Portable ultrasound scanners (PUS) have, in recent years, raised a lot of attention, as they can potentially overcome some of the limitations of static scanners. However, PUS have a lot of design limitations including size and power consumption. These restrictions can compromise the image quality of the scanner. In order to overcome these restrictions, application specific integrated circuits (ASICs) are needed to implement the electronics. In this work, a comparative study of the transmitting performance of a capacitive micromachined ultrasonic transducer (CMUT) driven by a commercial generic ultrasound transmitter and an ASIC optimized for CMUT-based PUS is presented. A single CMUT element is pulsed with a 1% duty cycle at a frequency of 5 MHz. The DC bias voltage is 80 V and the pulsing voltage is 20 V. The acoustic performance is assessed by comparing the ultrasonic signals measured with a hydrophone both in the time and frequency domains. The difference in normalized signal amplitude evaluated at the center frequency of the CMUT is −1.9 dB and the measured bandwidth is equivalent. The ASIC consumes only 1.3% of the total power consumption used by the commercial transmitter.