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Nanjing Ericsson Panda Communications Reduces LTCC Footprint by 80% Thanks to Cadence AWR Software

Key Challenges

Nanjing Ericsson Panda Communication Co., Ltd. (NEPCC) is a joint venture company established by Nanjing Panda Electronics Company Ltd., Ericsson Sweden Ericsson (China) Co., Ltd., China Putian Information Industry Group Co., Ltd., and Yung Shing Enterprise, Hong Kong, to manufacture high-technology communications system products, including the design, production, sales, and installation of GSM/CDMA digital mobile communication systems and switches. Incorporated in 1992, the company has become the largest manufacturing base of mobile communication base stations and system equipment and is rapidly becoming the largest system supply center for Ericsson in the Asia-Pacific region.

The quadrature hybrid (or branch-line coupler) is a key component found within microwave circuits such as balanced amplifiers, balanced mixers, phase shifters, and beamforming networks for array antennas. The conventional approach for a single section quadrature hybrid with 20dB return loss is limited to 10% bandwidth. While a broader bandwidth can be achieved using coupled lines, coupled line hybrids are difficult to implement on MMICs. Looking instead at branch-line hybrids, the bandwidth can be increased greatly by using stepped multi-section impedance transformers and cascading the multi-sections; however, the increase to the size of the MMIC is a deterrent. Therefore, the challenge for the NEPCC design team was to develop a novel approach for a quadrature hybrid that would not only decrease the size of the MMIC but also improve the performance bandwidth.

Application

- Microwave monolithic integrated circuit (MMIC)

Software

- Cadence® AWR Design Environment® Software Portfolio, including:
  - Cadence AWR® Microwave Office® software
  - Cadence AWR AXIEM® 3D Planar analysis

Benefits

- Saves design time
- Easy-to-use software
- Enhanced accuracy

The Solution

Nick Zhou, lead AWR user at NEPCC, used AWR Microwave Office circuit design software combined with AWR AXIEM 3D planar EM simulation to design a novel low-temperature co-fired ceramic (LTCC) quadrature hybrid device using a

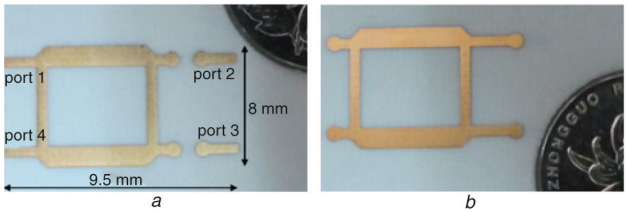

Figure 1: Photo of the hybrid LTCC

stacked multi-section structure based on a Ferro-A6 substrate (Figures 1 and 2).

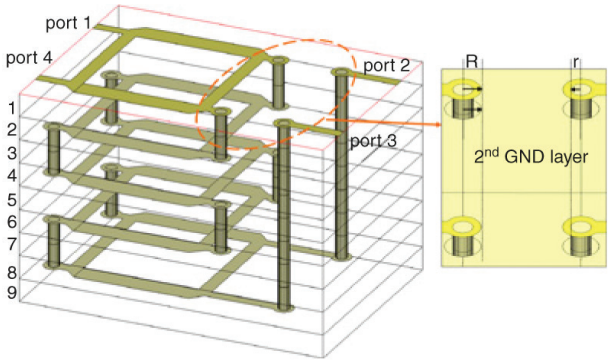

Figure 2: AWR layout of the hybrid LTCC

Zhou achieved a bandwidth of 40% larger than conventional devices and a size reduction of 80% using a vertical stacked structure instead of the traditional cascaded method. The main advantages of this novel approach are miniaturized size and low interference.

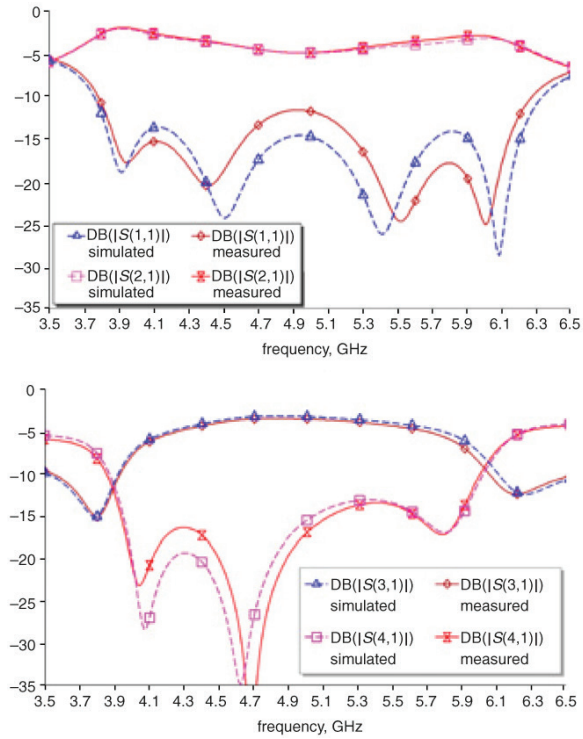

Figure 3: AWR simulation results agree well with measurements

Due to the large number of parameters, the optimization and verification would have been very time-consuming if simulated using only traditional FEM-based simulators. Because AWR Microwave Office software and AWR AXIEM analysis are closely integrated within the AWR Design Environment platform and share the same schematic/layout, he was able to combine the circuit-based simulator and EM-based simulator, which significantly enhanced his optimization efficiency as well as accuracy. In addition, there was no need to manually re-draw the layout, which saved even more time. The final simulated results versus measurements agreed very well (Figure 3), and the design team was extremely pleased with the success of this difficult challenge.

Nick found AWR software to be easy to install, fast to learn, and very user friendly. He also appreciated the fast, proficient, and dedicated support by Cadence's local application engineers.

> *With Cadence AWR software , we were able to optimize a novel LTCC quadrature hybrid design and achieve the difficult challenge of an 80% reduction in space and 40% wider bandwidth than conventional designs. AWR simulation results agreed well with measurements and the support from local engineers was outstanding.*
>
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> www.ericsson.com

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