The ***frequency-domain*** complex 3-D vector acoustic intensity "amplitude" is:

$$\boxed{\tilde{\vec{I}}_a(\vec{r},\omega) \equiv \tfrac{1}{2}\tilde{p}(\vec{r},\omega)\cdot\tilde{\vec{u}}^*(\vec{r},\omega)}$$

Which, broken down into its 3 individual space components is:

$$\begin{aligned}
\tilde{I}_{a_x}(\vec{r},\omega)\hat{x} &= \tfrac{1}{2}\tilde{p}(\vec{r},\omega)\cdot\tilde{u}_x^*(\vec{r},\omega)\hat{x}\\
\tilde{I}_{a_y}(\vec{r},\omega)\hat{y} &= \tfrac{1}{2}\tilde{p}(\vec{r},\omega)\cdot\tilde{u}_y^*(\vec{r},\omega)\hat{y}\\
\tilde{I}_{a_z}(\vec{r},\omega)\hat{z} &= \tfrac{1}{2}\tilde{p}(\vec{r},\omega)\cdot\tilde{u}_z^*(\vec{r},\omega)\hat{z}
\end{aligned}$$

Hence, at the space-point $\vec{r}$:

$$\boxed{\tilde{\vec{I}}_a(\omega) = \tfrac{1}{2}\tilde{\vec{S}}_{u\star p}(\omega) = \tfrac{1}{2}\tilde{\vec{S}}^*_{p\star u}(\omega)} \Rightarrow \boxed{\tilde{\vec{I}}_a(\omega) = \tilde{\vec{G}}_{u\star p}(\omega) = \tilde{\vec{G}}^*_{p\star u}(\omega)} \text{ for } \omega > 0 .$$

where:

$$\begin{aligned}
\tilde{\vec{I}}_a(\omega) = \tilde{\vec{G}}_{u\star p}(\omega) &= \tilde{G}_{u_x\star p}(\omega)\hat{x} + \tilde{G}_{u_y\star p}(\omega)\hat{y} + \tilde{G}_{u_z\star p}(\omega)\hat{z}\\
= \tilde{\vec{G}}^*_{p\star u}(\omega) &= \tilde{G}^*_{p\star u_x}(\omega)\hat{x} + \tilde{G}^*_{p\star u_y}(\omega)\hat{y} + \tilde{G}^*_{p\star u_z}(\omega)\hat{z}
\end{aligned}$$

Note that the complex 3-D vector specific acoustic ***impedance*** $\tilde{\vec{z}}_a(\vec{r},\omega)$ and ***admittance*** $\tilde{\vec{y}}_a(\vec{r},\omega) = 1/\tilde{\vec{z}}_a(\vec{r},\omega)$ are ***time-independent*** quantities. {They are in fact manifestly/intrinsically ***frequency domain*** quantities!}

Expressed in terms of their ***frequency domain*** definitions:

$$\begin{aligned}
\tilde{\vec{z}}_a(\vec{r},\omega) \equiv \frac{\tilde{p}(\vec{r},\omega)}{\tilde{\vec{u}}(\vec{r},\omega)} &= \frac{\tilde{p}(\vec{r},\omega)}{\tilde{u}_x(\vec{r},\omega)}\hat{x} + \frac{\tilde{p}(\vec{r},\omega)}{\tilde{u}_y(\vec{r},\omega)}\hat{y} + \frac{\tilde{p}(\vec{r},\omega)}{\tilde{u}_z(\vec{r},\omega)}\hat{z}\\
&= \tilde{z}_{a_x}(\vec{r},\omega)\hat{x} + \tilde{z}_{a_x}(\vec{r},\omega)\hat{y} + \tilde{z}_{a_x}(\vec{r},\omega)\hat{z}
\end{aligned}$$

and:

$$\begin{aligned}
\tilde{\vec{y}}_a(\vec{r},\omega) \equiv \frac{\tilde{\vec{u}}(\vec{r},\omega)}{\tilde{p}(\vec{r},\omega)} &= \frac{\tilde{u}_x(\vec{r},\omega)}{\tilde{p}(\vec{r},\omega)}\hat{x} + \frac{\tilde{u}_y(\vec{r},\omega)}{\tilde{p}(\vec{r},\omega)}\hat{y} + \frac{\tilde{u}_z(\vec{r},\omega)}{\tilde{p}(\vec{r},\omega)}\hat{z}\\
&= \tilde{y}_{a_x}(\vec{r},\omega)\hat{x} + \tilde{y}_{a_y}(\vec{r},\omega)\hat{y} + \tilde{y}_{a_z}(\vec{r},\omega)\hat{z}
\end{aligned}$$

Note also that:

$$\begin{aligned}
\tilde{\vec{z}}_a(\vec{r},\omega) &= \frac{\tilde{p}(\vec{r},\omega)}{\tilde{u}_x(\vec{r},\omega)}\cdot\frac{\tilde{u}_x^*(\vec{r},\omega)}{\tilde{u}_x^*(\vec{r},\omega)}\hat{x} + \frac{\tilde{p}(\vec{r},\omega)}{\tilde{u}_y(\vec{r},\omega)}\cdot\frac{\tilde{u}_y^*(\vec{r},\omega)}{\tilde{u}_y^*(\vec{r},\omega)}\hat{y} + \frac{\tilde{p}(\vec{r},\omega)}{\tilde{u}_z(\vec{r},\omega)}\cdot\frac{\tilde{u}_z^*(\vec{r},\omega)}{\tilde{u}_z^*(\vec{r},\omega)}\hat{z}\\
&= \frac{2\tilde{I}_{a_x}(\vec{r},\omega)}{\left|\tilde{u}_x(\vec{r},\omega)\right|^2}\hat{x} + \frac{2\tilde{I}_{a_y}(\vec{r},\omega)}{\left|\tilde{u}_y(\vec{r},\omega)\right|^2}\hat{y} + \frac{2\tilde{I}_{a_z}(\vec{r},\omega)}{\left|\tilde{u}_z(\vec{r},\omega)\right|^2}\hat{z}
\end{aligned}$$