Application Note 1896: Feb 20, 2003

The MAX2247 SiGe 802.11b WLAN PA Achieves 24% PAE at +21dBm Output Power with -36dBc/-56dBc ACPR

Article explains how to optimize the MAX2247 power amplifier for IEEE 802.11b WLAN at +21dBm output power, and the resulting performance versus output power, frequency and supply voltage.

Additional Information: Wireless Product Line Page
Quick View Data Sheet for the MAX2247
Applications Technical Support

The MAX2247- A Versatile WLAN Power Amplifier

The MAX2247 linear power amplifier (PA) is optimized for IEEE 802.11b and 802.11g WLAN applications in the 2.4GHz ISM band. Originally characterized to deliver +24dBm of linear output power, the device features a pin to adjust bias current, which allows the device to be optimized for lower output power levels.

+21dBm Application Performance

For this particular application, the device was optimized for best performance at +21dBm output power, where the device draws 175mA of supply current from a 3.0V supply. This power consumption allows the IC to provide first side-lobe suppression of -36dBc and a second-side lobe suppression of -56dBc. This amount of margin exceeds the IEEE 802.11b ACPR specification by 6dB and the FCC out of band 1MHz integrated power spec by 6dB (taking into account 3dB of loss between the PA and antenna). If ACPR requirements are relaxed to provide 3dB of margin, the PA can achieve +22dBm of output power, at -33dBc/-55dBc ACPR at 28% efficiency. Refer to Figures 1 and 2 for graphs of efficiency and supply current vs. output power.

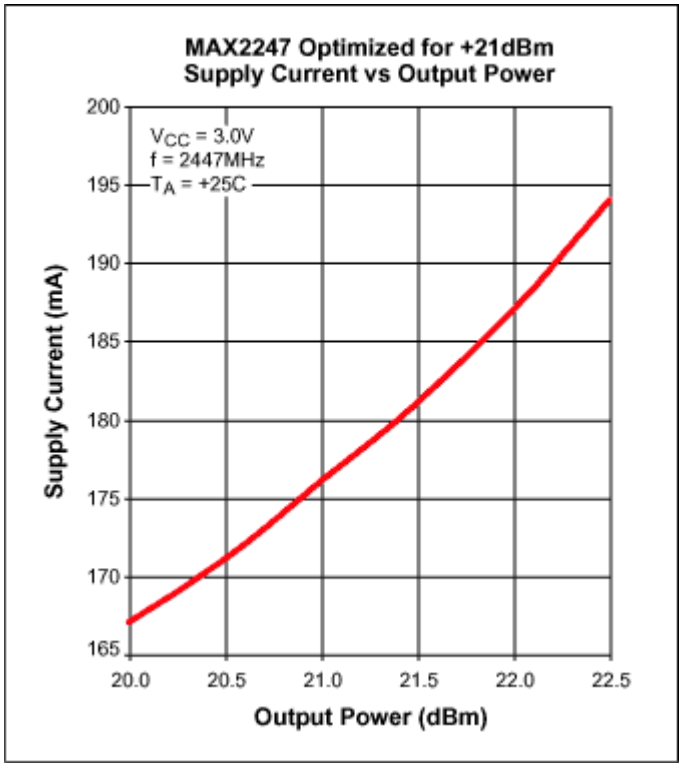

Figure 1. The MAX2247 optimized for +21dBm supply current vs. output power

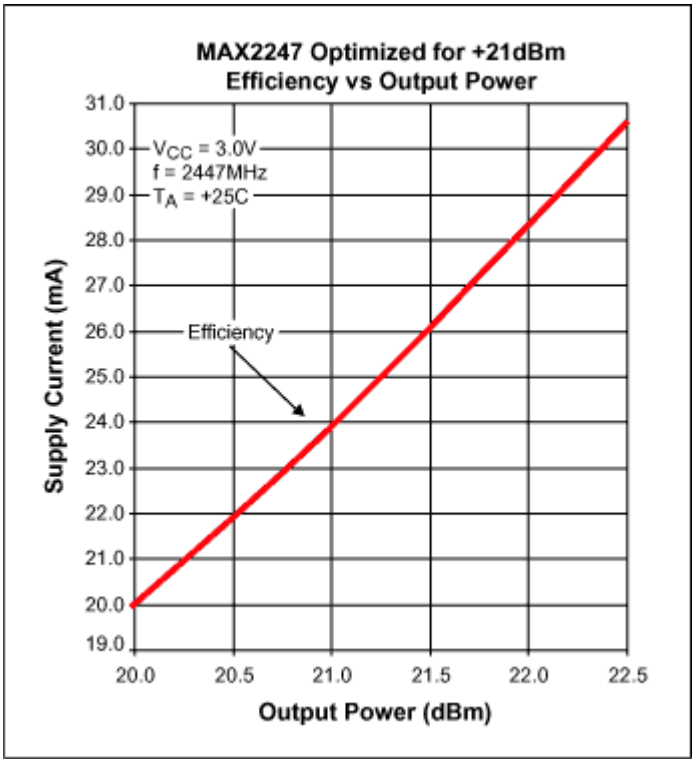

Figure 2. The MAX2247 optimized for +21dBm efficiency vs. output power

Refer to Figures 3, 4 and 5 for graphs of ACPR performance vs. output power, frequency and supply voltage.

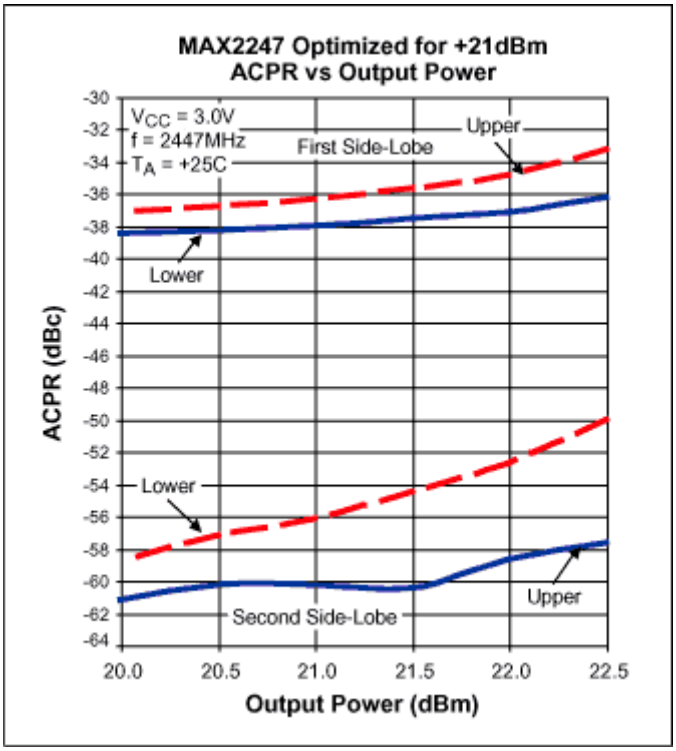

Figure 3. The MAX2247 optimized for +21dBm ACPR vs. output power

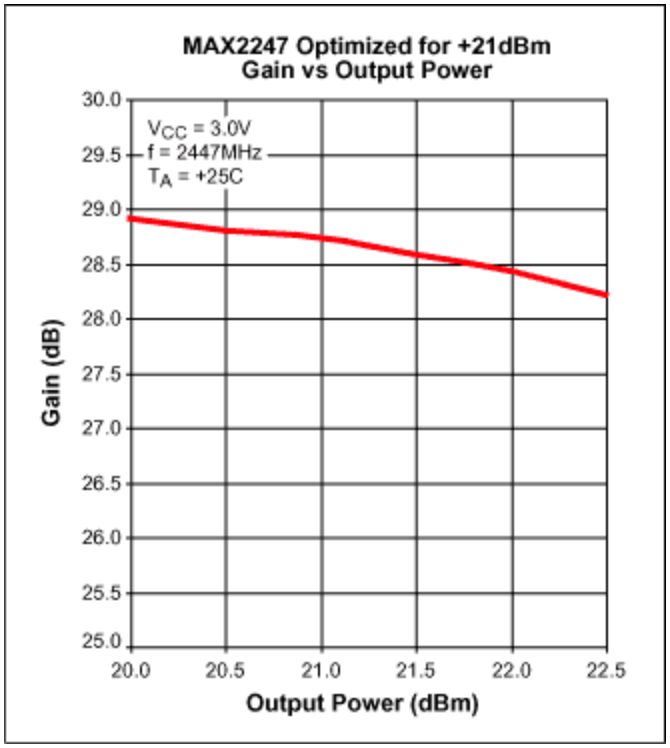

Figure 4. The MAX2247 optimized for +21dBm gain vs. output power

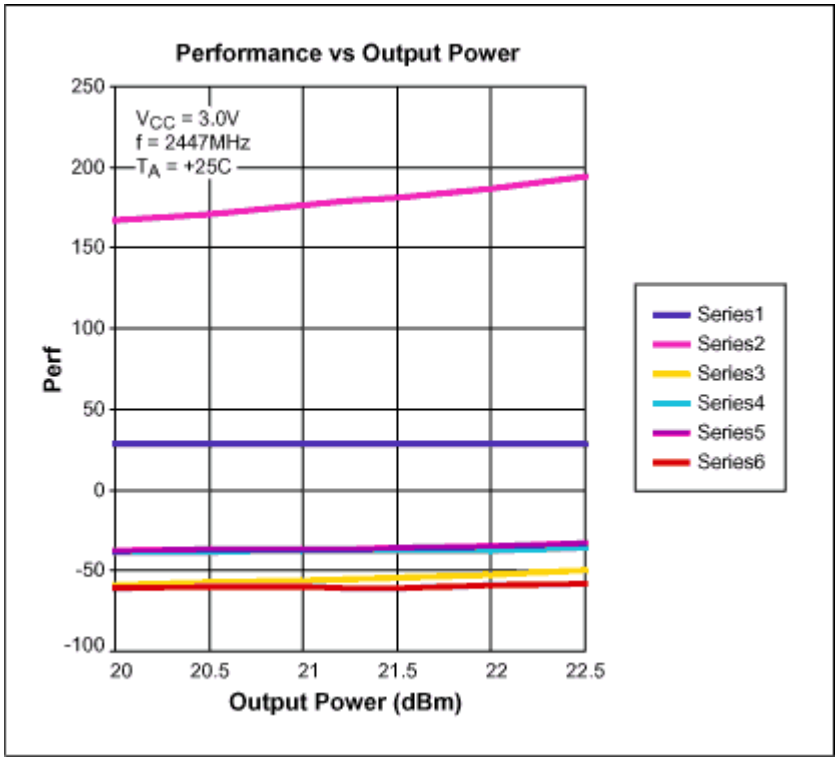

Figure 5. Performance vs. output power

Figures 6, 7, and 8 document gain vs. output power, frequency and supply voltage variations.

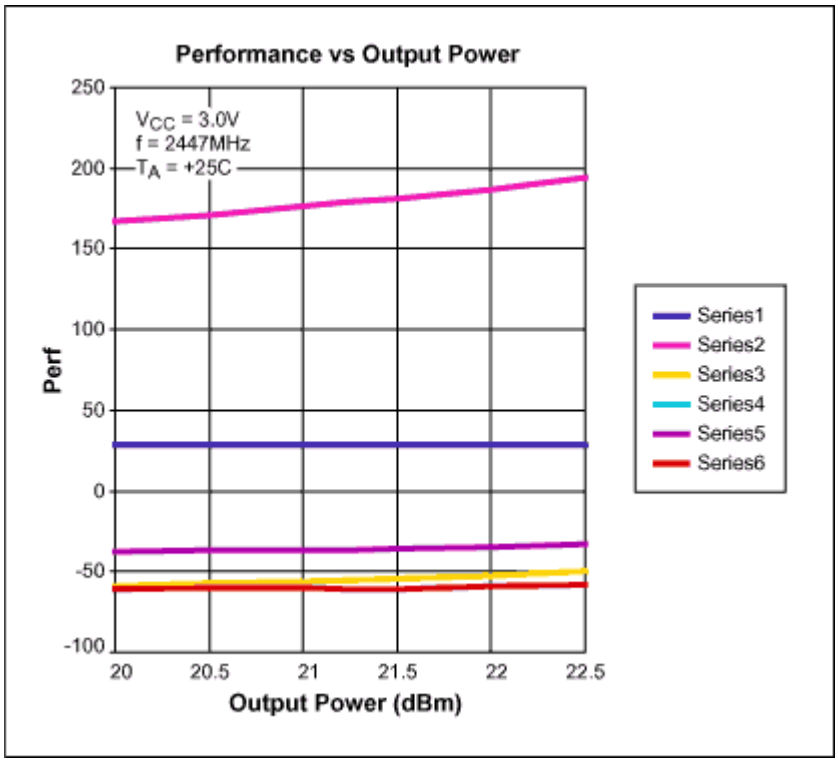

Figure 6. The MAX2247 optimized for +21dBm ACPR vs. frequency

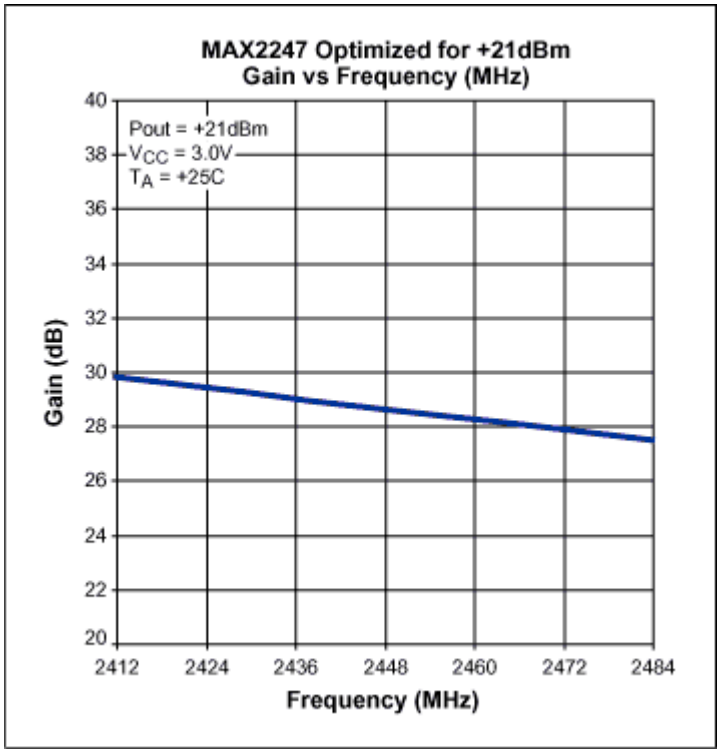

Figure 7. The MAX2247 optimized for +21dBm gain vs. frequency (MHz)

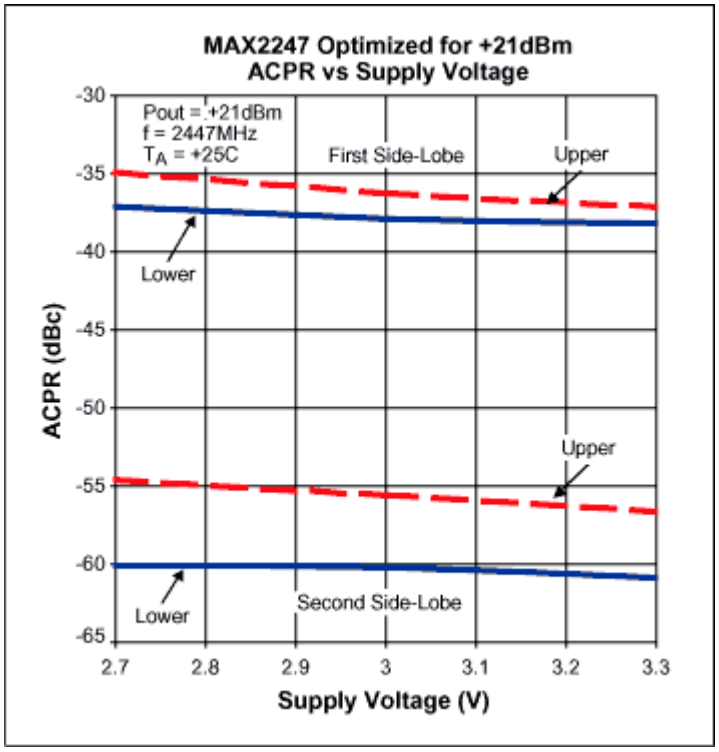

Figure 8. The MAX2247 optimized for +21dBm ACPR vs. supply voltage

PA Bias Control Techniques

The MAX2247 is a three stage amplifier, which integrates adjustable bias current control circuitry, a built in power detector, on-chip input matching and low-power shutdown mode. Figure 9 demonstrates the supporting circuitry required to optimize the part for +21dBm. Applying a voltage to the BIAS connector on the EV kit, allows the bias current of the device to be optimized for a particular output power. In addition, it allows the bias current to be throttled back when backing off output power. For +21dBm, adjust the voltage on the BIAS connector until the bias current, with no RF signal applied, is 135mA from a 3.0V supply. Increasing or decreasing the bias current slightly, will improve or degrade second side-lobe suppression, and allows you to tailor the device performance for your application.

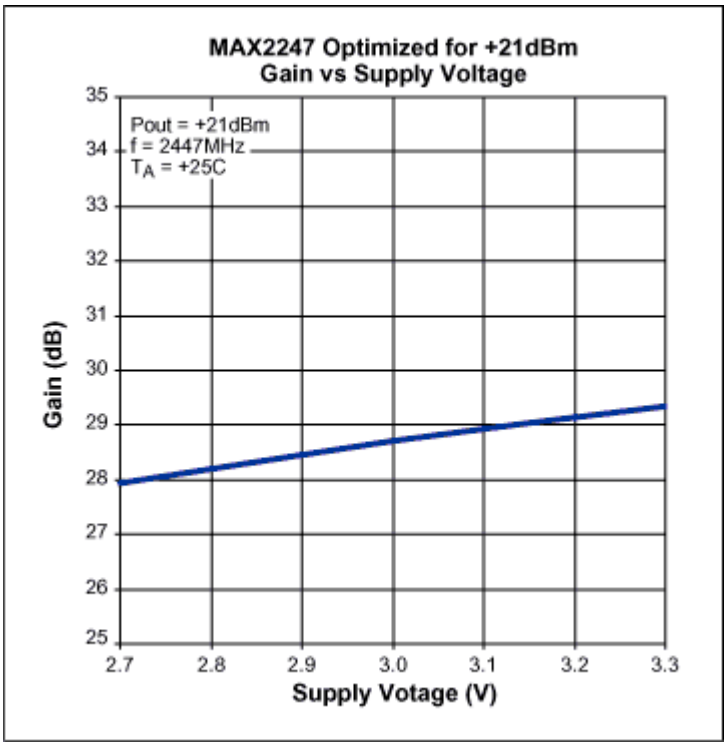

Figure 9. The MAX2247 optimized for +21dBm gain vs. supply voltage

Impedance Matching Issues

A small amount of inductance is required on VCC1 and VCC2 to optimize the interstage match between the first and second stages amplifiers. This is achieved with a small amount of transmission line between the VCC1 and VCC2 and the VCC bypass capacitors, C4 - C7 on the EV kit. A series-L, shunt-C network is required between the output of the MAX2247 and the load to optimize the output power, supply current and linearity of the device for +21dBm. A length of transmission line is used for the series-L network because of the cost advantage, higher-Q, and design flexibility that it provides. Refer to Figure 10 for interstage and output matching component locations.

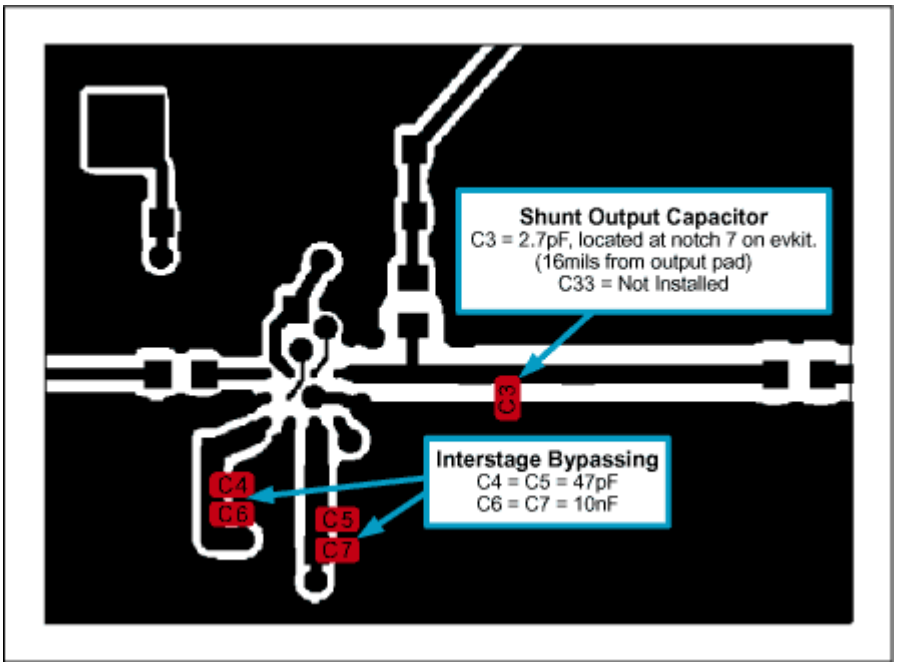

Figure 10. Interstage and output matching component, location changes to optimize the standard MAX2247 EV kit for +21dBm output power

Additional Design Support

For ease of implementation, it is recommended that the layout be copied as close as possible. Please contact Maxim for the MAX2247 EV kit Gerber files to assist you with your design.

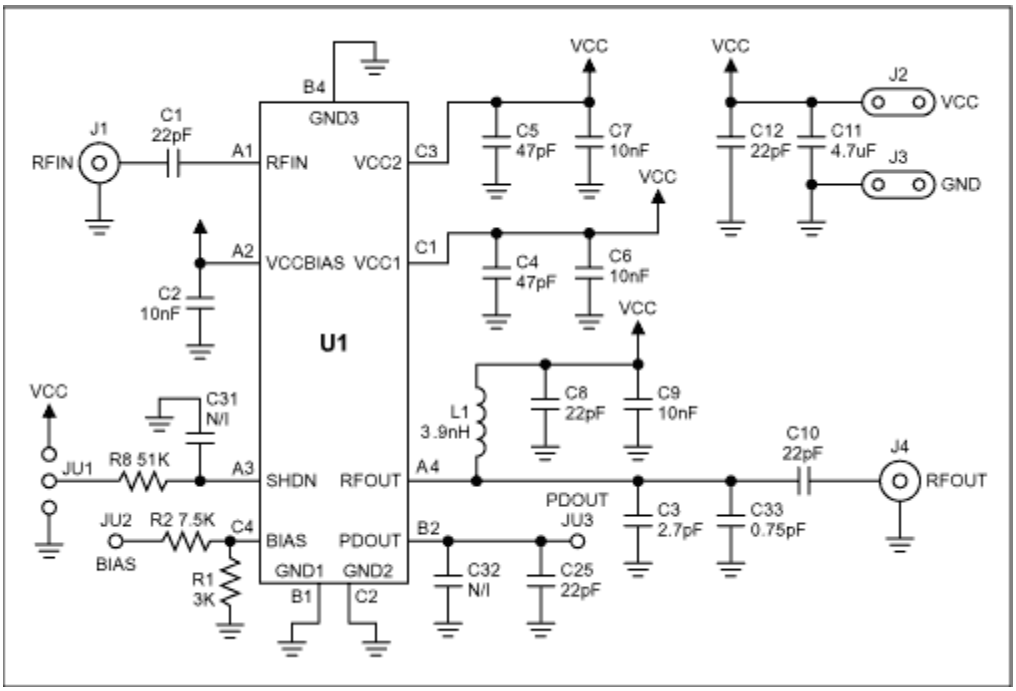

Figure 11.

MORE INFORMATION

MAX2247: QuickView -- Full (PDF) Data Sheet (240k) -- Free Sample