

$$\begin{aligned}
& C_{\text{qq}}^{(3)} \mathbf{i1_i2_i3_i4_} \rightarrow \tilde{h} \left(-\frac{1}{144} \frac{1}{m_s^2} \left(9 s_\gamma^2 c_\gamma^2 \overline{y_d}^{i2p} \overline{y_d}^{i4r} y_d^{i1p} y_d^{i3r} + \right. \right. \\
& \quad s_\gamma^2 \overline{y_d}^{i4p} \left(y_d^{i3p} \left(18 c_\gamma^2 \overline{y_u}^{i2r} y_u^{i1r} + g_2^2 \delta_{i1i2} \right) + 4 g_3^2 y_d^{i1p} \delta_{i2i3} \right) + \\
& \quad \left. c_\gamma^2 \left(9 s_\gamma^2 \overline{y_u}^{i2p} \overline{y_u}^{i4r} y_u^{i1p} y_u^{i3r} + \overline{y_u}^{i4p} \left(g_2^2 y_u^{i3p} \delta_{i1i2} + 4 g_3^2 y_u^{i1p} \delta_{i2i3} \right) \right) \right) + \\
& \frac{1}{18} g_2^4 \text{LF}_{3,0} [m_2] \delta_{i1i2} \delta_{i3i4} + \frac{1}{12} g_2^4 \text{LF}_{4,-1} [m_2] \delta_{i1i2} \delta_{i3i4} - \frac{4}{45} g_2^4 \text{LF}_{5,-2} [m_2] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{1}{12} g_3^4 \text{LF}_{3,0} [m_3] \delta_{i1i4} \delta_{i2i3} + \frac{1}{8} g_3^4 \text{LF}_{4,-1} [m_3] \delta_{i1i4} \delta_{i2i3} - \frac{2}{15} g_3^4 \text{LF}_{5,-2} [m_3] \delta_{i1i4} \delta_{i2i3} + \\
& \frac{1}{36} \sum_{\mathbf{p}} g_3^4 \text{LF}_{3,0} [m_{\mathbf{d}}^{\mathbf{p}}] \delta_{i1i4} \delta_{i2i3} - \frac{5}{96} \sum_{\mathbf{p}} g_3^4 \text{LF}_{4,-1} [m_{\mathbf{d}}^{\mathbf{p}}] \delta_{i1i4} \delta_{i2i3} + \\
& \frac{1}{45} \sum_{\mathbf{p}} g_3^4 \text{LF}_{5,-2} [m_{\mathbf{d}}^{\mathbf{p}}] \delta_{i1i4} \delta_{i2i3} + \frac{1}{36} \sum_{\mathbf{p}} g_2^4 \text{LF}_{3,0} [m_{\mathbf{l}}^{\mathbf{p}}] \delta_{i1i2} \delta_{i3i4} - \\
& \frac{5}{96} \sum_{\mathbf{p}} g_2^4 \text{LF}_{4,-1} [m_{\mathbf{l}}^{\mathbf{p}}] \delta_{i1i2} \delta_{i3i4} + \frac{1}{45} \sum_{\mathbf{p}} g_2^4 \text{LF}_{5,-2} [m_{\mathbf{l}}^{\mathbf{p}}] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{1}{36} \sum_{\mathbf{p}} \left(2 g_3^4 \delta_{i1i4} \delta_{i2i3} + 3 g_2^4 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{3,0} [m_{\mathbf{q}}^{\mathbf{p}}] - \\
& \frac{5}{96} \sum_{\mathbf{p}} \left(2 g_3^4 \delta_{i1i4} \delta_{i2i3} + 3 g_2^4 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{4,-1} [m_{\mathbf{q}}^{\mathbf{p}}] + \\
& \frac{1}{45} \sum_{\mathbf{p}} \left(2 g_3^4 \delta_{i1i4} \delta_{i2i3} + 3 g_2^4 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{5,-2} [m_{\mathbf{q}}^{\mathbf{p}}] + \frac{1}{36} \sum_{\mathbf{p}} g_3^4 \text{LF}_{3,0} [m_{\mathbf{u}}^{\mathbf{p}}] \delta_{i1i4} \delta_{i2i3} - \\
& \frac{5}{96} \sum_{\mathbf{p}} g_3^4 \text{LF}_{4,-1} [m_{\mathbf{u}}^{\mathbf{p}}] \delta_{i1i4} \delta_{i2i3} + \frac{1}{45} \sum_{\mathbf{p}} g_3^4 \text{LF}_{5,-2} [m_{\mathbf{u}}^{\mathbf{p}}] \delta_{i1i4} \delta_{i2i3} + \\
& \frac{1}{24} \left(3 s_\gamma^2 c_\gamma^2 \left(\overline{y_d}^{i2p} \overline{y_d}^{i4r} y_d^{i1p} y_d^{i3r} - 2 \overline{y_d}^{i4p} y_d^{i3p} \overline{y_u}^{i2r} y_u^{i1r} + \overline{y_u}^{i2p} \overline{y_u}^{i4r} y_u^{i1p} y_u^{i3r} \right) - \right. \\
& \quad \left. 2 g_3^2 \left(s_\gamma^2 \overline{y_d}^{i4p} y_d^{i1p} + c_\gamma^2 \overline{y_u}^{i4p} y_u^{i1p} \right) \delta_{i2i3} \right) \text{LF}_{1,2} [m_{\mathbb{E}}] + \\
& \frac{1}{48} \left(3 s_\gamma^4 \overline{y_d}^{i2p} \overline{y_d}^{i4r} y_d^{i1p} y_d^{i3r} + 3 c_\gamma^4 \overline{y_u}^{i2p} \overline{y_u}^{i4r} y_u^{i1p} y_u^{i3r} - 2 g_2^2 c_\gamma^2 \overline{y_u}^{i4p} y_u^{i3p} \delta_{i1i2} + \right. \\
& \quad \left. 2 s_\gamma^2 \overline{y_d}^{i4p} y_d^{i3p} \left(3 c_\gamma^2 \overline{y_u}^{i2r} y_u^{i1r} - g_2^2 \delta_{i1i2} \right) \right) \text{LF}_{2,1} [m_{\mathbb{E}}] + \\
& \frac{1}{72} g_2^2 \left(3 s_\gamma^2 \overline{y_d}^{i4p} y_d^{i3p} + 3 c_\gamma^2 \overline{y_u}^{i4p} y_u^{i3p} + 2 g_2^2 \delta_{i3i4} \right) \text{LF}_{3,0} [m_{\mathbb{E}}] \delta_{i1i2} - \\
& \frac{5}{96} g_2^4 \text{LF}_{4,-1} [m_{\mathbb{E}}] \delta_{i1i2} \delta_{i3i4} + \frac{1}{45} g_2^4 \text{LF}_{5,-2} [m_{\mathbb{E}}] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{1}{36} g_2^4 \text{LF}_{3,0} [\tilde{\mu}] \delta_{i1i2} \delta_{i3i4} + \frac{1}{24} g_2^4 \text{LF}_{4,-1} [\tilde{\mu}] \delta_{i1i2} \delta_{i3i4} - \frac{2}{45} g_2^4 \text{LF}_{5,-2} [\tilde{\mu}] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{1}{432} g_1^2 \left(g_3^2 \delta_{i1i4} \delta_{i2i3} + g_2^2 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{2,1,0} [m_1, m_{\mathbf{q}}^{i4}] + \\
& \frac{1}{432} g_1^2 \left(g_3^2 \delta_{i1i4} \delta_{i2i3} + g_2^2 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{2,2,-1} [m_1, m_{\mathbf{q}}^{i4}] - \\
& \frac{1}{216} g_1^2 \left(g_3^2 \delta_{i1i4} \delta_{i2i3} + g_2^2 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{3,1,-1} [m_1, m_{\mathbf{q}}^{i4}] + \\
& \frac{1}{432} g_1^2 \left(g_3^2 \delta_{i1i4} \delta_{i2i3} + g_2^2 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{4,1,-2} [m_1, m_{\mathbf{q}}^{i4}] + \\
& \frac{1}{48} \left(3 g_2^2 g_3^2 \delta_{i1i4} \delta_{i2i3} - g_2^4 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{2,1,0} [m_2, m_{\mathbf{q}}^{i4}] + \\
& \frac{1}{48} \left(3 g_2^2 g_3^2 \delta_{i1i4} \delta_{i2i3} - g_2^4 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{2,2,-1} [m_2, m_{\mathbf{q}}^{i4}] - \\
& \frac{1}{24} g_2^2 \left(3 g_3^2 \delta_{i1i4} \delta_{i2i3} + 5 g_2^2 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{3,1,-1} [m_2, m_{\mathbf{q}}^{i4}] + \\
& \frac{1}{16} \left(g_2^2 g_3^2 \delta_{i1i4} \delta_{i2i3} + g_2^4 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{4,1,-2} [m_2, m_{\mathbf{q}}^{i4}] - \\
& \frac{1}{72} g_3^2 \left(g_3^2 \delta_{i1i4} \delta_{i2i3} - 8 g_2^2 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{2,1,0} [m_3, m_{\mathbf{q}}^{i4}] - \\
& \frac{1}{72} g_3^2 \left(g_3^2 \delta_{i1i4} \delta_{i2i3} - 8 g_2^2 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{2,2,-1} [m_3, m_{\mathbf{q}}^{i4}] - \\
& \frac{1}{72} g_3^2 \left(25 g_3^2 \delta_{i1i4} \delta_{i2i3} + 16 g_2^2 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{3,1,-1} [m_3, m_{\mathbf{q}}^{i4}] + \\
& \frac{1}{9} \left(g_3^4 \delta_{i1i4} \delta_{i2i3} + g_2^2 g_3^2 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{4,1,-2} [m_3, m_{\mathbf{q}}^{i4}] - \\
& \frac{1}{12} g_3^2 \overline{y_d}^{i4p} y_d^{i1p} \text{LF}_{2,1,0} [m_{\mathbf{d}}^{\mathbf{p}}, \tilde{\mu}] \delta_{i2i3} + \frac{1}{24} g_3^2 \overline{y_d}^{i4p} y_d^{i1p} \text{LF}_{2,2,-1} [m_{\mathbf{d}}^{\mathbf{p}}, \tilde{\mu}] \delta_{i2i3} + \\
& \frac{1}{24} g_3^2 \overline{y_d}^{i4p} y_d^{i1p} \text{LF}_{3,1,-1} [m_{\mathbf{d}}^{\mathbf{p}}, \tilde{\mu}] \delta_{i2i3} - \\
& \frac{1}{216} g_1^2 \left(g_3^2 \delta_{i1i4} \delta_{i2i3} + g_2^2 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{2,1,0} [m_{\mathbf{q}}^{i4}, m_1] + \\
& \frac{1}{432} g_1^2 \left(g_3^2 \delta_{i1i4} \delta_{i2i3} + g_2^2 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{3,1,-1} [m_{\mathbf{q}}^{i4}, m_1] + \\
& \frac{1}{24} \left(-3 g_2^2 g_3^2 \delta_{i1i4} \delta_{i2i3} + g_2^4 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{2,1,0} [m_{\mathbf{q}}^{i4}, m_2] + \\
& \frac{1}{48} \left(3 g_2^2 g_3^2 \delta_{i1i4} \delta_{i2i3} - g_2^4 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{3,1,-1} [m_{\mathbf{q}}^{i4}, m_2] + \\
& \frac{1}{36} \left(g_3^4 \delta_{i1i4} \delta_{i2i3} - 8 g_2^2 g_3^2 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{2,1,0} [m_{\mathbf{q}}^{i4}, m_3] - \\
& \frac{1}{72} g_3^2 \left(g_3^2 \delta_{i1i4} \delta_{i2i3} - 8 g_2^2 \delta_{i1i2} \delta_{i3i4} \right) \text{LF}_{3,1,-1} [m_{\mathbf{q}}^{i4}, m_3] - \\
& \frac{1}{12} g_3^2 \overline{y_u}^{i4p} y_u^{i1p} \text{LF}_{2,1,0} [m_{\mathbf{u}}^{\mathbf{p}}, \tilde{\mu}] \delta_{i2i3} + \frac{1}{24} g_3^2 \overline{y_u}^{i4p} y_u^{i1p} \text{LF}_{2,2,-1} [m_{\mathbf{u}}^{\mathbf{p}}, \tilde{\mu}] \delta_{i2i3} + \\
& \frac{1}{24} g_3^2 \overline{y_u}^{i4p} y_u^{i1p} \text{LF}_{3,1,-1} [m_{\mathbf{u}}^{\mathbf{p}}, \tilde{\mu}] \delta_{i2i3} + \frac{1}{24} g_3^2 \overline{y_d}^{i4p} y_d^{i1p} \text{LF}_{2,1,0} [\tilde{\mu}, m_{\mathbf{d}}^{\mathbf{p}}] \delta_{i2i3} - \\
& \frac{1}{24} \overline{y_d}^{i4p} \left(3 g_2^2 y_d^{i3p} \delta_{i1i2} + 2 g_3^2 y_d^{i1p} \delta_{i2i3} \right) \text{LF}_{3,1,-1} [\tilde{\mu}, m_{\mathbf{d}}^{\mathbf{p}}] + \\
& \frac{1}{24} \overline{y_d}^{i4p} \left(g_2^2 y_d^{i3p} \delta_{i1i2} + g_3^2 y_d^{i1p} \delta_{i2i3} \right) \text{LF}_{4,1,-2} [\tilde{\mu}, m_{\mathbf{d}}^{\mathbf{p}}] + \\
& \frac{1}{24} g_3^2 \overline{y_u}^{i4p} y_u^{i1p} \text{LF}_{2,1,0} [\tilde{\mu}, m_{\mathbf{u}}^{\mathbf{p}}] \delta_{i2i3} - \\
& \frac{1}{24} \overline{y_u}^{i4p} \left(3 g_2^2 y_u^{i3p} \delta_{i1i2} + 2 g_3^2 y_u^{i1p} \delta_{i2i3} \right) \text{LF}_{3,1,-1} [\tilde{\mu}, m_{\mathbf{u}}^{\mathbf{p}}] + \\
& \frac{1}{24} \overline{y_u}^{i4p} \left(g_2^2 y_u^{i3p} \delta_{i1i2} + g_3^2 y_u^{i1p} \delta_{i2i3} \right) \text{LF}_{4,1,-2} [\tilde{\mu}, m_{\mathbf{u}}^{\mathbf{p}}] + \\
& \frac{1}{16} g_2^4 \text{LF}_{2,1,1,-1} [m_2, m_{\mathbf{q}}^{i4}, m_{\mathbf{q}}^{i2}] \delta_{i1i2} \delta_{i3i4} - \frac{1}{8} g_2^4 m_2^2 \text{LF}_{2,1,1,0} [m_2, m_{\mathbf{q}}^{i4}, m_{\mathbf{q}}^{i2}] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{7}{48} g_3^4 \text{LF}_{2,1,1,-1} [m_3, m_{\mathbf{q}}^{i4}, m_{\mathbf{q}}^{i3}] \delta_{i1i4} \delta_{i2i3} - \frac{1}{12} g_3^4 m_3^2 \text{LF}_{2,1,1,0} [m_3, m_{\mathbf{q}}^{i4}, m_{\mathbf{q}}^{i3}] \delta_{i1i4} \delta_{i2i3} - \\
& \frac{1}{4} \tilde{\mu}^2 \overline{y_d}^{i4p} y_d^{i3p} \overline{y_u}^{i2r} y_u^{i1r} \text{LF}_{2,1,1,0} [\tilde{\mu}, m_{\mathbf{d}}^{\mathbf{p}}, m_{\mathbf{u}}^{\mathbf{r}}] + \\
& \frac{1}{16} \overline{y_d}^{i2p} \overline{y_d}^{i4r} y_d^{i1p} y_d^{i3r} \text{LF}_{2,1,1,-1} [\tilde{\mu}, m_{\mathbf{d}}^{\mathbf{r}}, m_{\mathbf{d}}^{\mathbf{p}}] + \frac{1}{16} \overline{y_u}^{i2p} \overline{y_u}^{i4r} y_u^{i1p} y_u^{i3r} \\
& \text{LF}_{2,1,1,-1} [\tilde{\mu}, m_{\mathbf{u}}^{\mathbf{r}}, m_{\mathbf{u}}^{\mathbf{p}}] + \frac{1}{144} g_1^2 g_2^2 \text{LF}_{1,1,1,1,-1} [m_1, m_2, m_{\mathbf{q}}^{i4}, m_{\mathbf{q}}^{i2}] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{1}{72} m_1 m_2 g_1^2 g_2^2 \text{LF}_{1,1,1,1,0} [m_1, m_2, m_{\mathbf{q}}^{i4}, m_{\mathbf{q}}^{i2}] \delta_{i1i2} \delta_{i3i4} + \\
& \frac{1}{144} g_1^2 g_3^2 \text{LF}_{1,1,1,1,-1} [m_1, m_3, m_{\mathbf{q}}^{i4}, m_{\mathbf{q}}^{i3}] \delta_{i1i4} \delta_{i2i3} + \\
& \frac{1}{72} m_1 m_3 g_1^2 g_3^2 \text{LF}_{1,1,1,1,0} [m_1, m_3, m_{\mathbf{q}}^{i4}, m_{\mathbf{q}}^{i3}] \delta_{i1i4} \delta_{i2i3} - \\
& \frac{1}{24} g_2^2 g_3^2 \text{LF}_{1,1,1,1,-1} [m_2, m_3, m_{\mathbf{q}}^{i4}, m_{\mathbf{q}}^{i2}] \delta_{i1i2} \delta_{i3i4} - \\
& \frac{1}{12} m_2 m_3 g_2^2 g_3^2 \text{LF}_{1,1,1,1,0} [m_2, m_3, m_{\mathbf{q}}^{i4}, m_{\mathbf{q}}^{i2}] \delta_{i1i2} \delta_{i3i4} - \\
& \frac{1}{16} g_2^2 g_3^2 \text{LF}_{1,1,1,1,-1} [m_2, m_3, m_{\mathbf{q}}^{i4}, m_{\mathbf{q}}^{i3}] \delta_{i1i4} \delta_{i2i3} - \\
& \frac{1}{8} m_2 m_3 g_2^2 g_3^2 \text{LF}_{1,1,1,1,0} [m_2, m_3, m_{\mathbf{q}}^{i4}, m_{\mathbf{q}}^{i3}] \delta_{i1i4} \delta_{i2i3} \Big)
\end{aligned}$$