$$
\begin{aligned}
\Psi_{121} &= C_1\left(-|0d2u\rangle - |0u2d\rangle + |2d0u\rangle + |2u0d\rangle - |d0u2\rangle + |d2u0\rangle - |u0d2\rangle + |u2d0\rangle\right) \\
&\quad + C_2\left(|02du\rangle + |02ud\rangle - |0du2\rangle - |0ud2\rangle + |20du\rangle + |20ud\rangle - |2du0\rangle - |2ud0\rangle + |d02u\rangle + |d20u\rangle + |du02\rangle + |du20\rangle + |u02d\rangle + |u20d\rangle + |ud02\rangle + |ud20\rangle\right)
\end{aligned}
$$

$$
C_1 = \frac{i}{4}
$$

$$
C_2 = \frac{1}{4\sqrt{2}}
$$