We are grateful to Reviewer 2 for a comprehensive review and a positive opinion about our work.

In this reply, let us address explicitly three of the Reviewer's comments, while the suggested minor corrections have been added to the revised manuscript.

> 2. The authors deal with states, measurements and channels separately, but all of these objects can be seen as a special type of channels, e.g. a state ρ can be related to a preparation channel σ 7→ Tr [σ]ρ. What is obtained from the results for channels if the channels in question are in fact both preparation channels (or measurements)?

Indeed, that is an important point. While for state preparation channels the operational procedure of discrimination is equivalent and the result is the same, for measurements (which do not have quantum outputs) it is not the case – the interpretation and expressions are different. Moreover, for approximate designs for states, the functional dependence on δ is worse. We added the following remark after Theorem 3 in the revised manuscript:

> We note that one can view quantum states and measurements as special types of quantum channels. While for state preparation channels the operational procedure of discrimination is equivalent and one gets the same expression (see Example~11), for measurements it is not the case (this is because for measurement channels one can average only over input states). Moreover, in the case of δ-approximate desings, applying the above Theorem~3 for the average-case distance between state preparation channels gives worse than Theorem~1 constants and functional dependence on δ. This approach thus leads to less tight bounds for states than treating them separately.

We believe that this addition clarifies the matter at hand.

> 3. There are more general measurement procedures for channels, using an ancilla (as in Fig. 1). It is a natural question what happens if the random choice is over bipartite input states and POVMs. Lemma 20 seems to suggest that for unital channels this would lead to the same results. What happens in general? Remark 8 seems also relevant.

Indeed, adding ancilla and averaging over unitaries on an extended system formally amounts to calculating a distance between channels extended by identity. We believe that Remark 8 (in the revised version Remark 9) answers this question - for unital channels, there is no difference, while for non-unital channels there is an additional term that decreases with the size of the ancilla. To make it unambiguous, we added the following sentence at the end of Remark 8:

> Note that this scenario corresponds to a channel discrimination (via random circuits) with the use of an ancillary system.

The last point of the Reviewer was

> I think it would be a benefit for the readers if the authors add some explanations/more explicit computations/references for some of the formulas involving Psym (k) or expectations over the Haar measure (k-designs), e.g. for Eq. (38) or Eq. (A.3).

To address the above we added a reference to a specific Proposition of Ref. [59] that contains proof of Lemma 3 from our manuscript and extended calculation leading to Eq. 38 (in revised version Eq. 43) by multiple missing steps.