



Application Fixture (CGHV1F025S-AMP4)  
for C-Band Satellite Communications  
Power Amplifier Applications Using Two  
CGHV1F025S GaN HEMTs

## CGHV1F025S-AMP4 Application Fixture from 4.4 - 5.0 GHz

Wolfspeed, a Cree Company, has developed an application circuit that demonstrates the ability for the CGHV1F025S to operate between 4400 MHz to 5000 MHz for satellite communication (SatCom) applications. The circuit utilizes two devices connected using a Wilkinson combiner in a balanced configuration. This application note describes the typical performance that has been achieved and what can be expected when evaluating the application fixture. Key features of the amplifier include:

- Frequency range 4400 MHz – 5000 MHz
- Over 14 dB of small signal gain
- Over 50% drain efficiency
- 50 W saturated output power
- Less than 3% EVM under 6.0 dB PAPR OQPSK signal

### OVERALL DESIGN

The design goal was to create an application circuit for tactical radio capable of operating under a constant amplitude signal such as OQPSK. Overall the required peak power target was set at 47 dBm to allow for an average output power of about 43dBm across the band. The circuit was constructed on Rogers RO4350 mounted on an aluminum plate. It utilizes the CGHV1F025S which is a 25 W device housed in a plastic package DFN package for surface mount applications. Breakout paths are available on the board to operate a single device only to applications requiring lower output power. A picture of the PCB can be seen in Figure 1.

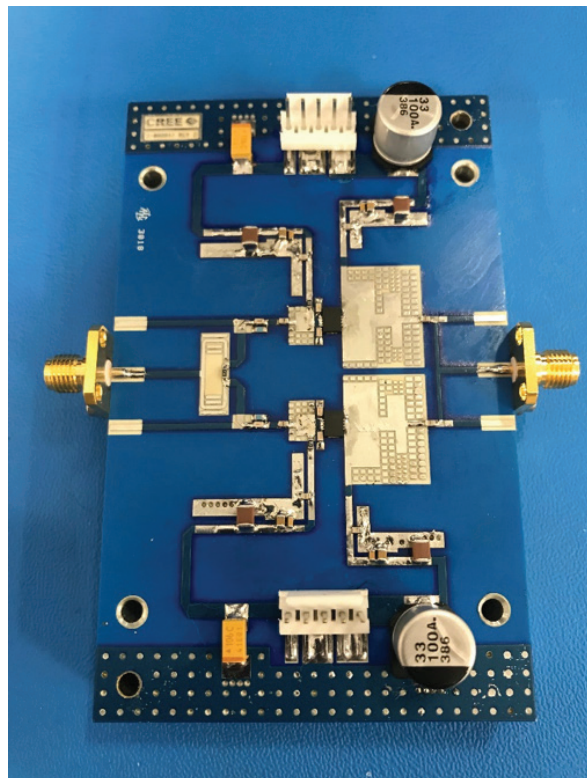


Figure 1

CGHV1F025S-AMP4 Application Fixture from 4.4 - 5.0 GHz

**APPLICATION FIXTURE PERFORMANCE**

Overall the application fixture operates from 4400 MHz – 5000 MHz and can deliver over 47dBm of output power across the band as shown in Figure 2. The power gain is above 11 dB with drain efficiency over 50%. This allows the device to be operated at CW at peak power under a case temperature of 65°C. Under typical operating conditions with OQPSK the device can be operated up to a case temperature of 85°C.

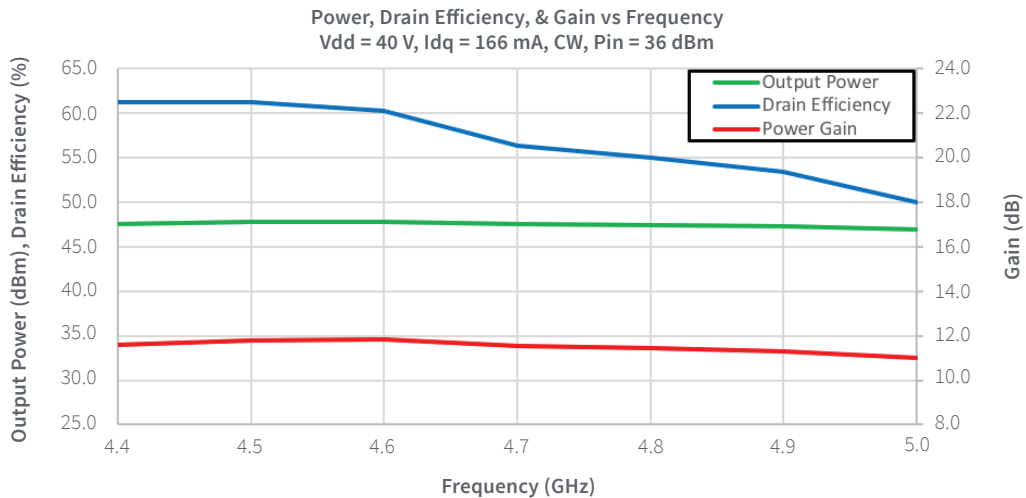


Figure 2

When tested with a 4.75 dB peak to average power (PAPR) QPSK modulated signal the evaluation fixture shows good EVM below 2% at 43 dBm average output power. Measurement results can be seen in Figure 3.

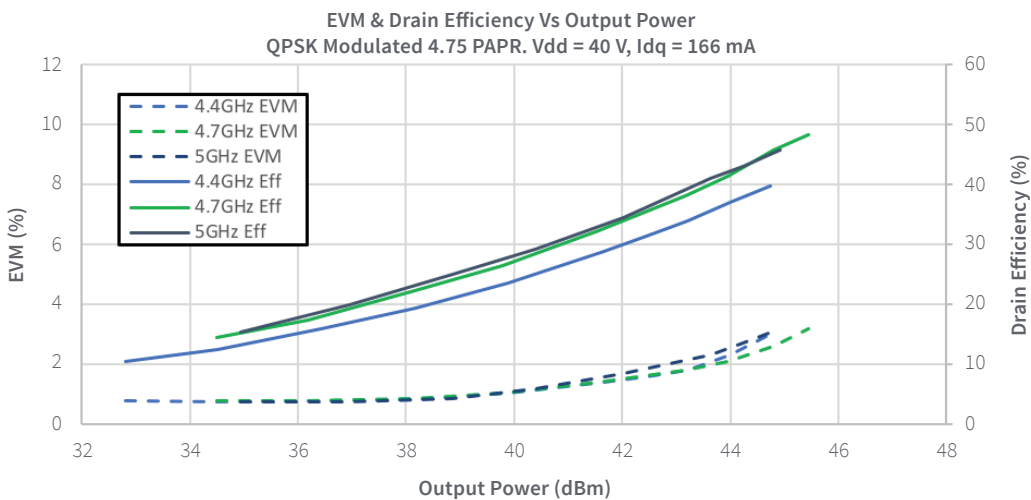


Figure 3

CGHV1F025S-AMP4 Application Fixture from 4.4 - 5.0 GHz

**MEASURED TO MODELLED CORRELATION**

The design was completed in National Instruments AWR Design Environment using Cree’s proprietary large signal transistor model for the CGHV1F025S. All components used in the design were modelled using the Modelithics component library to include the effect of the pad parasitics. Figure 4 shows the measured to modelled S-parameters which demonstrates very accurately the performance of the devices.

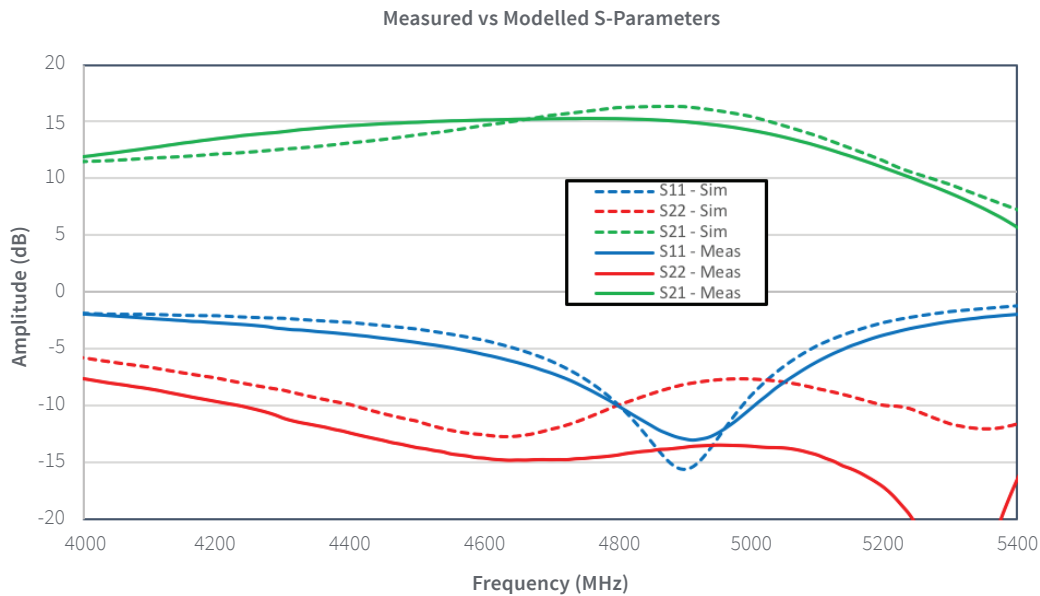


Figure 4

Figure 5 similarly shows how well the measured to model align for the large signal parameters.

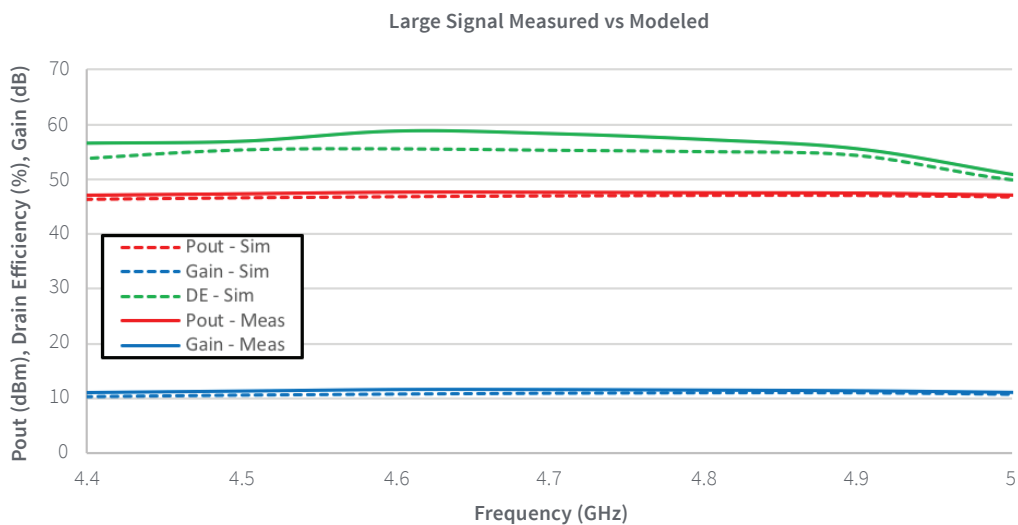


Figure 5

CGHV1F025S-AMP4 Application Fixture from 4.4 - 5.0 GHz \_\_\_\_\_

## **CONCLUSIONS**

This application note demonstrates the performance of the CGHV1F025S-AMP4 which shows great performance from 4.4 – 5.0 GHz with good measured to modelled correlation.