Starlink Verification Analysis

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July 10, 2025

1 Verification Steps for Set Cover for Starlink Service Zones

1.1 Continuity Testing

For the continuity testing parameters like max coverage radius (R) and covered population level (95%) are changed. By changing these parameters one by one while keeping other parameters constant, optimal sites for set cover is analyzed.

1.1.1 Changing the radius (R)

In Link Budget calculation, the optimal radius value is calculated as:

- Derived max coverage radius: R = 0.49 km

To start with, we altered the radius to find in what values we have a different or no feasible solution in our model. As expected, when radius is selected as 0, we have zero optimal locations. Until R = 0.16, we don't have any solutions other than zero.

When we use our optimal radius value in the model, the optimal location is location #3, with:

Latitude	Longitude
41.053217	28.967085

Until R = 6km, we have a unique optimal solution with just one site being #3. After 6km, we see site #1 aswell in our optimal solution set. After R = 8km, site #2 is appended to the set aswell.

From these tests, we can conclude that our optimal max coverage radius is not a Knife-Edge parameter, in other words, although it is binding, changing its value in a certain interval doesn't necessarily change the optimal solution set. As for the continuity testing, model is successful since when R = 0, we have a null set and as we increase our radius parameter, we realize more sites in our optimal solution set, as expected.

1.1.2 Changing the Level of Population Covered

Here, we test our population coverage level by changing the parameter. The hypothesis before executing this test would be to arrive at the same optimal

solution below 95%, and having more sites above this level. However, from this continuity testing, model fails. Any level below 95%, we have a null set. Also, increasing the level of population covered close to 100%, we still see that site #3 is still the only soluyion in the optimal set. This would mean that this site could cover 95% but more.

2 Verification Steps for Set-Cover Model

The Set-Cover model behaves exactly like the model above, has a successful output in continuity testing in radius parameter and failing in population coverage level.

Both models should be revised since models are internally faulty.

3 Verification Steps for Maximal Covering Model

As for the Maximal Covering Problem, model checks the steps of Continuity Testing. However, it is not the model for finding the optima lsites for this coverage problem, it demonstrates a hypothetical problem which it satisfies.