the finite sum

$$\begin{aligned}\frac{1}{K}\sum_{n=0}^{K-1}|x[n]|^2 &= \frac{1}{K}\sum_{n=0}^{K-1}x[n]\left(\sum_{k=0}^{K-1}a_k e^{j2\pi\frac{k}{K}n}\right)^* \\ &= \frac{1}{K}\sum_{k=0}^{K-1}a_k^*\sum_{n=0}^{K-1}x[n]e^{-j2\pi\frac{k}{K}n} \\ &= \frac{1}{K}\sum_{k=0}^{K-1}|a_k|^2\end{aligned}$$

This can also be done with more work by plugging in the Fourier series representation for $x[n]$, taking the magnitude squared, and manipulating the sums and limits.