ELEC-E7120 Wireless Systems

“A Comparative Analysis of 4G Networks Provided by Three Different Operators and Wi-Fi Networks in Five Distinct Locations”

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Introduction:

- 4G in Different Operators VS Wi-Fi:

In today's digitally connected world, network performance is crucial. This presentation explores the key differences between 4G networks offered by three operators, DNA, Telia, and Elisa, and Wi-Fi networks.

We will delve into the unique aspects of 4G networks, including frequency bands, signal strengths, data rates, and latency, as provided by these operators.

We'll also examine Wi-Fi networks, which are widely accessible, and discuss how they compare to 4G in terms of performance.

Introduction:

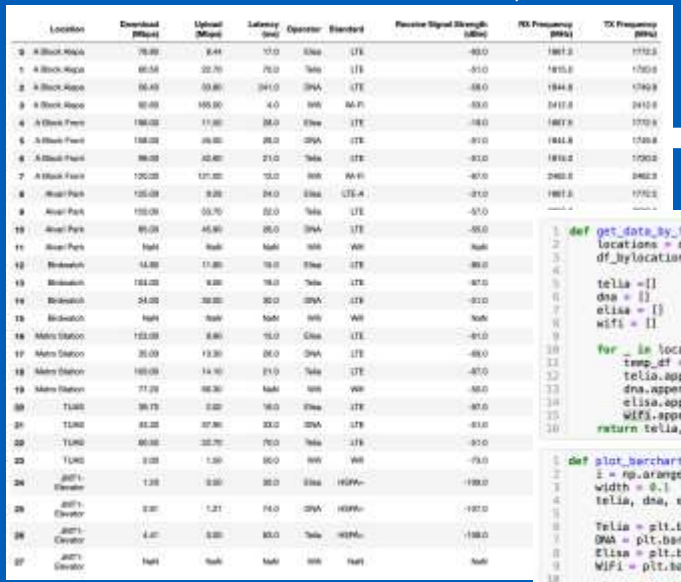
- Measurement Tools:

- CellMapper
- Opensignal
- Wi-Fi Analyzer

Our approach

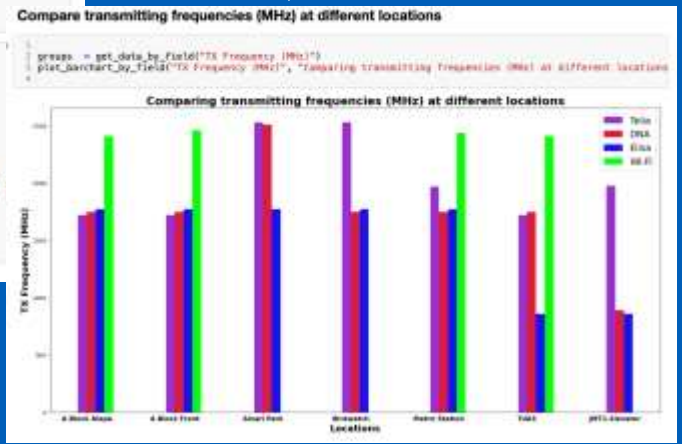
The methodology for analyzing and visualizing the coverage of 4G and Wi-Fi networks

- Conduct measurements in few locations around the campus
- Organize data in an Excel sheet (Dataset)
- Analyse the dataset using Python and some its libraries
- Visualize dataset for comparison of the network coverages using Python and some its libraries



```python
def get_data_by_field(field):
    locations = df["Location"].unique()
    df_bylocation = df.groupby("Location")

    telia =[]
    dna = []
    elisa = []
    wifi = []

    for _ in locations:
        temp_df = df_bylocation.get_group(_)
        telia.append(float((temp_df.loc[temp_df["Operator"] == "Telia"])[field]))
        dna.append(float((temp_df.loc[temp_df["Operator"] == "DNA"])[field]))
        elisa.append(float((temp_df.loc[temp_df["Operator"] == "Elisa"])[field]))
        wifi.append(float((temp_df.loc[temp_df["Operator"] == "Wifi"])[field]))
    return telia, dna, elisa, wifi
```

```python
def plot_barchart_by_field(field, title, group):
    i = np.arange(7)
    width = 0.1
    telia, dna, elisa, wifi = groups

    Telia = plt.bar(i-0.5*width, telia, width, color='darkorchid')
    DNA = plt.bar(i+0.5*width, dna, width, color='crimson')
    Elisa = plt.bar(i+1.5*width, elisa, width, color='blue')
    WiFi = plt.bar(i+2.5*width, wifi, width, color='lime')

    bars = ['A Block Alapa', 'A Block Front', 'Alvari Park', 'Birdwatch', 'Metro Station', 'TUAS',
    plt.xlabel("Locations", fontweight ='bold', fontsize = 17)
    plt.ylabel(field, fontweight ='bold', fontsize = 17)
    plt.title(title, fontweight ='bold', fontsize = 21)
    plt.xticks(i, bars, fontweight ='bold', fontsize = 12)
    plt.legend((Telia, DNA, Elisa, WiFi), ('Telia', 'DNA', 'Elisa', 'Wi-Fi'), fontsize = 17)
```



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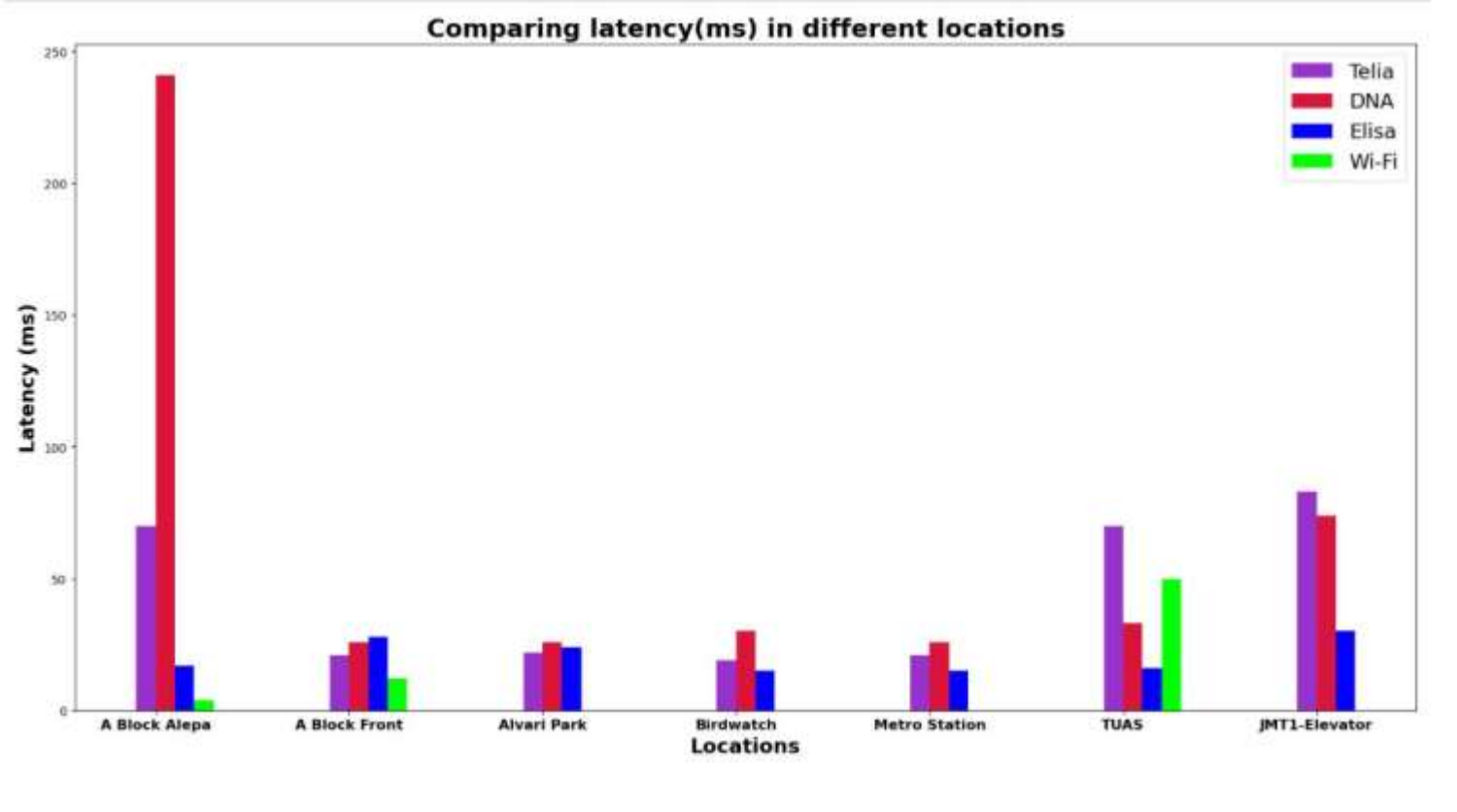
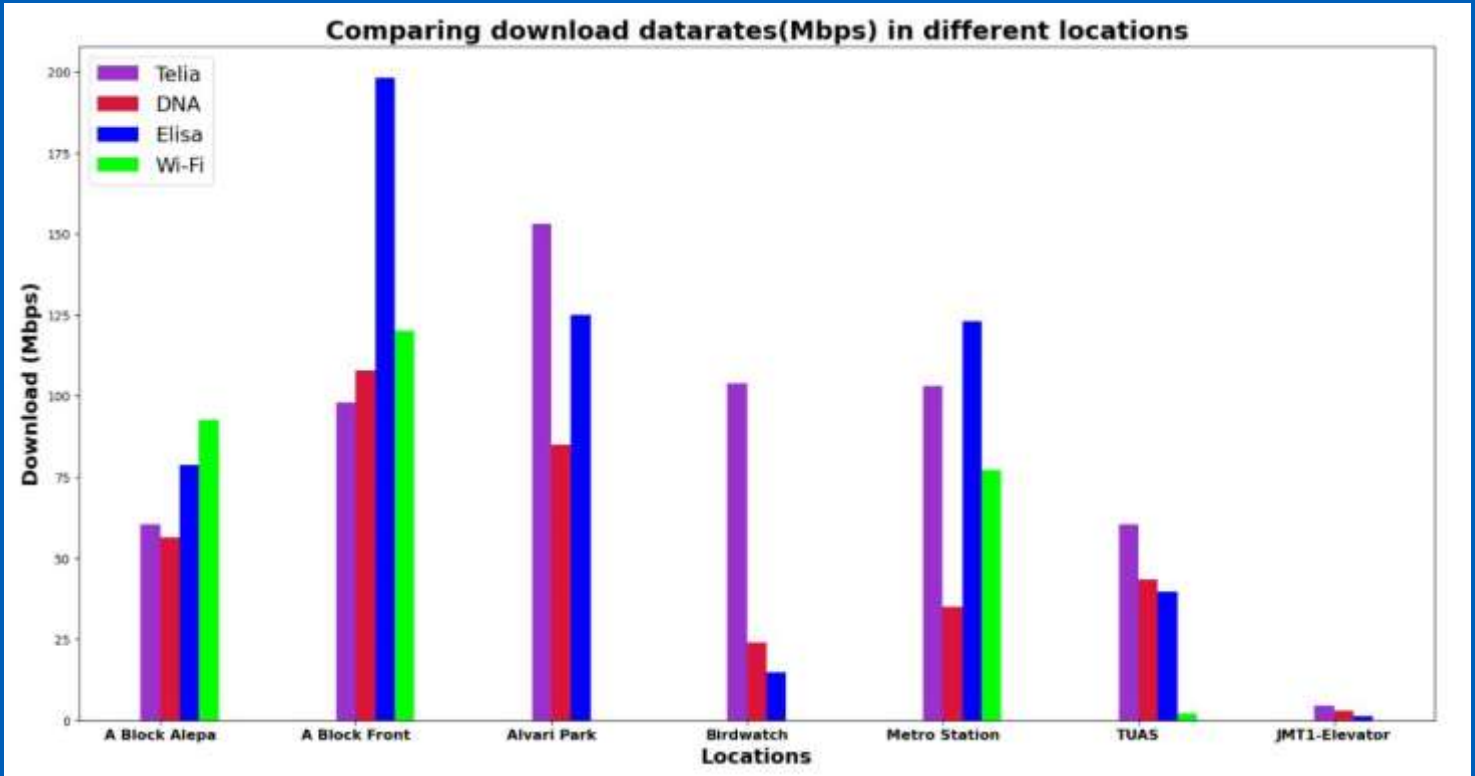
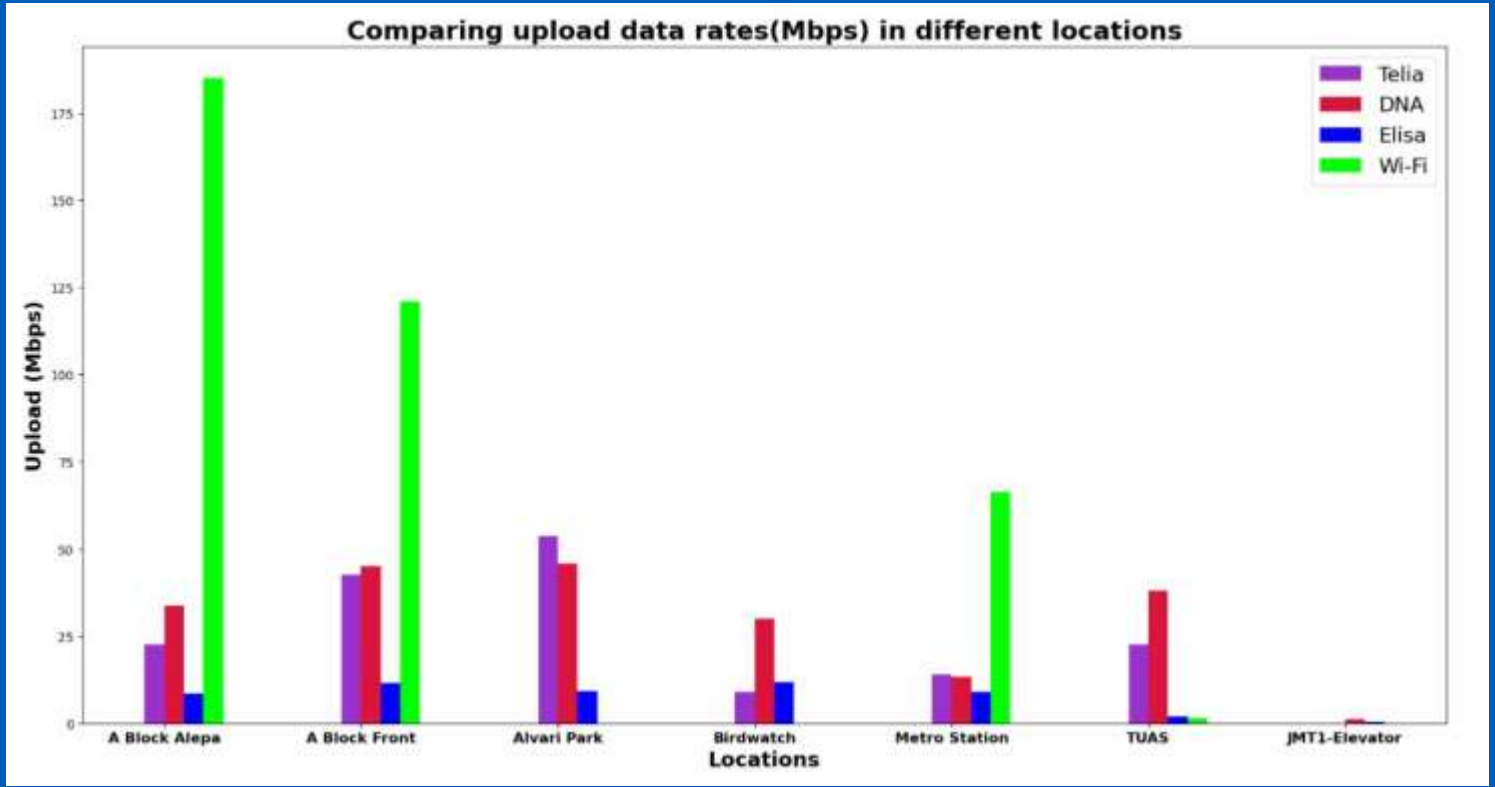
Latency


Comparing latency(ms) in different locations
Latency (ms)
250
200
150
100
50
0
Telia
DNA
Elisa
Wi-Fi
A Block Alepa
A Block Front
Alvari Park
Birdwatch
Metro Station
TUAS
JMT1-Elevator
Locations

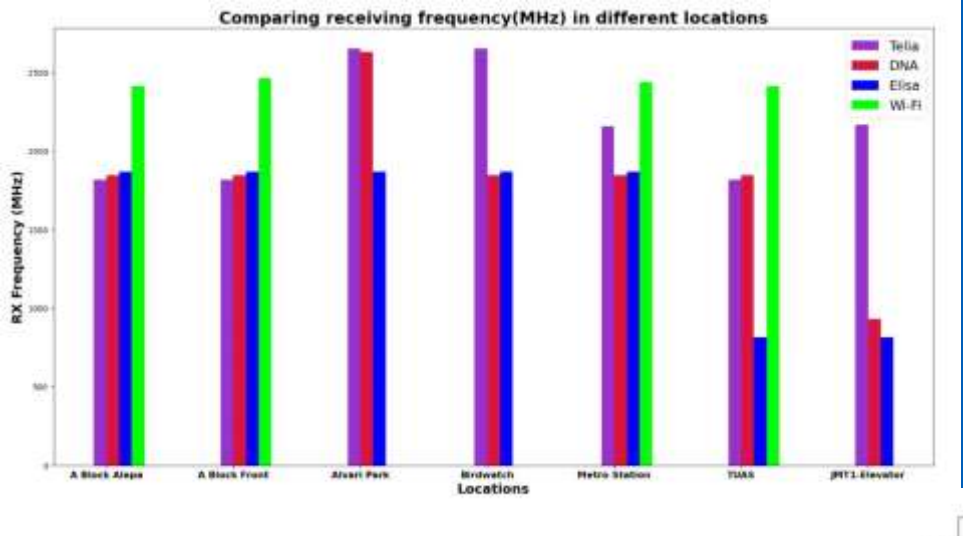
Download Data Rates



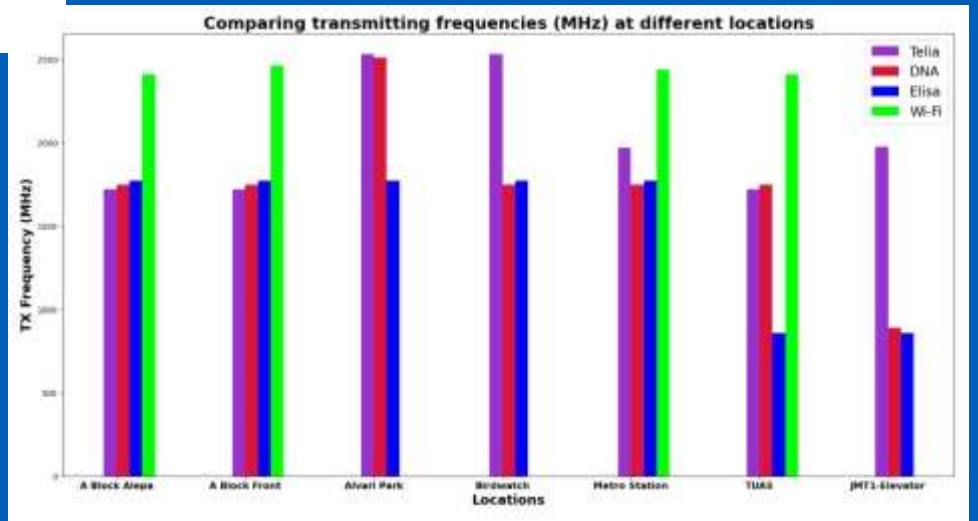
Upload Data Rates



Frequency Bands



- Cellular:
  - B3 (1800 MHz) is mostly used
  - JMT-1 connections were 3G
- Wi-Fi: Eduroam, "only" 2.4 GHz
  - Few measurements used 5 GHz instead of 2.4 GHz
  - 2.4 GHz is congested



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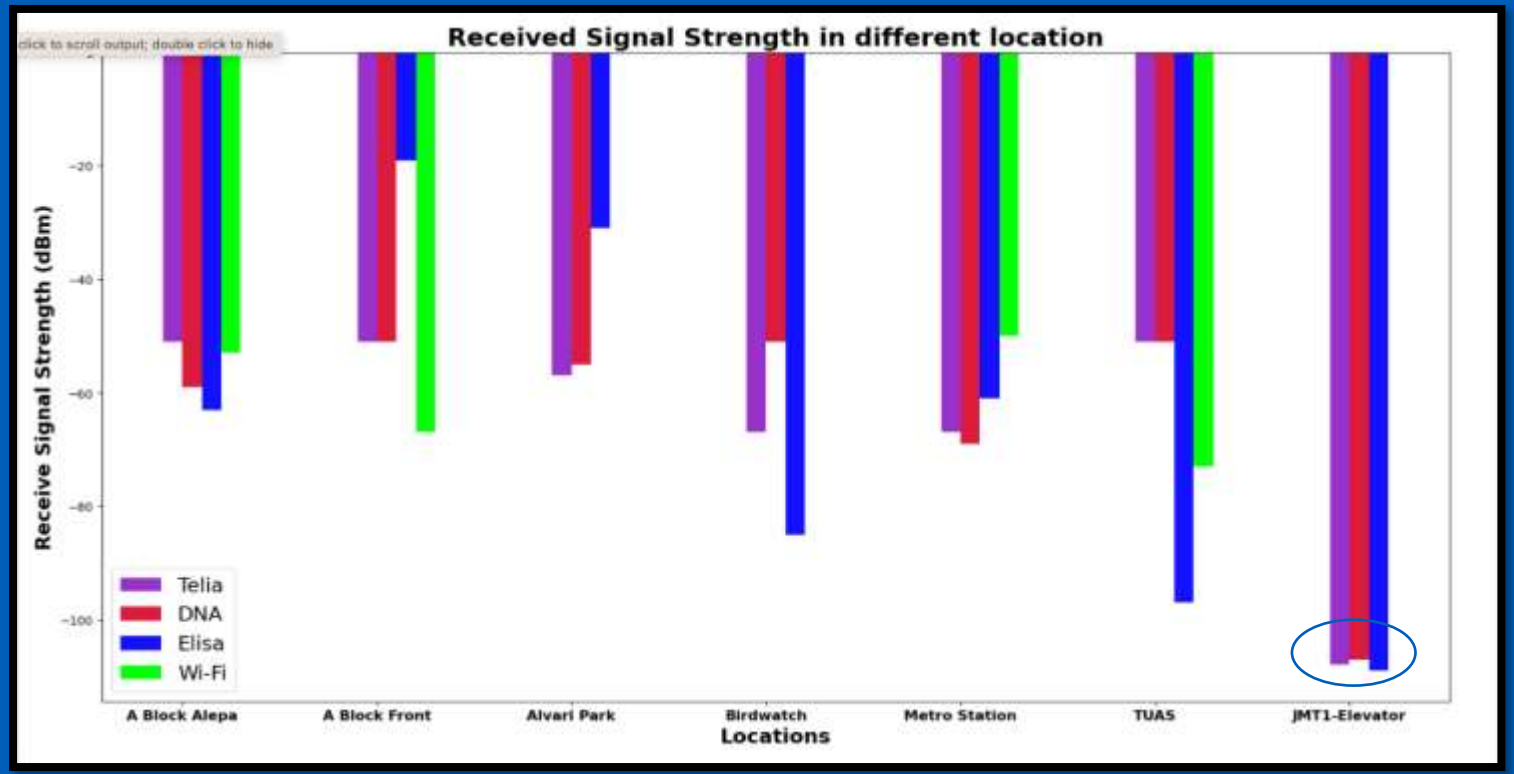
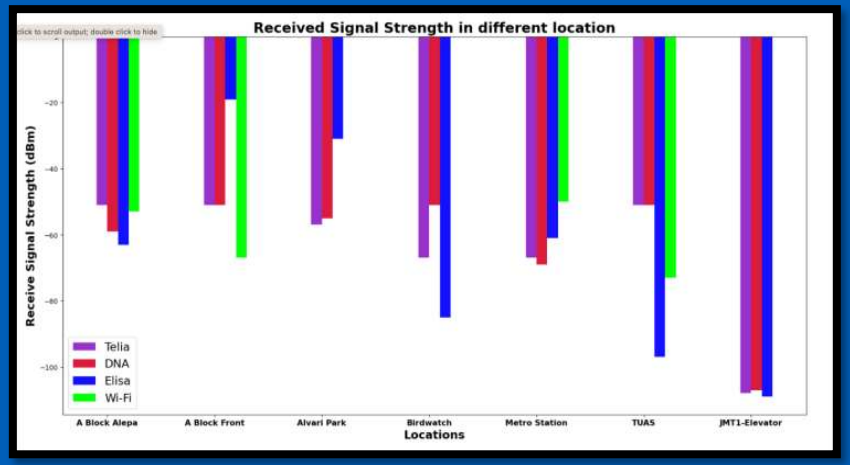
Signal Strength



Signal Strength



With the exception of Alvari Park and A Block, Elisa has always displayed stronger signal strength, particularly at the TUAS Building.

Additionally, there is a strong connection between DNA and Telia.

However, Wifi has had some issues and often disappears.

Conclusion

Analysis

- Elisa has improved signal strength and download speed and minimal latency.
- Though not always available, wi-fi has the fastest upload speeds.
- DNA and Telia are displaying average records.

Significance

- Coverage Assessment
- Performance Optimization
- Comparing Network Performance


THANK YOU