Rack-assembled, high-uptime $^{171}Yb^{+}$ single-ion optical clock with systematic uncertainty below 2x10^{-17} and instability below 4x10^{-18}

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We present TOPTICA's optical frequency standard TOPTICLOCK. It is based on the $^{2}S_{1/2}$ (F=0) – $^{2}D_{3/2}$ (F=2) electric quadrupole (E2) transition at 435.5 nm of a single laser-cooled and trapped $^{171}Yb^{+}$ ion. All required subsystems are contained in two transportable 19"rack compartments. TOPTICLOCK was transported to the German National Metrology Institute (Physikalisch-Technische Bundesanstalt, PTB) and compared to a research-style Yb-ion optical frequency standard operating at the electric octupole (E3) transition at 467 nm. A frequency instability of $5x10^{-15}/\sqrt{t}$ with no flickering or drift observed down to $< 4x10^{-18}$ and a total systematic uncertainty below 2x10^{-17} was demonstrated. In addition, the overall performance of the TOPTICLOCK was benchmarked by directly comparing it to another, fully independent Yb-ion optical frequency standard operating also at the E2 transition. An agreement between both systems with a total uncertainty well below 1e-17 was obtained.

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