



Enhancements for dynamic spectrum sharing in Rel-16

Ericsson

AI: 9.4

Discussion and decision

Summary of proposed enhancements for DSS

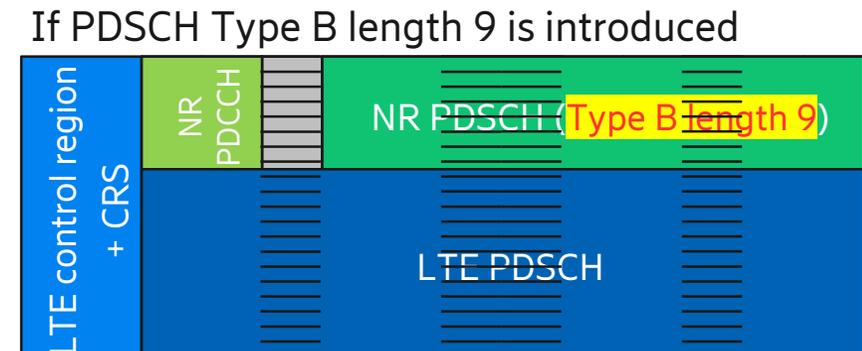
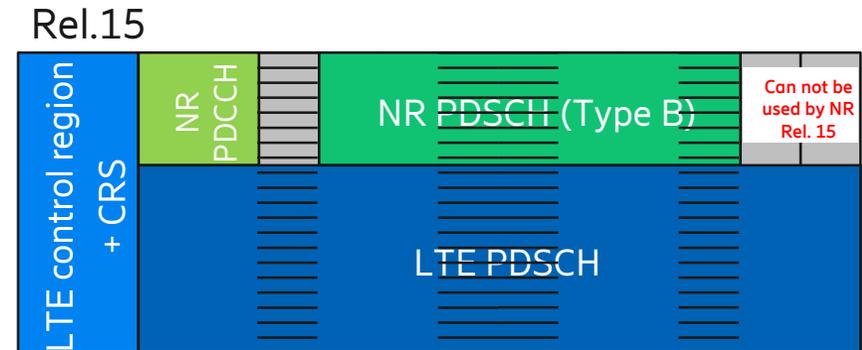


- Support PDSCH Type B scheduling of length 9 and 10
 - Support at least the case where DMRS doesn't collide with CRS when PDSCH is aligned with slot end, for both 30 kHz and 15 kHz SCS
- Support that a UE can be configured with multiple *LTE-CRS-RateMatch* Patterns (for 15 kHz SCS)
- Support PDSCH Type A scheduling where DMRS can be configured to be in symbol 4

Introduce PDSCH Type B of length 9 (for 15 kHz SCS use case)



- **Main issue:**
 - NR PDSCH cannot utilize all available OFDM symbols in the slot
- **Details:**
 - NR PDCCH is placed in symbol 3 or symbol 3+4
 - NR PDSCH Type B must be used, but limited in length to 7 symbols
 - → unused OFDM symbols
- **Spec enhancement:**
 - Introduce PDSCH mapping type B of length 9
 - Ensure DMRS is not colliding with CRS (at least when aligned with slot end)
 - DM-RS must avoid CRS symbol collisions for 15 kHz SCS, for example the DMRS can be in symbol 0 and 7



Introduce PDSCH Type B of length 9 and 10 (30 kHz SCS use case)



— Motivating scenario

- DSS with NR 30 kHz SCS, no frame shift
- LTE control region of two symbols
- 2 port CRS
- NR DMRS should avoid symbols with LTE CRS and/or sub-carriers with LTE PDCCH
- Type B scheduling used for 1st NR slot due to LTE PDCCH
- Type A scheduling used for 2nd NR slot
- NR UE configured with reserved resources to avoid CRS

— Main issue

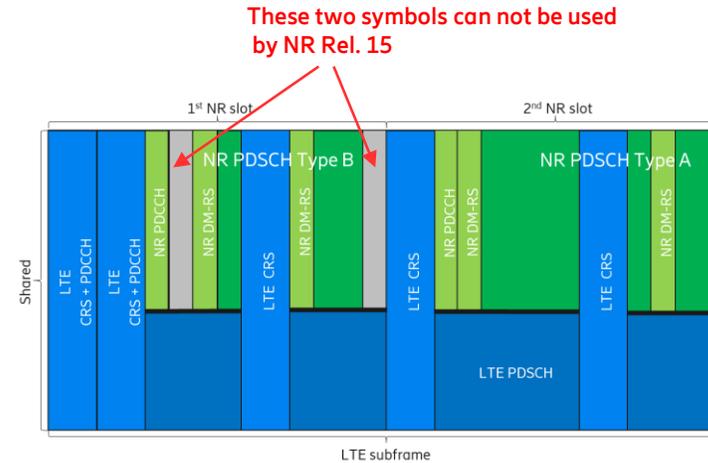
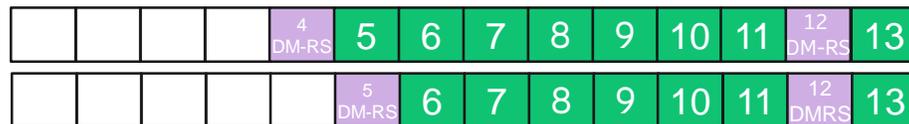
- 2 NR symbols in every second slot can not be used since Type B length is limited to 7 symbols

— Solution / Spec enhancement

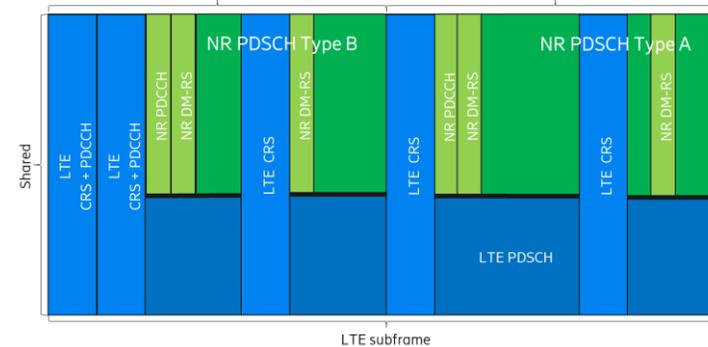
- Add support for PDSCH Type B of length 9 and length 10 where DMRS is not colliding with symbols containing CRS
- Length 10 support allows that NR PDCCH is FDM with NR PDSCH → even better NR spectrum efficiency,
- Note that **DMRS positions** must **avoid collision** with CRS symbols for both 2 and 4 CRS port cases and **when SCS is 30 kHz**

— For example:

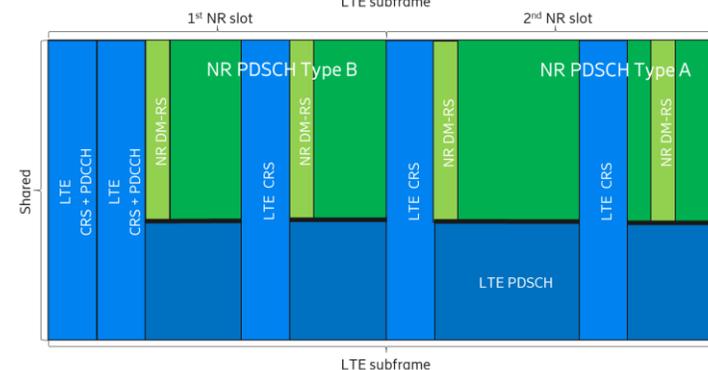
- Length 9 with DMRS in symbols {0,7}
- Length 10 with DMRS in symbols {0,8}



Rel 15



When PDSCH type B of length 9 is introduced



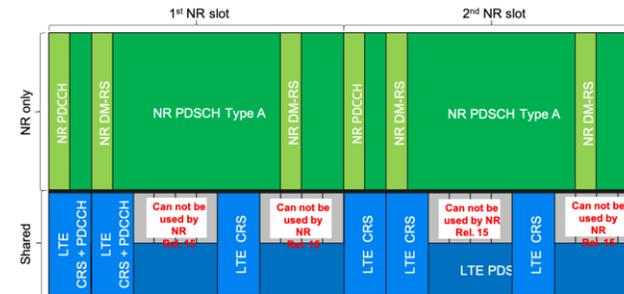
When PDSCH type B of length 10 is introduced

Introduce PDSCH Type A with DMRS in symbol 4 (30 kHz SCS use case)

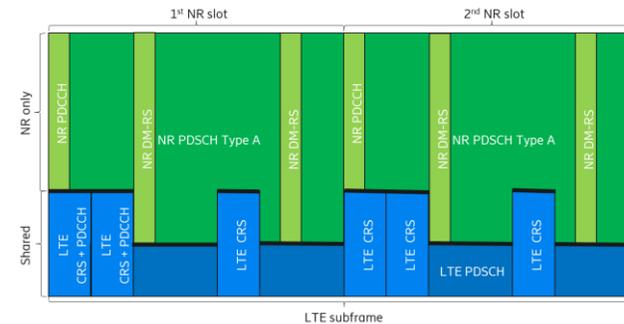


— Motivating Scenario

- DSS with NR 30 kHz SCS, large BW
- LTE control region of two symbols, 4 port CRS
- Use of a
 - Dedicated (NR only) bandwidth part containing the NR PDCCH
 - Shared (NR+LTE) part containing LTE PDCCH
- NR DMRS should avoid symbols with LTE CRS and/or sub-carriers with LTE PDCCH
 - => NR can not be scheduled with PDSCH Type A on PRB where LTE signals are present



Two options for enhanced



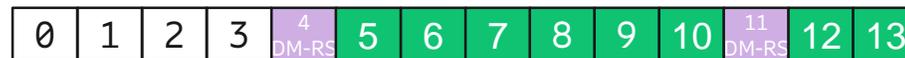
PDSCH Type A with DMRS in symbol 4

— Main issue

- In shared carrier part,
- **LTE CRS+PDCCH occupy symbol 0-3 and prevents the use of PDSCH Type A where DMRS is in symbol 3**
 - NR cannot use the leftover symbols that LTE doesn't use, plus
 - The first 4 symbols always unavailable for NR (even in subframes where no LTE control is transmitted)

— Solution / Spec enhancement

- **Add support for a PDSCH Type A with first DMRS configured in symbol 4**



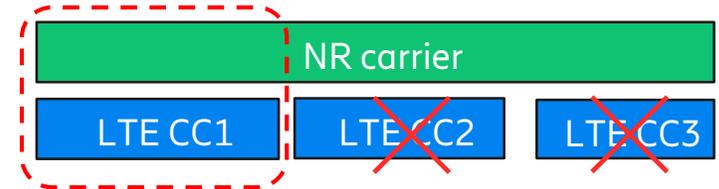
Introduce multiple LTE-CRS-RateMatch Patterns

(15 kHz SCS use case)



— Motivating scenario

- A wide NR carrier overlapping multiple LTE carriers

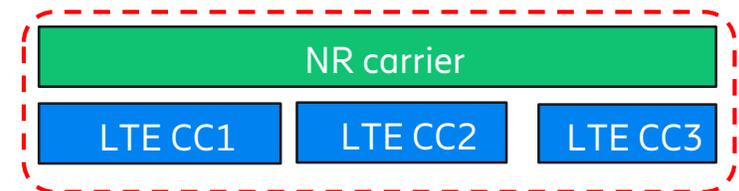


— Main issue

- Rel.15 only support a single CRS rate matching pattern
- → DSS can only be used with a single LTE CC
- → Either NR carrier bandwidth must be reduced or LTE component carriers must be disabled

— Solution / Spec enhancement

- UE can be higher layer configured with multiple CRS rate matching patterns (*LTE-CRS-RateMatch*)



Current Status



- RAN1 has already made Rel-16 agreements partially supporting these features
- In the NR-U work item, it was agreed to support all lengths for PDSCH mapping type B are supported
 - Hence, length 9 and 10 will be supported
 - DMRS aspects are FFS
- eMIMO work item agreed to extend *lte-CRS-ToMatchAround* to multiple CRS patterns in a serving cell

Proposed way forward



- Add needed Rel-16 work for dynamic spectrum sharing to existing work items
- Update to objective on multiple PDSCH starting positions in NR-U WID (R1-191044)
 - Add that for PDSCH Type B of length 9 and 10, the positions of DMRS are defined or can be configured so they do not collide with the symbols containing LTE CRS
- Add objectives to MIMO WID (R1-191043)
 - Extend the higher layer configuration of the LTE-CRS rate matching pattern by the parameter *RateMatchPatternLTE-CRS* in TS 38.331 to at least eight independently configured rate matching patterns per PDSCH
 - Enhance PDSCH mapping type A where the position l_0 of the first DM-RS symbol can be configured by dedicated signaling to $l_0=4$