An apparatus and method for signal detection in a Broadband Wireless Access (BWA) system are provided, in which a transmitter, a first preamble sequence generator generates preamble sequences, a low-Peak-to-Average Power Ratio (PAPR) preamble sequence selector selects a first low-PAPR preamble sequence from among the generated preamble sequences, a preamble sequence copier copies the first low-PAPR preamble sequence at least once and outputs the first low-PAPR preamble sequence and the at least one copy, a complex conjugator generates preamble sequences orthogonal to the first low-PAPR preamble sequence and the at least one copy by calculating complex conjugates of the first low-PAPR preamble sequence and the at least one copy, and a second preamble sequence generator generates at least one second low-PAPR preamble sequence using the first low-PAPR preamble sequence.

11 Claims, 13 Drawing Sheets