

## AUTHOR REVISION REPORT

Note: For comments/questions/Answer/Revisions, use the language according to the language used in the manuscript (English or Bahasa Indonesia).

### I. Manuscript Identity

|                                               |                                                                                            |
|-----------------------------------------------|--------------------------------------------------------------------------------------------|
| Title                                         | 4G Network Optimization Based on Hybrid Clustering, Physical Tuning, and Genetic Algorithm |
| Manuscript number                             | 91704                                                                                      |
| Article Type                                  | Research article / <i>Review Article</i>                                                   |
| First Submission date                         | 2025-03-13                                                                                 |
| Recommendation on First Submission Manuscript | Reviewer 1 (RV1) : <b>Minor Revision</b><br>Reviewer 2 (RV2) : <b>Minor Revision</b>       |
| Revision Submission Date                      | 2025-06-11                                                                                 |

### II. Reviewer's Comments

#### 2.1. General Impression

|                                         | Reviewers (R1 & R2)                                                                                                                                                                                                                                                                     | Authors                                                                                                                                                                                                                             |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                         | Comments/Questions                                                                                                                                                                                                                                                                      | Comments/Answers/Revisions in the Manuscript                                                                                                                                                                                        |
| General comprehension of the manuscript | [R1.1] In general, this manuscript has the potential to be published, there are some important notes as revisions that need to be considered<br><br>[R2.1] The discussion in this paper does not yet address what new contributions this research offers compared to previous research. | [R1.1] Author has made changes in accordance with the reviewer's recommendations.<br><br>[R2.1] Author have revised the manuscript to more explicitly highlight the novel contributions of this research compared to prior studies. |
| Language/style/Grammar in general       | [R1.1] It's good<br><br>[R2.1] slightly improved                                                                                                                                                                                                                                        | [R1.1] No any major/minor changes<br><br>[R2.1] No any major changes                                                                                                                                                                |
| Structure                               | [R1.1] needs improvement<br><br>[R2.1] sufficient                                                                                                                                                                                                                                       | [R1.1] Author have made minor changes in structure according to reviewer recommendations.<br><br>[R2.1] Author have made minor revision in structure                                                                                |
| Level of enthusiasm                     | [R1.1] usual<br><br>[R2.1] above average                                                                                                                                                                                                                                                | [R1.1] -<br><br>[R2.1] -                                                                                                                                                                                                            |

#### 2.2. Revision on Major Comments

|                     | Reviewers (R1 & R2)                                                                                                          | Authors                                                                                                                                                                                    |
|---------------------|------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | Major Comments                                                                                                               | Answers/Revisions in the Manuscript                                                                                                                                                        |
| <b>Abstract</b>     | [R1.1] Explicitly state the novelty of the proposed research method.<br><br>[R2.1] show the main objective of this research? | [R1.1] Revision: Author has made changes by explicitly stating the novelty of the proposed method.<br><br>[R2.1] Revision: Author have made explicitly the main objective of this research |
| <b>Introduction</b> | [R2.1] Add discussion What clustering method was used in this study? Why was that method                                     | [R2.1] Revision: Author have made improvement to adding discussion according                                                                                                               |

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                | chosen?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | reviewer suggestion on last sentences of second paragraph.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Methodology</b>             | <p>[R1.1] The explanation of the method is quite complete, but the genetic algorithm (GA) part needs to be explained in more depth, such as the crossover and mutation schemes and the fitness function used.</p> <p>[R1.2] What is the basis for selecting the azimuth and tilt change limit parameters (<math>\pm 30^\circ</math> for azimuth and <math>0-6^\circ</math> for tilt) based on previous studies, hardware limits, or experimental results?</p> <p>[R2.1] How does ACP (Automatic Cell Planning) perform compared to the genetic algorithm (GA) method?</p> | <p>[R1.1] Revision: The author has added more detailed explanations about the genetic algorithm used, how to obtain individuals, populations, calculate performance from the fitness function, perform crossover and mutation.</p> <p>[R1.2] Answer: Limitations on changes are based on ISP regulations, as well as hardware limitations to maintain the coverage area of each sectoral antenna.</p> <p>[R2.1] Answer: We have conducted a comparison between the Automatic Cell Planning (ACP) method and the proposed Genetic Algorithm (GA)-based optimization. The results show that both methods successfully improve RSRP levels, with GA slightly outperforming ACP. However, the GA-based approach demonstrated a more significant improvement in SINR, indicating better interference management. These findings have now been included in the revised manuscript in the Results and Discussion section.</p> |
| <b>Results and Discussions</b> | <p>[R1.1] Use the term “Figure X” consistently.</p> <p>[R1.2] In the narrative, cite figures according to their labels</p> <p>[R1.3] ambiguous phrasing in “From the figure above there are 2 locations that have poor signal coverage based on SINR metrics”, not mentioning which image is meant.</p> <p>[R2.1] What parameters, to be displayed, were used in evaluating network performance before and after optimization?</p>                                                                                                                                        | <p>[R1.1] Answer: The author has changed the use of the term “Figure”</p> <p>[R1.2] Answer: Yes, there is inconsistency between the image and the description. It has been changed to maintain consistency.</p> <p>[R1.3] Revision: Author has explicitly stated the purpose of each explanation in the figures and tables.</p> <p>[R2.1] Answer: In our manuscript, we used RSRP and SINR as the main parameters for evaluating signal quality and coverage before and after optimization. These parameters are clearly discussed in Sections [3] sub-section [A], with supporting results shown in Tables [4] and result on section [3] sub-section [D] with ACP method and sub-section [E] using GA.</p>                                                                                                                                                                                                            |
| <b>Conclusions</b>             | <p>[R1.1] The conclusion summarizes the main results concisely and clearly, but does not include suggestions or recommendations for further development.</p> <p>[R2.1] The success of the optimization carried out meets the KPI targets of the ISP set, and the benefits that can be used by users</p>                                                                                                                                                                                                                                                                   | <p>[R1.1] Answer: Author has added recommendations for further reading.</p> <p>[R2.1] Answer: Thank you for the suggestion. We have added a clarification in the discussion section regarding how the optimization outcomes fulfill key performance indicators (KPIs) typically targeted by ISPs, such as improved RSRP and SINR levels. Furthermore, we elaborated on how these improvements contribute to better user experiences, particularly in high-demand or previously low-signal areas.</p>                                                                                                                                                                                                                                                                                                                                                                                                                   |

### 2.3. Revision on Minor Comments

|                                        | Reviewers (R1 & R2)                                                                   | Authors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                        | Minor Comments/Questions                                                              | Comments/Answers/Revisions in the Manuscript                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Style/Grammar</b>                   | [R1.1] No numbering of mathematical equations.                                        | [R1.1] Answer: Author has added numbering on each equations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Consistency/Terminology</b>         | [R1.1] The term “Physical Tunning” should be “Physical Tuning”.                       | [R1.1] Answer: Author has changed term of “Physical Tuning”                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                        | [R1.2] Writing Minimum value (minPts), $\delta_p$                                     | [R1.2] Answer: Author has changed the writing format on minPts and $\delta_p$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>References</b>                      | [R1.1] There are inconsistencies between the in-text citations and the reference list | [R1.1] Answer: There was an error when entering the citation, the author has corrected it.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                        | [R2.1] It needs to be supplemented with the latest information for comparison.        | [R2.1] Answer: Thank you for your insightful comment. We agree that integrating up-to-date references is essential to contextualize the research. In response, we have ensured that the manuscript includes recent references from the last five years (2019–2024), particularly from reputable sources such as IEEE Xplore. These references have been incorporated primarily in the Introduction, Related Work, and Discussion sections to support the novelty of our proposed approach and to provide a meaningful comparison with the latest developments in antenna optimization, clustering techniques, and LTE/4G network planning. Should further specific references be expected, we would be happy to include additional studies upon request. |
| <b>Tables</b>                          | [R2.1] Pay attention to the punctuation writing format in the English version         | [R2.1] Answer: Thank you for your attention. We have carefully reviewed and revised the manuscript to ensure that all punctuation marks follow standard academic English conventions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Figures</b>                         | [R1.1] Some images are presented in poor quality, such as Picture 3 and Picture 4     | [R1.1] Answer: The author has attempted to improve the image quality. Hopefully, the changes are satisfactory.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                                        | [R2.1] There is an unusual flow chart, in size                                        | [R2.1] Answer: We have revised the flow chart by increasing its resolution and adjusting its size to ensure it displays clearly and proportionately in the manuscript. The updated figure now follows the formatting guidelines and maintains visual clarity in both print and digital formats.                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>References, tables, and figures</b> |                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

**\*\* Add a yellow background to the revised/improved manuscript, according to the results of the review.**

