PCI in 5G

PCI is Physical Cell Identity. It is the identification of the 5G cell. Physical cell ID is required for the Downlink (DL) synchronization. 5G NR PCI is required for synchronization purposes as it is composed of synchronization signals PSS (Primary Synchronization Signal) and SSS (Secondary Synchronization Signal). PSS and SSS signals provide the information which is required for the downlink synchronization. The information contains: PSS provides Radio Frame boundary, SSS provides Sub-frame boundary, PCI information using both PSS and SSS. It is to provide a pseudo-unique value for identifying cells. Its value is derived from PSS and SSS. PSS has values 0, 1 and 2. SSS has values between 0 and 335. There are a total of 1008 PCI available in 5G technology. 1008 PCIs are divided into 336 unique PCI groups and each group consisting of three different identities. The PCI planning for 5G NR is very similar to PCI planning for LTE. PCI for 5G NR is double that in LTE technology.
5G PCI Planning

- The PCI Planning process has a basic step that neighboring cells cannot have the same PCI. If neighboring cells are having the same PCI, then there is a chance of PCI collision. In the case of a PCI collision, the UE may not be able to get the appropriate cell to latch on and the phenomenon is called a PCI collision. This issue can be resolved by having the physical separation between cells using the same PCI to ensure that the UE will never get the same PCI. So reuse distance should be kept in mind. PCI collision can delay downlink synchronization and handover failures.

- PCI confusion is the next issue in the planning process in which two neighboring sectors of the one cell cannot be allocated the same PCI. If it occurs, there is always confusion for the UE as to which sector to latch on to and creates an issue in the network. This could be resolved while allocating PCI should be such that a cell should not have
multiple neighbors using the same PCI and physical separation should be required.

- Using the Mod principle: As per this, UE should not be able to simultaneously receive multiple PCI from Mod 3, Mod 4, and Mod 30. These Mods are based on the channels in the Physical layer like PSS (Primary Synchronization Signal), DMRS (Demodulation reference signal), and SRS Sounding Reference Signal).