

## TriQuint Solves Entire Non-Uniform Distributed Power Amplifier Structure Using AXIEM

### THE DESIGN CHALLENGE

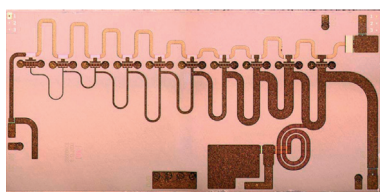
TriQuint Semiconductor, leader in high-performance RF components for wireless communication, designs wideband power amplifier monolithic microwave integrated circuits (MMICs) suitable for electronic warfare (EW) systems. These systems require amplifiers with high power, wide bandwidth and high efficiency to which TriQuint researchers have developed power amplifier MMICs utilizing the non-uniform distributed power amplifier (NDPA) approach. Showcasing impressive results, these NDPA MMICs are designed for saturated operation. This requires accurate electromagnetic data up to the 5th-7th harmonic frequency which results in a very large mesh/matrix. Consequently solving the entire structure has never been practical and ergo not attempted, but upon hearing about AXIEM's nearly linear scaling, TriQuint fellow Chuck Campbell elected to take the AXIEM challenge.

### THE SOLUTION

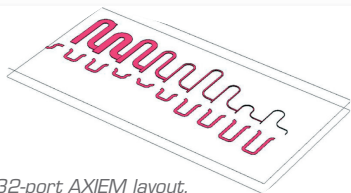
TriQuint had never attempted prior to electromagnetically (EM) simulate the entire MMIC circuit of their NDPA, which includes more than 32 ports and for a gridded planar EM tool upwards of 30,000 unknowns.

None the less, Chuck Campbell decided to put AXIEM to the test. The result: AXIEM solved the entire structure from DC to 120GHz in under 2 minutes per frequency on a quad-core desktop PC with 4G Ram (32-bit OS). What's more, AXIEM's shape pre-processor and hybrid adaptive meshing algorithms meant that the final mesh size was little more than 6000 unknowns – highly efficient.

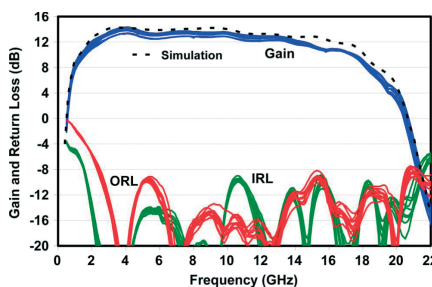
"The power and speed of AWR's new AXIEM 3D planar EM software made it possible to accurately and efficiently simulate the entire structure of this very complex NDPA MMIC," said Chuck Campbell, a TriQuint fellow. "The resulting device (as simulated and measured) has demonstrated, in the 1.5–17 GHz band, experimental results of 9 W to 15 W saturated output power with an associated PAE typically above 20%. To my knowledge, these results are among the highest reported for a monolithic solid-state power amplifier covering this frequency range."



Photograph of the NDPA MMIC.



32-port AXIEM layout.



30 V small signal gain and return loss.

The simulated small signal gain is shown as the broken line and is in good agreement with the measured results.

**TriQuint** SEMICONDUCTOR

Application:  
MMIC Power Amplifier  
AWR Software:  
Microwave Office®  
AXIEM™



"The power and speed of AWR's new AXIEM 3D planar EM software made it possible to accurately and efficiently simulate the entire structure of this very complex NDPA MMIC."

Chuck Campbell  
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