AWR® Success Story

MILMEGA UTILIZES AWR SOFTWARE AND CREE NON-LINEAR MODELS TO DESIGN COMPACT, HIGH-POWER, DECADE-SPANNING GALLIUM NITRIDE AMPLIFIER

MILMEGA

Application:
High-Power Amplifier

AWR Software:
Microwave Office™

CUSTOMER BACKGROUND

MILMEGA is a leading specialist in the design and manufacture of solid-state, high-power microwave and RF amplifiers. The company's core strength lies in the development of broadband Class A amplifiers, typically operating in the 80MHz to 8GHz range with output powers from 30W to 1kW. MILMEGA is based on the Isle of Wight, off the south coast of England, UK.

THE DESIGN CHALLENGE

Known for high-reliability and high power-density products that operate in the 1-8GHz range, MILMEGA's new amplifier design was initiated to address customer demand for a sub 1GHz amplifier family suitable for electromagnetic compatibility (EMC) testing environments, a market currently addressed with amplifiers designed nearly 2 decades ago.

The MILMEGA 80RF1000 amplifier range comprises scalable power ranges from 175W to 1000W over the multi-octave band of 80MHz to 1000MHz. Employing the latest technology in solid-state gallium nitride (GaN) devices, the range of amplifiers delivers unparalleled power density and performance, supports the entire multi-octave test band in one range, and with a reduction in size of 4 times that of competitive products.

From the beginning, the design team set out to utilize the latest in device technology and design software to deliver the smallest, lightest, most efficient, easiest to build and maintain amplifier ever produced for the EMC testing market.

MILMEGA 80RF1000, 1000 Watt - solid-state power amplifier from 80MHz to 1GHz.

"The tight integration and accuracy of the Cree-supplied non-linear models within the AWR software environment was the first critical element to the project's success. Additionally, being able to create custom scripts in AWR for optimization routines that accurately explored the capabilities of the device was another key element for success."

Andy Kozakewycz
Senior Microwave Design Engineer
MILMEGA
www.milmega.com

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"From initial device selection to an RF-compliant first-prototype took us about four weeks. For earlier projects involving older silicon device technology and less accurate models, this process took several months."

Mark Bloom, Design Engineering Manager, MILMEGA

THE SOLUTION

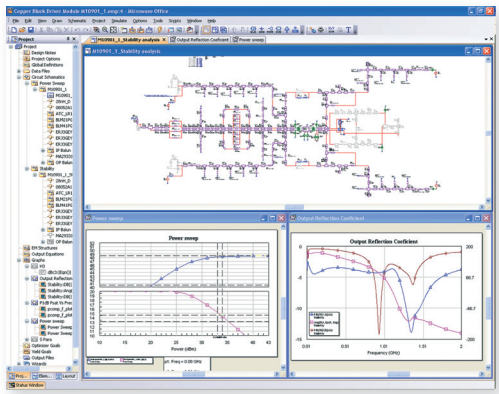
The achievement of the aforementioned design goal was possible given the maturing of several key technologies:

- Harmonic balance simulation software from AWR
- Availability of accurate device models from Cree
- Robust and well defined, wide bandgap devices
- Raw algorithm solving power of available computer hardware

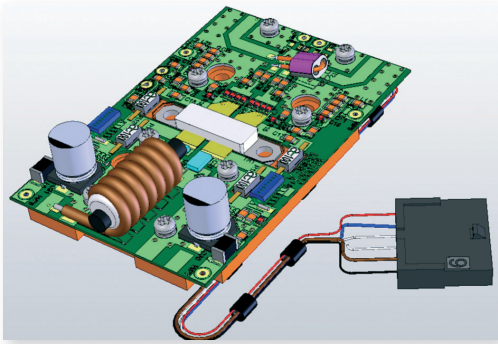
The tight integration and accuracy of the Cree-supplied non-linear models within the AWR software environment was the first critical element to the project's success. Here, Microwave Office software was used for all aspects of the RF design but particularly in the development of the key component(s) of each and every MILMEGA amplifier - the basic building blocks created around the devices. The enhanced modeling capabilities provided by the AWR harmonic balance solver enabled accurate exploration of the capabilities of the GaN dual device under AB bias and push-pull conditions.

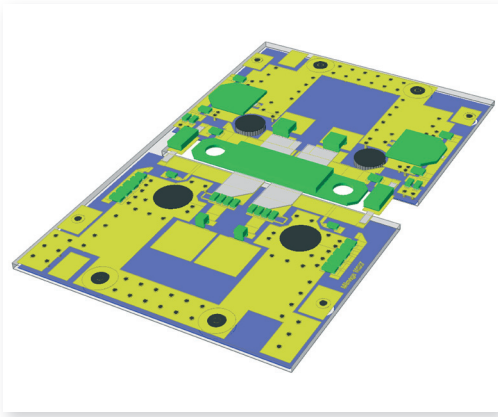
The design used novel high-power, multi-octave band baluns – they too were designed in AWR and leveraged its wide range of built-in models. Parasitic effects were then added based upon various technical publications and prior in-house experiences. After the initial balun was fabricated, measurements were taken and imported back into the project as S-parameter blocks. Matching circuits were also created using the linear simulator for best gain flatness over the decade band. Additionally, the self-heating feature of the Cree device model was invoked extensively to confirm acceptable thermal operation of the device. These results were also verified and confirmed to great accuracy against first manufactured prototypes.

Lastly, the programming capabilities of the AWR software were used to create custom scripts for the implementation of an algorithm that searched for the important amplifier non-linear performance points like P1dB and gain error versus power. These scripts were further enhanced to allow optimization of the device matching for best P1dB over the entire frequency band. This type of optimization, as empowered through AWR scripting, is a powerful and unique aspect of AWR's software products.



Microwave Office schematic and simulation results such as power sweep and stability analysis.





In-house mechanical model representation of the final 60W power block (shown in top image.) Initial layout of the power block in Microwave Office (bottom image.)

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