Butenko, Commander, and Pardalos have a reduction which we recap in this paper. They consider the following problem:

Broadcast Scheduling Problem
INSTANCE: A undirected graph $G = (V, E)$ and an integer K.
QUESTION: Does there exist a broadcast schedule with frame length $\leq K$?

Theorem 1. Broadcast Scheduling Problem *is $\mathcal{NP}$-complete.*

Proof. Recall that the k-coloring problems is, given $G = (V, E)$ and an integer k, does there exist a proper coloring of vertices of G that uses $\leq k$ colors?

Given a graph $G = (V, E)$, we will construct the corresponding graph $G' = (V', E')$, where $V' = V \cup E$ and $E' = \{[i, (i, j)] : (i, j) \in E, i, j \in V\} \cup \{(e_1, e_2) : e_1, e_2 \in E\}$. By the construction of graph G', $(v_1, v_2 \in E$ if and only if $v_1, v_2 \in V$ are 2-hop neighbors in G'. Also, $V' \setminus V$ forms a clique in G', and any vertex in this clique is a 2-hop neighbor of any vertex in V. Thus no other vertex can transmit in the same time slot with a vertex from the clique, so any broadcast schedule in G' will require m time slots just for vertices from the clique to transmit.

The remaining vertices in V' (*i.e.*, vertices from V) can transmit according to any proper coloring in G, where different time slots in the resulting broadcast schedule will correspond to different colors in the coloring. $\square$