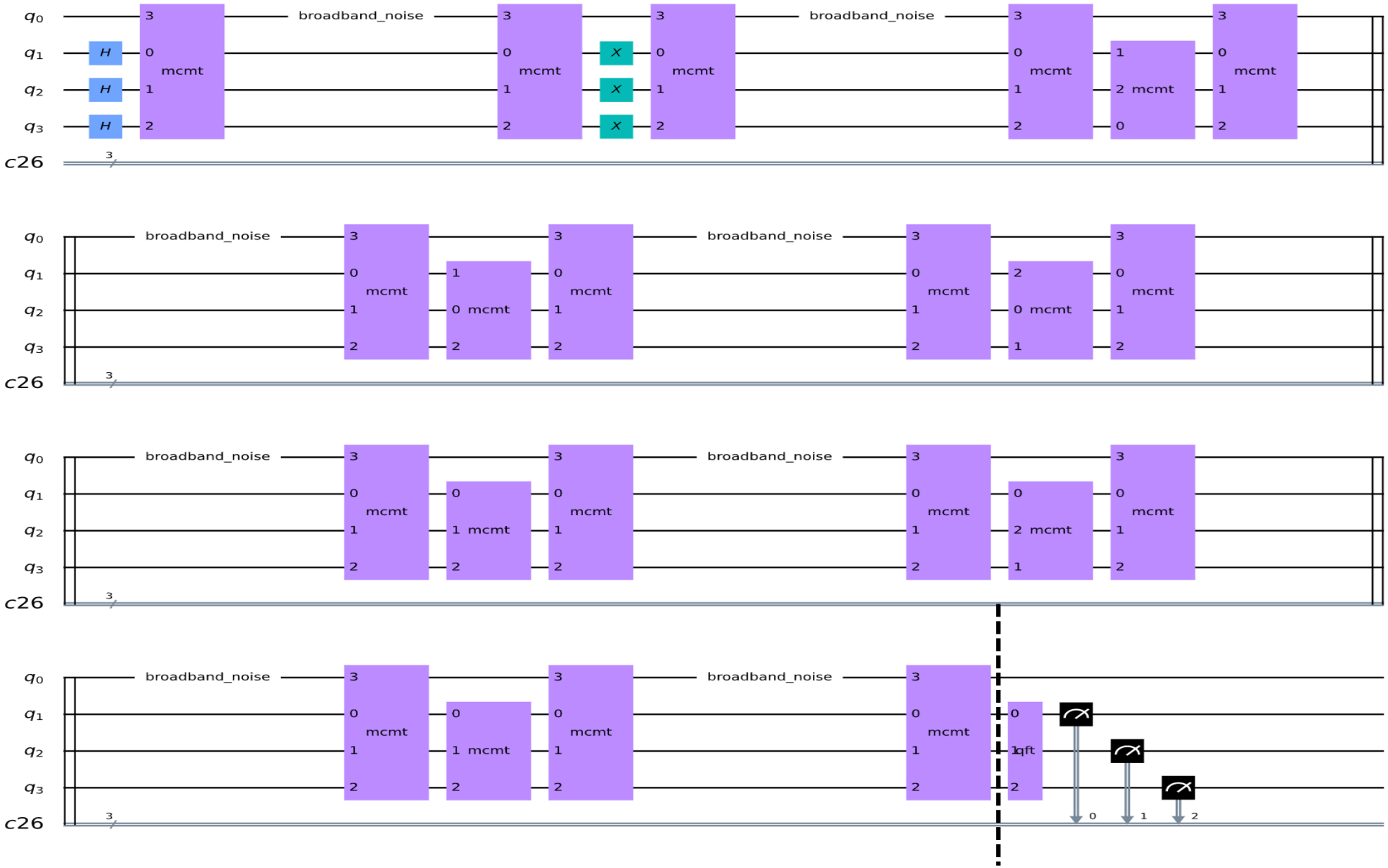

$$|\psi\rangle_{Reg} = \frac{1}{\sqrt{2^N}}\left(e^{i\phi_0}|0\ldots00\rangle + e^{i\phi_1}|0\ldots01\rangle + \ldots + e^{i\phi_{2^N-1}}|1\ldots11\rangle\right)$$