to quickly and accurately model the complex interactions between various design features, significantly easing the prototyping and development effort. CST's macro-driven model generation tools were a good fit to array design. Using macros to generate the multitude of elements that comprise the antennas sped up the process greatly.

For simulating larger sections and even the whole array, Kymeta turned to the time domain solver. The MSA-T arrays consist of thousands or tens of thousands of elements, and can reach 60 λ by 60 λ in size. To simulate these complex, electrically-large arrays, Kymeta used GPU acceleration with four Nvidia Tesla® K40 cards. Together, these made it possible to simulate large sections of the array within a day.

About Kymeta Corporation

Kymeta Corporation is commercializing a new, innovative software-enabled metamaterials-based electronic beam-forming antenna for satellite communications. Kymeta has been named by MIT Technology Review, as well as by CNBC, as one of 2013's 50 most disruptive companies as part of their annual list of the world's most innovative technology companies. Kymeta was selected by Future in Review as a 2014 FiRe Starter company. The company is based in Redmond, Washington, and operates on a worldwide basis.

For more information, please visit **www.kymetacorp.com**.

KYMETA™

CONNECTED. ANYWHERE.

CST

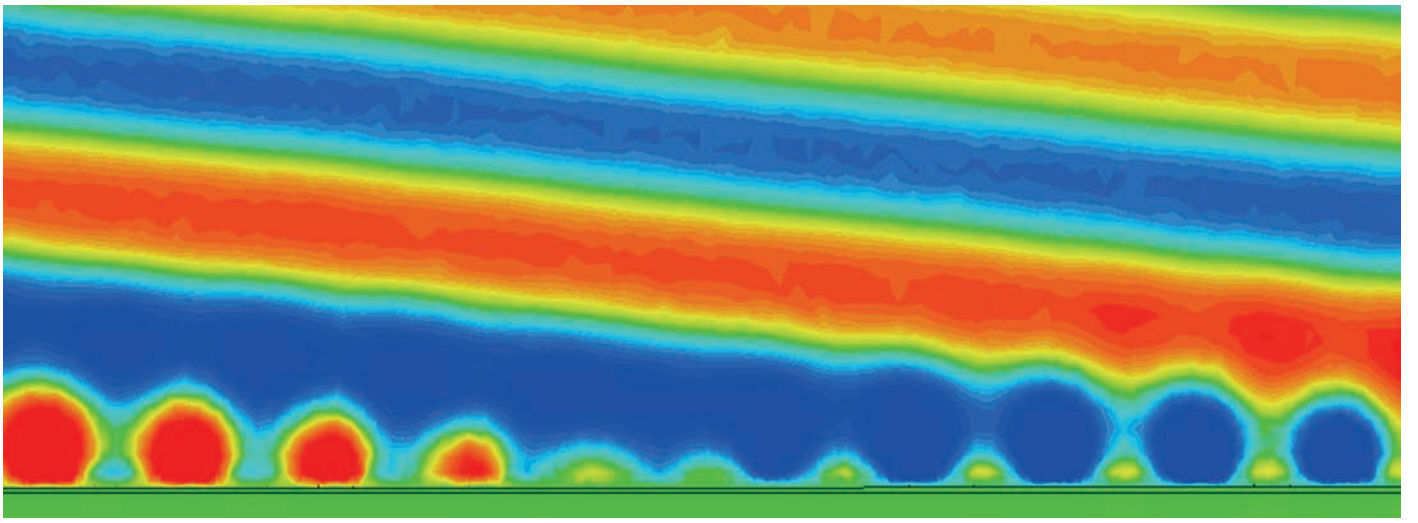


Figure 2 CST MWS nearfield simulation result, showing beam-forming MSA-T.

Once Kymeta had a viable initial design, it was fine-tuned using the Trust Region Framework optimizer. This is a powerful local optimization algorithm built into the CST MICROWAVE STUDIO design environment, which can use sensitivity information to speed up the optimization process. Optimizations were carried out over multiple variables – in some cases, as many as 40 in a single run – to improve the characteristics of the antenna. The parameters that described the excitation of the array were also optimized using the same tools to allow high-performance beam steering.

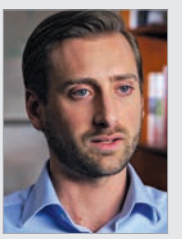
Figure 3 Kymeta Portable Satellite Terminal mock-up.

THE RESULT: A SMALL, PRACTICAL SATELLITE TERMINAL

Virtual prototyping reduced Kymeta's prototyping costs by reducing the number of real prototypes required during the design process. It also helped inform the decision making process, offering insight into what worked and what did not. The range of import/export tools for CAD formats such as Gerber, DXF and SAT made it feasible to start and develop designs using CST products, and then send them to other platforms and vendors when necessary.

From the founding of Kymeta right through to the production of field-tested prototypes, CST STUDIO SUITE® has been an integral part of the design process at the company. Using CST STUDIO SUITE, Kymeta were able to design a range of antennas with a smaller form factor and reduced weight, while also keeping costs and power consumption low.

»CST MICROWAVE STUDIO provided a necessary component of our RF design flow at Kymeta. Without it, the challenge of designing numerous interrelated antenna features would have been nearly insurmountable.«



Adam Bily
Lead RF Design Engineer
Kymeta Corporation
Redmond, Washington