This paper presents a high-efficiency gallium nitride Doherty power amplifier (DPA) using an integrated compensating reactance (CR) for broadband operation. With an additional quarter-wavelength transmission line integrated in the peaking amplifier output, a CR is generated to compensate the load impedance of the carrier amplifier in the low-power region and thus enhance the back-off efficiency over a wide frequency range without affecting the Doherty load modulation at saturation. For this purpose, a peaking output matching network (OMN) is employed to convert the output impedance of the peaking device into quasi-short circuit when it is off and achieve proper impedance matching when it is on. A two-point matching technique using the transmission (ABCD) matrix is employed to design such desired OMN. Measurement results show that the DPA has a 6-dB back-off efficiency of 50%-55% and a saturated efficiency of 57%-71% over the frequency band of 1.7-2.8 GHz (49% fractional bandwidth). When driven by a 20-MHz long term evolution modulated signal at 6.5-dB back-off power, the DPA can achieve an average efficiency of more than 50% with high linearity after linearization over the design frequency band.