Coverage and Performance Analysis

September 30, 2025

1 Introduction

This document outlines a set of recommended features that you can use as a starting point for your IN5060 assignment. You are, of course, free to include additional features in your analyses if needed. Please make sure you refer to i. the description document available on Zenodo `https://zenodo.org/records/8224890/files/description.pdf?download=1` (as this document refers to a campaign from 2021, there are minor differences in the naming of some features; however, the description is still easy to navigate) and ii. the paper 'The Chronicles of 5G Non-Standalone: An Empirical Analysis of Performance and Service Evolution' `https://ieeexplore.ieee.org/document/10753472`. A list of features is provided for both the passive and active dataset.

2 Passive Dataset

- **Date/Time:** Indicates the date/time of the measurements
- **Latitude/Longitude:** GPS coordinates of the measurements. Use these two parameters to geolocate your data (e.g., by plotting them on a map). It is possible that for some IS locations this information is missing which should not be an obstacle, as these are static measurements (so probably you should not want to geolocate)
- **Speed:** Relevant for OD measurements
- **EARFCN/Frequency:** Operating Frequency
- **PCI:** Cell identifier
- **SSBIdx:** Only relevant if the operator adopts beamforming (more on that later)
- **MNC:** Operator identifier
- **(SS-)RSRP, (SS)-SINR, (SS)-RSRQ:** Signal strength identifiers. You will notice that for 5G, this information is available for multiple signals (while for 4G it is only measured for the reference signal). We suggest focusing on the Secondary Synchronization Signals, i.e., SSS_RSRP, SSS.SINR, and SSS.RSRQ
- **scenario:** Mobility scenario – IS stands for Indoor Static, OD, stands for Outdoor Driving, and OW stands for Outdoor Walking. We suggest focusing only on IS and OD.

- **Band:** Frequency Band

IMPORTANT: Please make sure that you understand the structure of the dataset. As discussed in the course, the scanner performs frequency scans to capture the status of nearby cells operating on a particular frequency. To isolate each frequency scan, group your data using the Date, Time, and Frequency features (i.e., rows that share these three identifiers belong to the same frequency scan). For each frequency scan, you can then check how many PCIs are detected along their signal strength characteristics. In case that a PCI appears more than once in a frequency scan, check the SSBIdx value as it should be different for each measurement. This indicates that the operator is using beamforming, thus more than one beam/antenna for transmission.

HINT 1: If you want to report the coverage for a particular operator/frequency/location you can choose to report the cell that provides the highest RSRP (among the available ones within a frequency scan).

HINT 2: When reporting coverage, select a single indicator for your results (we recommend using (SS-)RSRP or (SS-)SINR). Since all three metrics provide a similar perspective on coverage, including all three of them might clutter your presentation (and should be avoided).

3 Active Dataset

You will notice that the name of all features end with *'...1.'* or *'...2.'*. '1' represent Operator 1, and '2' Operator 2. Take that into consideration when subsetting your dataset. The feature names listed below correspond to Operator 1.

- **Day, Timestamp..dd.mm.yyyy.hh.mm.ss.ss.:** Indicates the date/time of the measurements
- **GPS_Position_Distance..GPS...obsolete...m.....1.:** GPS coordinates of the measurements
- **X5G.NR.UE_Cell.Environment_1..PCI....1.:** 5G Cell identifier
- **LTE.UE_PCell_PCI..PCI.MCG.PCell.....1.:** 4G Cell identifier
- **X5G.NR.UE_5G.NR.Carriers_SS.RSRP..SS.RSRP.n.a....dBm.....1.** SS-RSRP of the 5G cell
- **LTE.UE_PCell_RSRP..RSRP.MCG.PCell...dBm.....1.** RSRP of the 4G cell
- **GSM.UE_RAT.Info_Mode....1.** Represents whether the UE is connected to a 4G or a 5G cell.
- **X5G.NR.UE_PDSCH.Total_Net.PDSCH.Thp..MBit.s.....1.** 5G Physical Layer DL throughput (application agnostic)
- **LTE.UE_PDSCH.Total_Total.PDSCH.Throughput..MBit.s.....1.** 4G Physical Layer DL throughput (application agnostic)
- **X5G.NR.UE_PUSCH.Total_Scheduled.PUSCH.Thp..MBit.s.....1.** 5G Physical Layer UL throughput (application agnostic)

- **LTE.UE_PUSCH.Total_Total.PUSCH.Throughput..MBit.s.....1.** 4G Physical Layer UL throughput (application agnostic)
- **QoS.Tester_Net.Throughput_Current.Netw..DL..MBit.s.....1.** Current DL throughput during a session (agnostic to technology)
- **QoS.Tester_Net.Throughput_Current.Netw..UL..MBit.s.....1.** Current UL throughput during a session (agnostic to technology)
- **QoS.Tester_QP.Interactivity.Result_Interactivity.Score.....1.** Interactivity score (combination of Round Trip Time (RTT), Packet Delay Variation (PDV), Packet Error Rate)) **Hint:** A very good indicator to use for e-gaming and AR/VR cloud gaming applications to assess the responsiveness of the system.

Other notes

- The UE collects information about the active state of the connection. Therefore, it may choose to connect to a 4G cell either because no 5G coverage is available in the area or because the 4G signal is stronger (among other possible reasons not discussed here).
- Data files tagged as 'LTE_only' represent sub-campaigns where the UEs were forced to connect to a 4G cell (thus no 5G data are available). If you are not interested in such scenarios, please ignore them.
- Remember that RSRP, RSRQ, and SINR can also be collected from the active dataset. However, these will always report information about the connected cell (4G or 5G) and not from any neighboring cells. This can be important for the types of analysis you will be conducting.