The main purpose of this paper is to characterize, not necessarily linear, generalized (weakly) peripherally multiplicative maps between Figà–Talamanca–Herz algebras. Let $G_1$ and $G_2$ be locally compact Hausdorff groups, $\Gamma$ and $\Omega$ be arbitrary nonempty sets, and $1 < p < \infty$. We characterize surjections $S_1 : \Gamma \rightarrow A_p(G_1)$, $S_2 : \Omega \rightarrow A_p(G_1)$, $T_1 : \Gamma \rightarrow A_p(G_2)$ and $T_2 : \Omega \rightarrow A_p(G_2)$ satisfying $\|T_1(\gamma)T_2(\omega)\|_\infty = \|S_1(\gamma)S_2(\omega)\|_\infty$ for all $\gamma \in \Gamma$, $\omega \in \Omega$. We apply this to get a description of certain peripherally multiplicative maps. In particular, it is shown that if surjections $T_1, T_2 : A_p(G_1) \rightarrow A_p(G_2)$ satisfy $R_\varepsilon(T_1(f)T_2(g)) \subseteq R_\varepsilon(fg)$ for all $f, g \in A_p(G_1)$, or $R_\varepsilon(fg) \subseteq R_\varepsilon(T_1(f)T_2(g))$ for all $f, g \in A_p(G_1)$, then $T_1$ and $T_2$ are weighted composition operators. For amenable groups $G_1$ and $G_2$, $T_1$ and $T_2$ are shown to be weighted isomorphisms which induce an algebra isomorphism between $A_p(G_1)$ and $A_p(G_2)$. Moreover, when one of $G_1$ or $G_2$ is first countable, precise characterizations of weakly peripherally multiplicative maps are obtained. Conditions are also given to guarantee that $T_1$ and $T_2$ are algebra isomorphisms.