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| Lab 07 |
| *7* | *LTE in MatLab:*  *Downlink & Uplink* |
| **Advanced Wireless Lab** |
| TLEN 5830-AWL |
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1. Map the downlink PBCH & PDSCH channels to the resource grid. Answer the associated questions. Use your choice of Reference Channel Measurements (R.x) or declare the cell-wide setting structure.

NOTE: For Physical Downlink Shared Channel mapping, you have to declare a few additional values for ‘enb.PDSCH’ value.

**Questions 1.a. - 1.h.**

* 1. Include the cell-wide setting structure in the report.
  2. Explain the importance of physical cell identity and how it is computed? What step to be taken to avoid the UE detecting the same physical cell identity from two different base stations?
  3. List and explain the role (in a word/sentence) about different downlink Reference Signals.
  4. Explain the role of MIB in the downlink communication and how it assists the UE. Mention the logical channel, transport channel, and physical channels through the MIB information is passed.
  5. Mention the specific sub-carriers (position in the resource grid) to which the MIB is mapped and the reason behind it. Mention other signals/channels which are also present along with MIB information.
  6. Why does PBCH use only QPSK modulation scheme? How many are slots/sub-frames required for transmission of the Master Information Block? Does UE need to decode all the slots/sub-frames information to read the contents of the MIB?
  7. What is the information carried by the PBSCH channel?
  8. With respect to PDSCH channel, explain PRBsets, RNTI, RV, and codeword in a sentence or two.

1. Implement the SC-FDMA transmission (for uplink transmission) with the help of MATLAB. This objective doesn’t require LTE System Toolbox.

**Questions 2.a. - 2.c.**

* 1. Include the code (.m file) and any related screenshots in the report.
  2. List and explain the reasons behind the selection of SC-FDMA on the uplink over OFDMA.
  3. Why is it not applicable to use SC-FDMA on downlink? Explain.

1. Map the below-mentioned uplink physical channels and signal to the resource grid. Similar to the ‘enb’ structure on the downlink, ‘ue’ structure is utilized on the uplink. The [Reference measurement Channel](https://www.mathworks.com/help/lte/ref/ltermcul.html) for uplink is in the form of ‘Ax-y’ where x & y are integers. You can either declare the ‘ue’ structure or assign an RMCUL Reference Channel number. If declaring, be aware that the ‘ue’ structure requirements may differ for each of the channels or signals.

**Questions 3.a. - 3.d.**

* 1. PUSCH, PUCCH1, PUCCH2, PUCCH3, DRS, and SRS. (DRS signals are associated with PUSCH & PUCCH channels)
  2. Mention the role of each of the above channels and signals.
  3. Explain in a couple of sentences about the different formats of PUCCH signals.
  4. Describe Uplink Channel Information (UCI) and HARQ Indicator Bits in PUCCH Signals.