$$\sum_{n=0}^{\infty} \frac{1}{T_{mn+r}} = \frac{2}{m} \sum_{0<j<m/2} \left\{ \left[\cos\left(\frac{2\pi j(r+1)}{m}\right) - \cos\left(\frac{2\pi jr}{m}\right) \right] \right.$$
$$\cdot \ln\left[2 - \cos\left(\frac{2\pi j}{m}\right)\right] - \left[\sin\left(\frac{2\pi j(r+1)}{m}\right) - \sin\left(\frac{2\pi jr}{m}\right)\right]$$
$$\left. \cdot \frac{\pi(m-2j)}{m} \right\} + 2\delta_{mr} + \varepsilon_m \cdot (-1)^{r+1} 2 \ln(n)$$