Fig. 4. Impact on removed interference considering different metrics.

a consequence of a fixed number of available channels (e.g., 5) combined with an increasing number of neighbors (i.e., links), leading to an increasing level of interference.

Figure 4(c) presents the network expansion effect, with the number of nodes varying between 10 to 100. To understand this effect, the average network link density is considered constant and equal to 5. The area has the same node density (i.e., if the number of nodes is increased, the area also will be increased to maintain a constant average network link density). Similar to the previous result, the RANDOM performance is independent of the number of nodes, remaining dependant only on the number of channels. CTBA and ZAP have a decrease in performance between 10 and 40 nodes. This is due to the fact that smaller topologies have higher probability of having some nodes with a high knowledge of the network (i.e., dense nodes). Such knowledge helps to decrease the interfering links during the ZAP execution. Nevertheless, for more than 40 nodes, these methods do not have a significant variation in the interference reduction. In fact, large networks also tend to be more spread, which results in an increasing number of nodes with similar high densities. This helps to converge the results.

Although having the upper bound results, CTBA is centralized and, consequently, has an exponential communication cost proportional to the number of network nodes. In contrast, ZAP does not have any scalability constraints (c.f. Section III-E), since it works in a decentralized way, exchanging messages only with 2-hop neighbors. Moreover, a centralized algorithm needs a routing protocol or at least a flooding mechanism to send and receive control messages of the complete network. Therefore, CTBA suffers from all well-known scalability constraints of a centralized method, whereas ZAP achieves relatively close performance without similar scalability constraints.

Figure 4(d) shows results for scenarios with 5% of message losses, using different random topologies with 100 nodes, 5 available channels, a varying number of network link densities, and a varying number of ZAP interactions (i.e., ZAP’s stopping criterion). It is worth noting that the number of channels was selected from results observed in Figure 4(a), in which 5 available channels have shown good performances in terms of removed interference for all the strategies. We then vary the number of interactions to reach the stopping criterion in the ZAP algorithm for different link densities. We remark that after 6 interactions, performance levels off, without any significant gain for further interactions. These results suggest