described by

$$\frac{\omega_g}{T_c} \approx 8, \tag{4.1}$$

with deviations of less than 8%. This is roughly twice the BCS value 3.5 indicating that the holographic superconductors are strongly coupled. However, the authors in Refs. [16, 42] found that this relation is not stable in the presence of the Gauss-Bonnet correction terms. And Cai *et al.* [36] got a relation

$$\frac{\omega_g}{T_c} \approx 13 \tag{4.2}$$

with the accuracy more than 93% for a planar Hořava-Lifshitz black hole with the condition of the detailed balance. We now examine this result for the Hořava-Lifshitz gravity considered here.

In order to compute the electrical conductivity, we should study the electromagnetic perturbation in this Hořava-Lifshitz black hole background, and then calculate the linear response to the perturbation. In the probe approximation, the effect of the perturbation of metric can be ignored. Assuming that the perturbation of the vector potential is translational symmetric and has a time dependence as $\delta A_x = A_x(r)e^{-i\omega t}$, we find that the Maxwell equation in the Hořava-Lifshitz black hole background reads

$$A_x'' + \frac{f'}{f}A_x' + \left(\frac{\omega^2}{f^2} - \frac{2\psi^2}{f}\right)A_x = 0 \ , \tag{4.3}$$

where a prime denotes the derivative with respect to r. An ingoing wave boundary condition near the horizon is given by

$$A_x(r) \sim f(r)^{-\frac{2i\omega L^2}{3r_+}}. \tag{4.4}$$

In the asymptotic AdS region ($r \to \infty$), the general behavior should be

$$A_x = A^{(0)} + \frac{A^{(1)}}{r} + \cdots \ . \tag{4.5}$$

By using AdS/CFT correspondence and the Ohm's law, we know that the conductivity can be expressed as [8]

$$\sigma = \frac{\langle J_x \rangle}{E_x} = -\frac{i\langle J_x \rangle}{\omega A_x} = \frac{A^{(1)}}{i\omega A^{(0)}} \ . \tag{4.6}$$