$$\sum_{k=0}^{2^n-1} \Big(a_{k0}|k\rangle \otimes |0\rangle \otimes (\frac{1}{\sqrt{2}}|00\rangle + \frac{1}{\sqrt{2}}|11\rangle) \\ + a_{k1}|k\rangle \otimes |1\rangle \otimes (\frac{1}{\sqrt{2}}|10\rangle + \frac{1}{\sqrt{2}}|01\rangle) \Big).$$