1 SchemeIBMECH

1.1 SKGen$(\sigma) \rightarrow \boldsymbol{ek}_\sigma$

generate $r \in \mathbb{Z}_p^*$
$ek_\sigma \leftarrow \frac{\boldsymbol{d}_{3,i}^{\eta + r\sigma}}{\boldsymbol{d}_{4,i}^{r}}, \forall i \in \{1, 2, \cdots, 8\}$
return ek_σ

1.2 RKGen$(\rho) \rightarrow \boldsymbol{dk}_\rho$

generate $s, s_1, s_2 \in \mathbb{Z}_p^*$ randomly
$k_1 \leftarrow \{g_2^{\boldsymbol{d}_{1,i} \cdot (\alpha + s_1 \rho) - s_1 \boldsymbol{d}_{2,i} + s\boldsymbol{d}_{3,i}}, \forall i \in \{1, 2, \cdots, 8\}\}$
$k_2 \leftarrow \{g_2^{s_2 \cdot (\rho * \boldsymbol{d}_{1,i} - \boldsymbol{d}_{2,i}) + s\boldsymbol{d}_{4,i}}, \forall i \in \{1, 2, \cdots, 8\}\}$
$k_3 \leftarrow (g_T^\eta)^s$
$dk_\rho \leftarrow (k_1, k_2, k_3)$
return dk_ρ

1.3 Enc$(\boldsymbol{ek}_\sigma, \boldsymbol{rcv}, m) \rightarrow \boldsymbol{ct}$

generate $z \leftarrow \mathbb{Z}_p^*$ randomly
$C \leftarrow \{\boldsymbol{d}_{1,i}^z \boldsymbol{d}_{2,i}^{z \cdot rcv} \cdot (ek_\sigma)_i, \forall i \in \{1, 2, \cdots, 8\}\}$
$C_0 \leftarrow (g_T^\alpha)^z m$
$ct \leftarrow (C, C_0)$
return ct

1.4 Dec$(\boldsymbol{dk}_\rho, \boldsymbol{snd}, \boldsymbol{ct}) \rightarrow m$

$m \leftarrow \frac{C_0 k_3}{\prod_{i=1}^{8} e(C_i, k_{1,i} k_{2,i}^{snd})}$
return m