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# HIGHLIGHTS ON NR UE FEATURE LIST

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# 2-4 TCI STATES FOR PDSCH

## › Motivation

- The maximum number of configured TCI states in 38.331 is 64
- The UE is only required to track *active* TCI states (component-1), not *configured* TCI states (component-2)
- For FR2, multiple SS/PBCH blocks will be used (max 64 for mmWave)
  - › Number of TCI states scales with the number of SS/PBCH blocks
- If the number of configured TCI states is small, frequent RRC re-configurations are required to support UE mobility within a cell

## › Proposal:

- Remove Component-2
- Or, 64 configured TCI states is mandatory

# 3-4 MORE THAN ONE TCI STATE CONFIGURATIONS PER CORESET

## › Motivation

- If this feature remains optional, and only 1 TCI state is configured for a CORESET, an RRC re-configuration is needed for every PDCCH beam change
  - › Heavy RRC signaling load required for mobility *within* a cell
- It is not clear why this UE feature is needed
  - › TCI states for a CORESET are always a subset of the TCI states configured for PDSCH
  - › Configuration contains only “pointers” to the TCI states configured for PDSCH

## › Proposal:

- Remove UE feature
- Or, Mandatory without capability signaling

# 2-20 BEAM CORRESPONDENCE

## › Motivation

- Exploiting beam correspondence allows measurement and reporting from DL beam management procedures to support UL beamforming
  - › Avoids excessive air interface load from UL beam management procedures based on SRS beam sweeping (per UE)
  - › Simplifies network operation
- All UEs must be capable of a certain degree of beam correspondence to be able to access the network
  - › Transmit PRACH/MSG3 in the same direction as the detected SS/PBCH block
- Additional UL beam management procedures (SRS beam sweep) to support high gain (narrow) UL beamforming is an optimization

## › Proposal:

- Mandatory without capability signaling at least for FR2

# CSI REPORTING / CSI-RS CAPABILITIES (2-33, 2-35, 2-36)

## › Motivation

- UE complexity driven by the number of simultaneously calculated CS report and active CSI-RS resources, not the number of configured ones
  - › Restricting the number of configured CSI report settings and CSI-RS resources can severely impact network performance and gNB flexibility
- For FR1, even when reciprocity-based operation is used, Type I CSI feedback capturing all antenna ports of the array is needed for fallback to ensure good performance also on cell edge.

## › Proposals

- 2-33: 16 configured CSI-RS resources mandatory; Remove component on maximum number of configured ports
- 2-35: 4 configured CSI reporting settings per time-domain behavior is mandatory
- 2-36: For FR1, support of 1 CSI-RS resource with 32 ports and 4 CSI-RS resources each with 8 ports is mandatory

# 2-55 SRS TX SWITCH

## › Motivation

- SRS sounding is used to support DL CSI acquisition either with Tx antenna switching (1T2R, 2T4R, 1T4R) or without switching ( $T = R$ )
- If a UE declares that 2-55 is not supported, it is likely still capable of supporting sounding on a fixed set of antennas ( $T = R$ )
- Reciprocity-based DL beamforming is central to NR, and UE capability signaling must reflect that

## › Proposal:

- 2-55 is Mandatory with UE capability signaling
  - › Candidate values (UE indicates one): 1T2R, 2T4R, 1T4R, 1T4R/2T4R, or  $T = R$

# 5-1 BASIC SCHEDULING/HARQ OPERATION

## › Motivation

- The NR specification supports dynamic UL/DL determination (dynamic TDD) by both SIB and none SIB configuration.
  - › Both operational modes are ways to achieve dynamic UL/DL determination.
- Operation with and without both dynamic UL/DL determination is key features within NR and should be ensured to be supported.
- Not supporting the feature will lead to initial access and forward compatibility problems

## › Proposal:

- 5-1 shall contain the following component
  - › “7) Dynamic UL/DL determination based on L1 scheduling DCI with/without cell specific RRC configured UL/DL assignment”

# 5-28 RATE-MATCHING AROUND LTE CRS

- › **Enabling deployments wherein NR and LTE is operating is key for**
  - Efficient spectrum utilization between NR and LTE
    - › Important for LTE based IoT technologies
  - Migrating LTE spectrum to NR
    - › Allow flexible allocation of spectrum between NR and LTE.
    - › Allows operators an very competitive and efficient way of deploying NR within LTE spectrum
  
- › **Proposal:**
  - 5-28 is set to mandatory with capability signalling

# 7.5 KHZ UL RASTER SHIFT

- › **Enabling deployments wherein NR and LTE is operating is key for**
  - Efficient spectrum utilization between NR and LTE
    - › Important for LTE based IoT technologies
  - Migrating LTE spectrum to NR
    - › Allow flexible allocation of spectrum between NR and LTE.
    - › Allows operators an very competitive and efficient way of deploying NR within LTE spectrum
  
- › **Proposal:**
  - 7.5 kHz shift is mandatory for all NR bands that overlap with any LTE band

# 5-25 LBRM FOR PUSCH

## › **LBRM offers benefits for uplink processing**

- Similar benefits as downlink LBRM since UL and DL use same LDPC codes
  - › E.g. decoder h/w complexity reduction, throughput enhancement, and latency reduction
- If LBRM for PUSCH is optional, gNB has to always implement both LBRM and FBRM, rendering it difficult to benefit from LBRM e.g. h/w dimensioned according to worst case
- If LBRM for PUSCH is mandatory, gNB has freedom to implement FBRM-only, or LBRM-only, latter providing benefits in implementation

## › **UL LBRM does not increase UE complexity**

- LBRM only requires UE to store fewer bits in the circular buffer in encoding process ( $R_{\text{LBRM,UL}} = 2/3$ )

## › **Proposal:**

- 5-25 is mandatory with capability signalling



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