In our experiments the central regions of both wells and barriers were nearly equally doped by acceptor impurity Be. Thus the holes from the barriers have a possibility to occupy the second position for the acceptor in the wells forming the upper Hubbard band. However for the hole there was another possibility - to stay around its native acceptor in the barrier forming single-occupied center which we will denote as $\tilde{A}^0$. The corresponding scenario was first discussed in [13]. As a result, at the Fermi level we have centers with different occupation numbers - at least, A^+ (doubly occupied). A^0 (single occupied) $\tilde{A}^0$ (holes bound to the barrier acceptor) and A^- (empty barrier acceptor with no hole around).

The possibility for the hole to form A^+ or $\tilde{A}^0$ center depends on relation between the binding energies of these centers, U_b and $\tilde{U}_b$. In particular, if $U_b > \tilde{U}_b$, then all the barrier acceptors form A^- centers while all the acceptors in the well form A^+ centers. However for our experiments of the distance between the barrier acceptor and the interface between the barrier and well was not large and we expect $\tilde{U}_b > U_b$. In this case the probability to form A^+ center depends on the distance between the barrier acceptor and the closest acceptor in the well. Indeed, the formation of A^+ center profit from the interaction between A^+ center and A^0 center [13].

Here we assume that some holes from the barrier are still coupled to their parent acceptors ($\widetilde{A}^0$ centers) and some are localized on the acceptors in the well (A^+ centers). According to charge conservation the number of $\widetilde{A}^-$ centers (that are free $\widetilde{A}^0$ centers) is equal to the number of A^+ centers.

$$N(A^+) = N(\widetilde{A}^-). \tag{29}$$

In addition, we believe that there exists a random potential that overlap the energies of different types of centers. If the variances of $\widetilde{A}^0$ and $\widetilde{A}^-$ energies are equal, (29) leads to equal densities of states for $\widetilde{A}^0$ and $\widetilde{A}^-$ at the Fermi level. For our purpose we assume that this densities of states are at least comparable.

As for the negative magnetoresistance for the upper Hubbard band, it can be considered in the same way as for the lower Hubbard band discussed above. Note that the scattering potential strongly decays with distance $U_0 \propto r^{-4}$ and thus the corresponding asymptotics of the wave functions are similar to the one given by Eq.24 but one should take $r_{min} = a$.