

In this paper, we first propose a novel construction of 16-quadrature amplitude modulation (QAM) near-complementary sequences with low peak-to-mean envelope power ratio (PMEPR) in orthogonal frequency division multiplexing (OFDM) systems. The proposed 16-QAM near-complementary sequences can be constructed by utilizing novel nonlinear offsets, where the length of the sequences is  $n = 2^m$ . The family size of the newly constructed 16-QAM near-complementary sequences is  $8 \times (m!/2) \times 4^{m+1}$ , and the PMEPR of these sequences is proven to satisfy  $\text{PMEPR} \leq 2.4$ . Thus, the proposed construction can generate a number of 16-QAM near-complementary sequences with low PMEPR, resulting in the improvement of the code rate in OFDM systems. Furthermore, we also propose a novel construction of 64-QAM near-complementary sequences with low PMEPR, which is the first proven construction of 64-QAM near-complementary sequences. The PMEPRs of two types of the proposed 64-QAM near-complementary sequences are proven to satisfy that  $\text{PMEPR} \leq 3.62$  or  $\text{PMEPR} \leq 2.48$ , respectively. The family size of the newly constructed 64-QAM near-complementary sequences is  $64 \times (m!/2) \times 4^{m+1}$ .