This paper presents a methodology for the design of Ka/Q-band monolithic microwave integrated circuit (MMIC) high-power amplifiers (HPAs). Design techniques are introduced to reduce chip area and to improve bandwidth (BW). These techniques are applied to the design of a 31-39-GHz 5-W HPA implemented on a 0.1-μm AlGaAs-InGaAs pseudomorphic HEMT (pHEMT) technology. With chip dimensions of 3.35×3.2 mm^2, the HPA achieves 24% average power-added efficiency (PAE) over the frequency band, while maintaining an average 22-dB small-signal gain. A balanced high-power amplifier (BPA) is also presented, which combines the power of two 5-W HPA cells to deliver peak 8.5-W output power (Pout) in the frequency band of 30-38 GHz. The BPA chip area is 3.5×6.5 mm^2, and 21-dB average small-signal gain is obtained over the frequency band.