Among the key technologies that have been identified as capacity boosters for fifth generation - 5G - mobile networks, are millimeter wave (mmWave) transmissions and non-orthogonal multiple access (NOMA). The large amount of spectrum available at mmWave frequencies combined with a more effective use of available resources, helps improving the overall capacity. NOMA, unlike orthogonal multiple access (OMA) methods, allows sharing the same frequency resources at the same time, by implementing adaptive power allocation. In this paper we present a performance analysis of NOMA in mmWave cells, using OMA as a benchmark. The results show that up to 70% channel capacity gain can be achieved when using NOMA instead of OMA. Most of the NOMA studies to the date focus mainly on the capacity gain; therefore we also present an analysis of the required signal-to-interference-plus-noise ratio (SINR) in NOMA, needed to achieve a target block error rate (BLER). The results show that an average SINR penalty of 12 dB is present when choosing NOMA over OMA.