

$$\begin{aligned}
& \sum_{k=0}^{2^n-1} \frac{1}{2} \left( |k\rangle \otimes |00\rangle \otimes (a_{k0}|0\rangle + a_{k1}|1\rangle) \right. \\
& \quad + |k\rangle \otimes |01\rangle \otimes (a_{k0}|1\rangle + a_{k1}|0\rangle) \\
& \quad + |k\rangle \otimes |10\rangle \otimes (a_{k0}|0\rangle - a_{k1}|1\rangle) \\
& \quad \left. + |k\rangle \otimes |11\rangle \otimes (a_{k0}|1\rangle - a_{k1}|0\rangle) \right)
\end{aligned}$$