For a real-valued electric field $\mathbf{E}(\mathbf{x},t)$ that is a free space solution of the Maxwell equation, its plane wave decomposition has the form

$$\mathbf{E}(\mathbf{x},t) = \mathrm{Re}\int \frac{d^3k}{(2\pi)^3}\mathbf{E}(\mathbf{k})\,e^{i\mathbf{k}\cdot\mathbf{x}-ickt} = \frac{1}{2}\int \frac{d^3k}{(2\pi)^3}\left[\mathbf{E}(\mathbf{k})\,e^{i\mathbf{k}\cdot\mathbf{x}-ickt}+\mathbf{E}^*(\mathbf{k})\,e^{-i\mathbf{k}\cdot\mathbf{x}+ickt}\right] \tag{1}$$

where

$$\mathbf{E}(\mathbf{k}) = \int d^3x\,\mathbf{E}(\mathbf{x},t)\,e^{-i\mathbf{k}\cdot\mathbf{x}+ickt} \tag{2}$$

This can be verified by plugging (2) into (1) and use $\int d^3p\,e^{i\mathbf{p}\cdot\mathbf{q}} = (2\pi)^3\,\delta(\mathbf{q})$.
Same applies for $\mathbf{B}(\mathbf{x},t)$, i.e.,

$$\mathbf{B}(\mathbf{x},t) = \frac{1}{2}\int \frac{d^3k}{(2\pi)^3}\left[\mathbf{B}(\mathbf{k})\,e^{i\mathbf{k}\cdot\mathbf{x}-ickt}+\mathbf{B}^*(\mathbf{k})\,e^{-i\mathbf{k}\cdot\mathbf{x}+ickt}\right] \qquad \text{where} \qquad \mathbf{B}(\mathbf{k}) = \int d^3x\,\mathbf{B}(\mathbf{x},t)\,e^{-i\mathbf{k}\cdot\mathbf{x}+ickt} \tag{3}$$

The $\mathbf{E}(\mathbf{k}),\mathbf{B}(\mathbf{k})$ amplitudes satisfy the usual orthogonality relation

$$\mathbf{B}(\mathbf{k}) = \frac{\hat{\mathbf{k}}\times\mathbf{E}(\mathbf{k})}{c} \tag{4}$$

By (1) and (3), for $\mathbf{Y}=\mathbf{E}$ or $\mathbf{B}$, we have

$$\begin{aligned}
\mathbf{Y}(\mathbf{x},t)\cdot\mathbf{Y}(\mathbf{x},t) =& \frac{1}{4}\int \frac{d^3k}{(2\pi)^3}\int \frac{d^3k'}{(2\pi)^3}\Big[\mathbf{Y}(\mathbf{k})\cdot\mathbf{Y}(\mathbf{k}')\,e^{i(\mathbf{k}+\mathbf{k}')\cdot\mathbf{x}-ic(k+k')t}+\\
&\mathbf{Y}^*(\mathbf{k})\cdot\mathbf{Y}^*(\mathbf{k}')\,e^{-i(\mathbf{k}+\mathbf{k}')\cdot\mathbf{x}+ic(k+k')t}+\\
&\mathbf{Y}(\mathbf{k})\cdot\mathbf{Y}^*(\mathbf{k}')\,e^{i(\mathbf{k}-\mathbf{k}')\cdot\mathbf{x}-ic(k-k')t}+\\
&\mathbf{Y}^*(\mathbf{k})\cdot\mathbf{Y}(\mathbf{k}')\,e^{-i(\mathbf{k}-\mathbf{k}')\cdot\mathbf{x}+ic(k-k')t}\Big]
\end{aligned} \tag{5}$$

Thus at t, the instantaneous total energy of the field is

$$\begin{aligned}
U(t) =& \int d^3x\left[\frac{\epsilon_0}{2}\mathbf{E}(\mathbf{x},t)\cdot\mathbf{E}(\mathbf{x},t)+\frac{1}{2\mu_0}\mathbf{B}(\mathbf{x},t)\cdot\mathbf{B}(\mathbf{x},t)\right]\\
=& \frac{1}{8}\int d^3x\int \frac{d^3k}{(2\pi)^3}\int \frac{d^3k'}{(2\pi)^3}\Bigg\{\left[\epsilon_0\mathbf{E}(\mathbf{k})\cdot\mathbf{E}(\mathbf{k}')+\frac{\mathbf{B}(\mathbf{k})\cdot\mathbf{B}(\mathbf{k}')}{\mu_0}\right]e^{i(\mathbf{k}+\mathbf{k}')\cdot\mathbf{x}-ic(k+k')t}+\\
&\left[\epsilon_0\mathbf{E}^*(\mathbf{k})\cdot\mathbf{E}^*(\mathbf{k}')+\frac{\mathbf{B}^*(\mathbf{k})\cdot\mathbf{B}^*(\mathbf{k}')}{\mu_0}\right]e^{-i(\mathbf{k}+\mathbf{k}')\cdot\mathbf{x}+ic(k+k')t}+\\
&\left[\epsilon_0\mathbf{E}(\mathbf{k})\cdot\mathbf{E}^*(\mathbf{k}')+\frac{\mathbf{B}(\mathbf{k})\cdot\mathbf{B}^*(\mathbf{k}')}{\mu_0}\right]e^{i(\mathbf{k}-\mathbf{k}')\cdot\mathbf{x}-ic(k-k')t}+\\
&\left[\epsilon_0\mathbf{E}^*(\mathbf{k})\cdot\mathbf{E}(\mathbf{k}')+\frac{\mathbf{B}^*(\mathbf{k})\cdot\mathbf{B}(\mathbf{k}')}{\mu_0}\right]e^{-i(\mathbf{k}-\mathbf{k}')\cdot\mathbf{x}+ic(k-k')t}\Bigg\}\\
=& \frac{1}{8}\int \frac{d^3k}{(2\pi)^3}\Bigg\{\left[\epsilon_0\mathbf{E}(\mathbf{k})\cdot\mathbf{E}(-\mathbf{k})+\frac{\mathbf{B}(\mathbf{k})\cdot\mathbf{B}(-\mathbf{k})}{\mu_0}\right]+\left[\epsilon_0\mathbf{E}^*(\mathbf{k})\cdot\mathbf{E}^*(-\mathbf{k})+\frac{\mathbf{B}^*(\mathbf{k})\cdot\mathbf{B}^*(-\mathbf{k})}{\mu_0}\right]+\\
&2\left[\epsilon_0\mathbf{E}(\mathbf{k})\cdot\mathbf{E}^*(\mathbf{k})+\frac{\mathbf{B}(\mathbf{k})\cdot\mathbf{B}^*(\mathbf{k})}{\mu_0}\right]\Bigg\}
\end{aligned} \tag{6}$$

If we consider the vector potential of the same form

$$\mathbf{A}(\mathbf{x},t)=\frac{1}{2}\int\frac{d^3k}{(2\pi)^3}\left[\mathbf{A}(\mathbf{k})\,e^{i\mathbf{k}\cdot\mathbf{x}-ickt}+\mathbf{A}^*(\mathbf{k})\,e^{-i\mathbf{k}\cdot\mathbf{x}+ickt}\right]\tag{7}$$

and the relations $\mathbf{E}=-\partial\mathbf{A}/\partial t$, $\mathbf{B}=\boldsymbol{\nabla}\times\mathbf{A}$, we have

$$\mathbf{E}(\mathbf{k})=ick\mathbf{A}(\mathbf{k})\qquad\Longrightarrow\qquad\mathbf{E}(\mathbf{k})\cdot\mathbf{E}(-\mathbf{k})=[ick\mathbf{A}(\mathbf{k})]\cdot[ick\mathbf{A}(-\mathbf{k})]=-c^2k^2\mathbf{A}(\mathbf{k})\cdot\mathbf{A}(-\mathbf{k})\tag{8}$$

$$\mathbf{B}(\mathbf{k})=i\mathbf{k}\times\mathbf{A}(\mathbf{k})\qquad\Longrightarrow\qquad\mathbf{B}(\mathbf{k})\cdot\mathbf{B}(-\mathbf{k})=[i\mathbf{k}\times\mathbf{A}(\mathbf{k})]\cdot[-i\mathbf{k}\times\mathbf{A}(-\mathbf{k})]=k^2\mathbf{A}(\mathbf{k})\cdot\mathbf{A}(-\mathbf{k})\tag{9}$$

We see that (8) and (9), and their complex conjugates, render the first two brackets of (6) zero, leaving

$$U(t)=\frac{\epsilon_0}{4}\int\frac{d^3k}{(2\pi)^3}\left[\mathbf{E}(\mathbf{k})\cdot\mathbf{E}^*(\mathbf{k})+c^2\mathbf{B}(\mathbf{k})\cdot\mathbf{B}^*(\mathbf{k})\right]\tag{10}$$

The total number of photons can be obtained by dividing the integrand of (10) by $\hbar ck$ before the integration, i.e.,

$$\begin{aligned}
N(t)&=\frac{\epsilon_0}{4}\int\frac{d^3k}{(2\pi)^3}\left[\frac{\mathbf{E}(\mathbf{k})\cdot\mathbf{E}^*(\mathbf{k})+c^2\mathbf{B}(\mathbf{k})\cdot\mathbf{B}^*(\mathbf{k})}{\hbar ck}\right] && \text{by (2)}\\
&=\frac{\epsilon_0}{4\hbar c}\frac{1}{(2\pi)^3}\int\frac{d^3k}{k}\int d^3x\int d^3x'\left[\mathbf{E}(\mathbf{x},t)\cdot\mathbf{E}\left(\mathbf{x}',t\right)+c^2\mathbf{B}(\mathbf{x},t)\cdot\mathbf{B}\left(\mathbf{x}',t\right)\right]e^{-i\mathbf{k}\cdot\left(\mathbf{x}-\mathbf{x}'\right)}\\
&=\frac{\epsilon_0}{4\hbar c}\frac{1}{(2\pi)^3}\int d^3x\int d^3x'\left[\mathbf{E}(\mathbf{x},t)\cdot\mathbf{E}\left(\mathbf{x}',t\right)+c^2\mathbf{B}(\mathbf{x},t)\cdot\mathbf{B}\left(\mathbf{x}',t\right)\right]\underbrace{\int d^3k\left[\frac{e^{-i\mathbf{k}\cdot\left(\mathbf{x}-\mathbf{x}'\right)}}{k}\right]}_{\frac{4\pi}{|\mathbf{x}-\mathbf{x}'|^2}}\\
&=\frac{\epsilon_0}{8\pi^2\hbar c}\int d^3x\int d^3x'\left[\frac{\mathbf{E}(\mathbf{x},t)\cdot\mathbf{E}(\mathbf{x}',t)+c^2\mathbf{B}(\mathbf{x},t)\cdot\mathbf{B}(\mathbf{x}',t)}{|\mathbf{x}-\mathbf{x}'|^2}\right]
\end{aligned}\tag{11}$$

which has an additional $1/2$ factor compared to the claim given by Jackson.

Note, the inner-most integral of (11) is calculated via

$$\begin{aligned}
\int d^3k\left[\frac{e^{-i\mathbf{k}\cdot\left(\mathbf{x}-\mathbf{x}'\right)}}{k}\right]&=\int_0^\infty kdk\int_0^\pi\sin\theta\,d\theta\int_0^{2\pi}d\phi\,e^{-ik\left|\mathbf{x}-\mathbf{x}'\right|\cos\theta}\\
&=2\pi\int_0^\infty kdk\left(\frac{e^{ik\left|\mathbf{x}-\mathbf{x}'\right|}-e^{-ik\left|\mathbf{x}-\mathbf{x}'\right|}}{ik\,|\mathbf{x}-\mathbf{x}'|}\right)\\
&=\frac{4\pi}{|\mathbf{x}-\mathbf{x}'|}\,\mathrm{Im}\int_0^\infty e^{ik\left|\mathbf{x}-\mathbf{x}'\right|}dk\\
&=\frac{4\pi}{|\mathbf{x}-\mathbf{x}'|}\lim_{\mu\to0}\left(\mathrm{Im}\int_0^\infty e^{ik\left|\mathbf{x}-\mathbf{x}'\right|}e^{-\mu k}\right)\\
&=\frac{4\pi}{|\mathbf{x}-\mathbf{x}'|}\lim_{\mu\to0}\left[\mathrm{Im}\left(\frac{1}{\mu-i\,|\mathbf{x}-\mathbf{x}'|}\right)\right]\\
&=\frac{4\pi}{|\mathbf{x}-\mathbf{x}'|}\lim_{\mu\to0}\left(\frac{|\mathbf{x}-\mathbf{x}'|}{\mu^2+|\mathbf{x}-\mathbf{x}'|^2}\right)\\
&=\frac{4\pi}{|\mathbf{x}-\mathbf{x}'|^2}
\end{aligned}\tag{12}$$