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IMT-2020 submission templates: Description characteristics template

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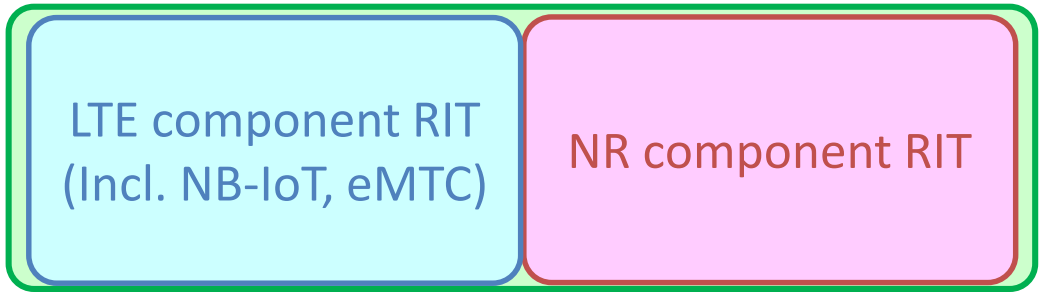
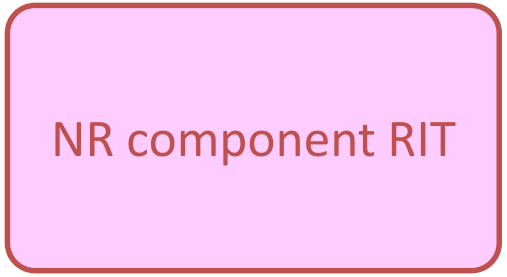
Characteristics templates for SRIT and RIT of "5G"

- Description template; one characteristics template for SRIT (encompassing NR and LTE), and one characteristics template for NR RIT (RP-182052)
  - SRIT
    - Component RIT: NR
    - Component RIT: EUTRA/LTE (incl. standalone LTE, NB-IoT, eMTC, and LTE-NR DC)
  - RIT
    - NR RIT

SRIT → One template



RIT → One template



Contents of Description Template (27 Items)

5.2.3.2.1 Test environment(s)

5.2.3.2.2 Radio interface functional aspects

5.2.3.2.3 Describe channel tracking capabilities (e.g. channel tracking algorithm, pilot symbol configuration, etc.) to accommodate rapidly changing delay spread profile.

5.2.3.2.4 Physical channel structure and multiplexing

5.2.3.2.5 Mobility management (Handover)

5.2.3.2.6 Radio resource management

5.2.3.2.7 Frame structure

5.2.3.2.8 Spectrum capabilities and duplex technologies

5.2.3.2.9 Support of Advanced antenna capabilities

5.2.3.2.10 Link adaptation and power control

5.2.3.2.11 Power classes

5.2.3.2.12 Scheduler, QoS support and management, data services

5.2.3.2.13 Radio interface architecture and protocol stack

5.2.3.2.14 Cell selection

5.2.3.2.15 Location determination mechanisms

5.2.3.2.16 Priority access mechanisms

5.2.3.2.17 Unicast, multicast and broadcast

5.2.3.2.18 Privacy, authorization, encryption, authentication and legal intercept schemes

5.2.3.2.19 Frequency planning

5.2.3.2.20 Interference mitigation within radio interface

5.2.3.2.21 Synchronization requirements

5.2.3.2.22 Link budget template

5.2.3.2.23 Support for wide range of services

5.2.3.2.24 Global circulation of terminals

5.2.3.2.25 Energy efficiency

5.2.3.2.26 Other items

5.2.3.2.27 Other information

3GPP provided description for most items

➔ Describe items related to evaluations

Test environment and radio interface functionality

- 5.2.3.2.1 Test environment(s)
  - Cover 5 test environments across eMBB, URLLC, mMTC usage cases
- 5.2.3.2.2 Radio interface functional aspects
  - Describe multiple access, modulation, error coding schemes, etc.

Items	NR	LTE
Multiple access schemes	DL: CP-OFDM • Spectral confinement techniques transparent to receiver UL: CP-OFDM and DFT-s-OFDM	DL: CP-OFDM UL: DFT-s-OFDM
Error coding schemes	LDPC for data channel Polar coding for control channel	Turbo coding for data channel Convolutional coding for control channel

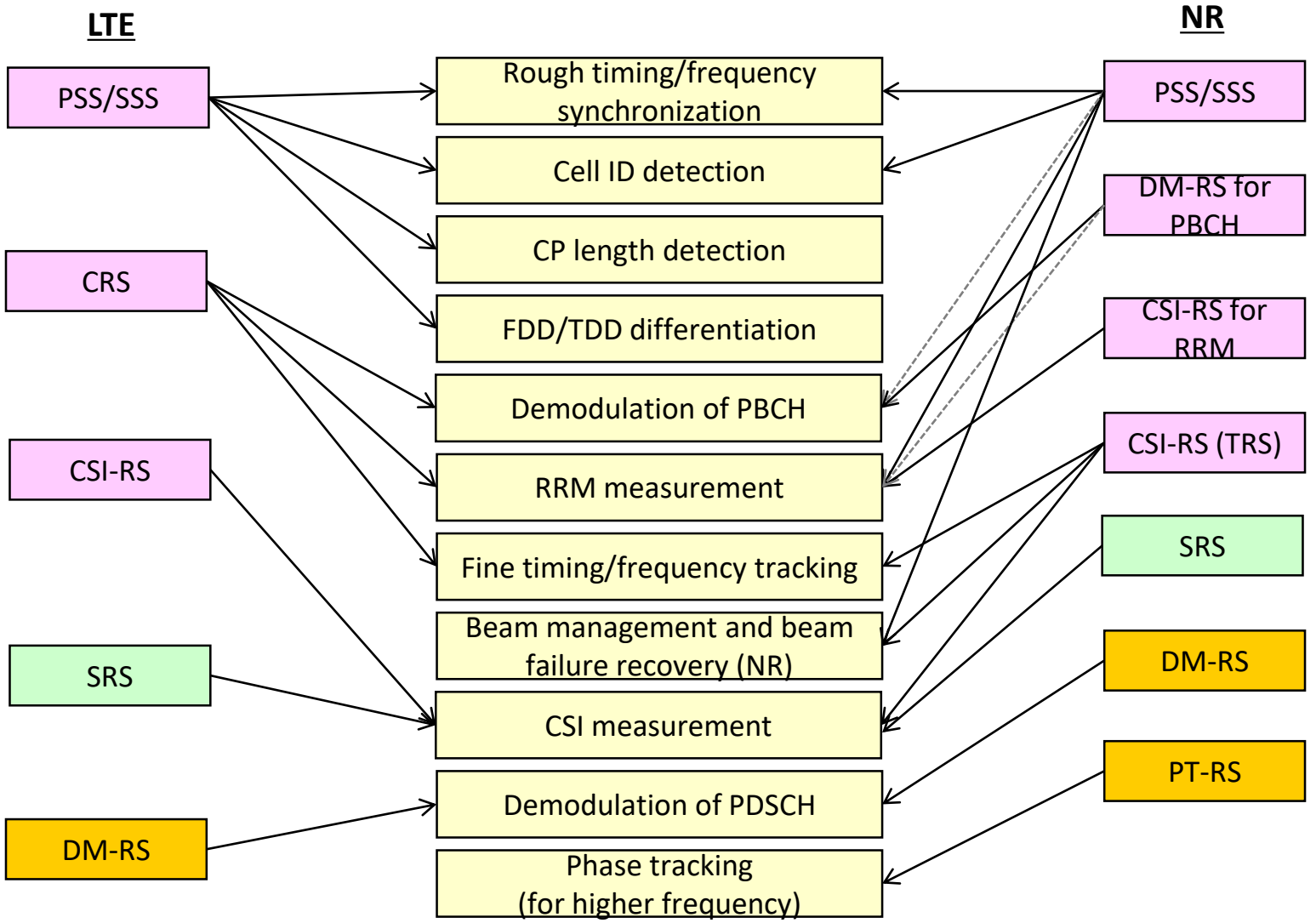
RS and channel structure

- 5.2.3.2.3 Describe channel tracking capabilities
  - Reference signal (RS) to support channel tracking are listed for NR and LTE (next slide)
- 5.2.3.2.4 Physical channel structure and multiplexing
  - Describe physical channel bit rate, L1/L2 overhead, etc.

Example of RS overhead calculation

Reference signal type	Example configurations	Overhead for example configurations
DMRS-PDSCH	As examples, DMRS can occupy 1/3, ½, or one full OFDM symbol. 1, 2, 3 or 4 symbols per slot can be configured to carry DMRS.	2.4 % to 29 %
PTRS- PDSCH	1 resource elements in frequency domain every second or fourth resource block. PTRS is mainly intended for FR2.	0.2% or 0.5 % when configured.
CSI-RS	1 resource element per resource block per antenna port per CSI-RS periodicity	0.25 % for 8 antenna ports transmitted every 20 ms with 15 kHz subcarrier spacing
TRS	2 slots with 1/2 symbol in each slot per transmission period	0.36 % or 0.18% respectively for 20 ms and 40ms periodicity

Example of SS and RS Structure

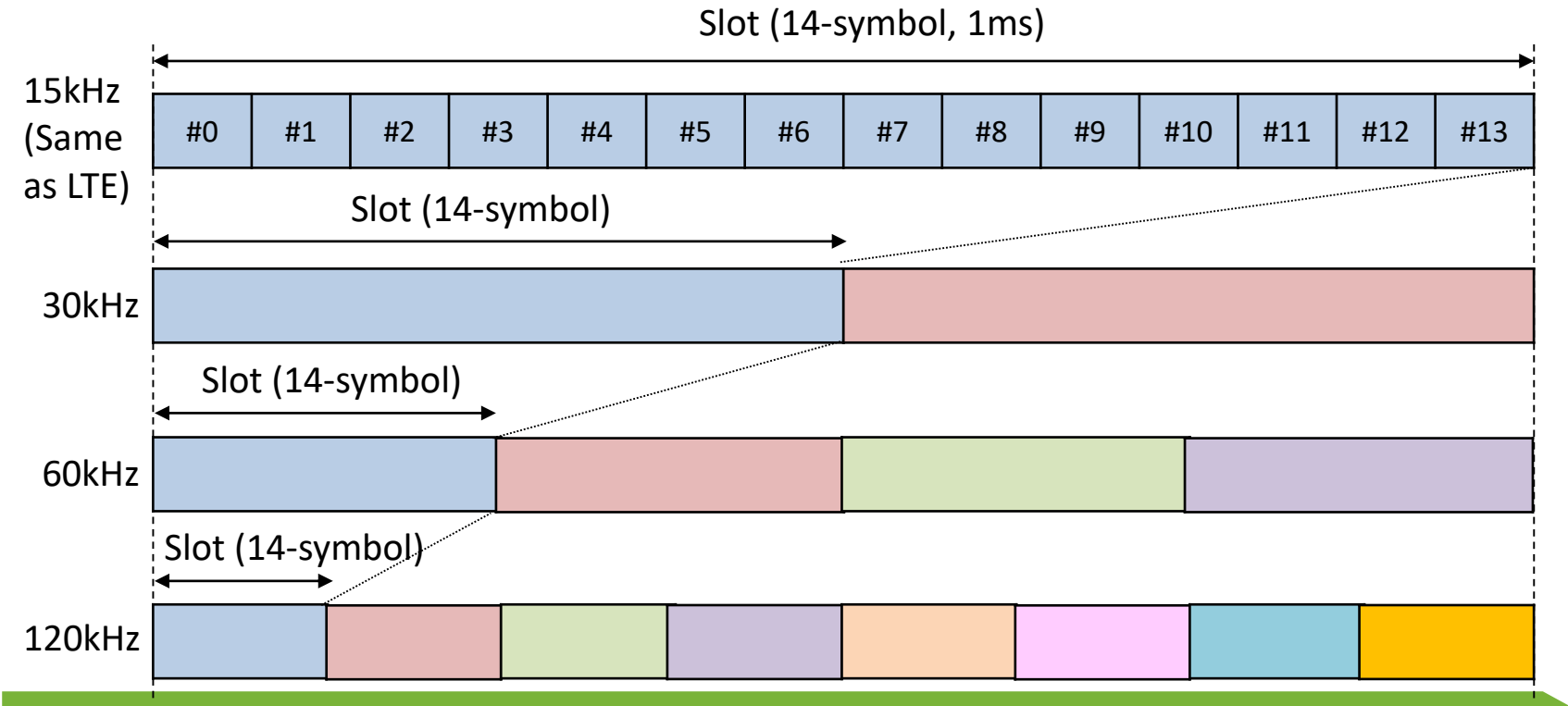


Mobility and RRM

- 5.2.3.2.5 Mobility management (Handover)
  - 1) Intra-NR handover: Network controlled mobility for UEs in RRC_CONNECTED
    - Cell level mobility (Handover)
    - Beam level mobility (at lower layers)
      - Measurement of multiple beams of a cell
  - 2) Inter-RAT handover: Intra 5GC inter RAT mobility between NR and E-UTRA
- 5.2.3.2.6 Radio resource management
  - Multi-RAT dual connectivity (MR-DC): Tight inter-working between E-UTRA and NR
    - MR-DC with the EPC
      - E-UTRA-NR Dual Connectivity (EN-DC). eNB is master node (MN) and gNB is secondary node (SN)
    - MR-DC with the 5GC:
      - NG-RAN E-UTRA-NR Dual Connectivity (NGEN-DC): eNB is MN and gNB is SN
      - NR-E-UTRA Dual Connectivity (NE-DC): gNB is MN and eNB is SN

Frame structure and spectrum aspects

- 5.2.3.2.7 Frame structure
  - NR supports the following scalable numerologies and slot structure
- 5.2.3.2.8 Spectrum capabilities and duplex technologies
  - NR supports flexible spectrum use through, CA, BWP, SUL and co-existence with LTE-M/NB-IoT
  - NR supports scalable bandwidth of up to 100MHz for FR1 and 400MHz for FR2

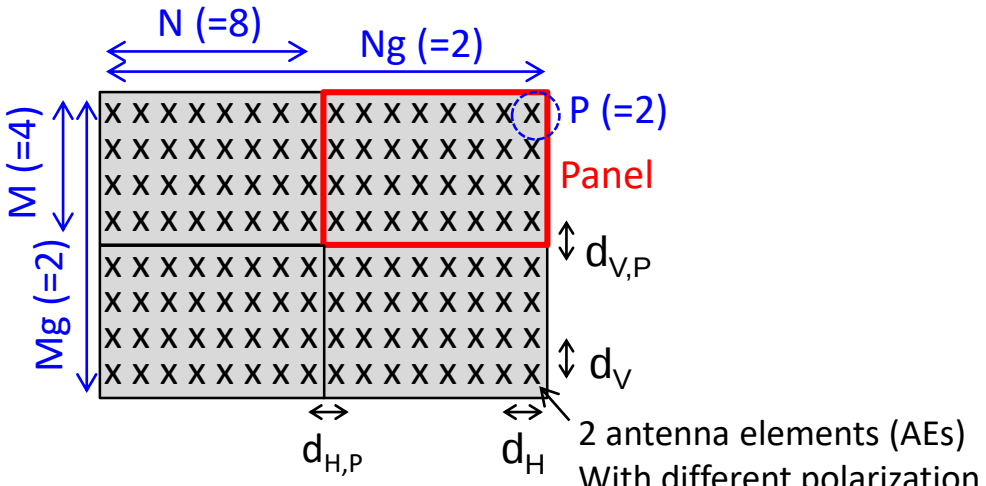


SCS [kHz]	No. of symbols per slot	No. of slots per subframe	No. of subframes per radio frame
15	14	1	10
30	14	2	10
60	14	4	10
120	14	8	10

Note: this is for normal CP.
For SCS 60kHz, extended CP is supported.
For ECP, no. of symbols per slot is 12.

MIMO and link adaptation

- 5.2.3.2.9 Support of Advanced antenna capabilities
  - NR/LTE: Enabling hybrid beamforming including both digital and analog beamforming
  - NR/LTE: Up to 32 antenna ports for DL and up to 4 antenna ports for UL
- 5.2.3.2.10 Link adaptation and power control
  - NR/LTE: Link adaptation based on Channel State information (CSI) reported from UE
  - NR/LTE: Both open-loop and closed-loop power control are supported



Example of MIMO antenna

MIMO layers for spatial multiplexing

		Rel. 14/15 LTE	NR
DL	SU-MIMO	Max 8 layers	Max 8 layers
	MU-MIMO	Max 8 layers (orthogonal/ non-orthogonal DM-RS)	Max 12 layers (orthogonal DM-RS)
UL	SU-MIMO	Max 4 layers	Max 4 layers

Power class and scheduling

- 5.2.3.2.11 Power classes
  - For NR, 2 power classes for FR1 and 4 power classes for FR2 are specified
    - For FR2, the maximum output power radiated by the UE for any transmission bandwidth of NR carrier is defined as TRP (Total Radiated Power) and EIRP(Equivalent Isotropically Radiated Power)
- 5.2.3.2.12 Scheduler, QoS support and management, data services
  - Scheduling, e.g., proportional fair algorithm, may be performed based on CSI reporting
  - NR also supports following features related to scheduling
    - Semi-persistent scheduling
    - UL configured grant transmission
    - Slot aggregation
    - Dynamic DL/UL allocation for TDD
    - MCS with low code rate
    - Pre-emption

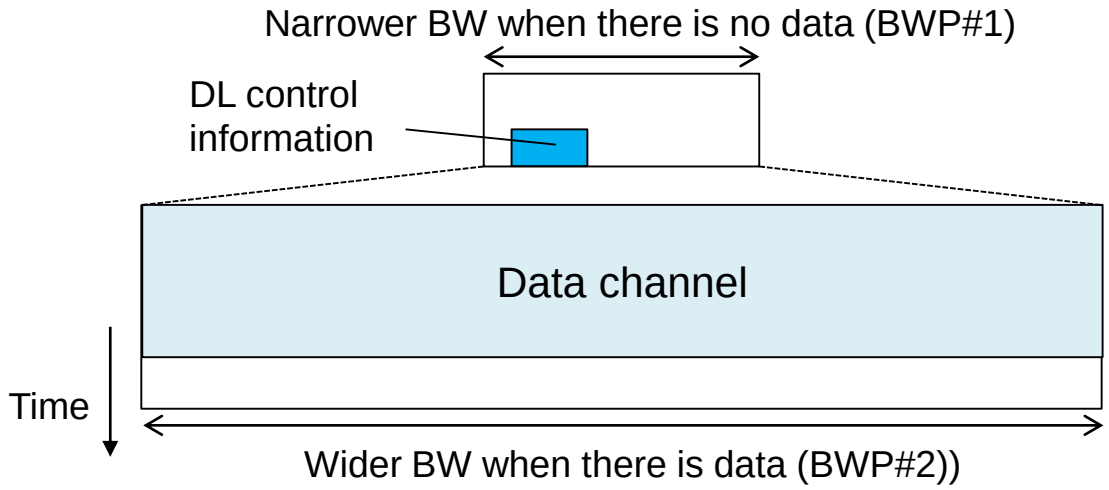
Frequency planning, interference mitigation and synchronization

- 5.2.3.2.19 Frequency planning
  - 1008 physical cell IDs for NR and 504 physical cell IDs
- 5.2.3.2.20 Interference mitigation within radio interface
  - NR/LTE support coordinated multipoint transmission/reception (CoMP)
  - NR further supports, for reducing inter-cell interference,
    - Longer periodicities of synchronization signal blocks (SSBs)
    - UE-specific RSs for control/data channels that are only transmitted
    - Configurable frequency-domain control channel resources
- 5.2.3.2.21 Synchronization requirements
  - NR/LTE performs almost the same procedures, i.e., based on primary synchronization signal (PSS) and secondary synchronization signal (SSS)
    - PSS: Initial symbol boundary, cyclic prefix, subframe boundary, initial frequency synchronization.
    - SSS: Radio frame boundary identification
    - Note: PSS and SSS together used for cell ID detection

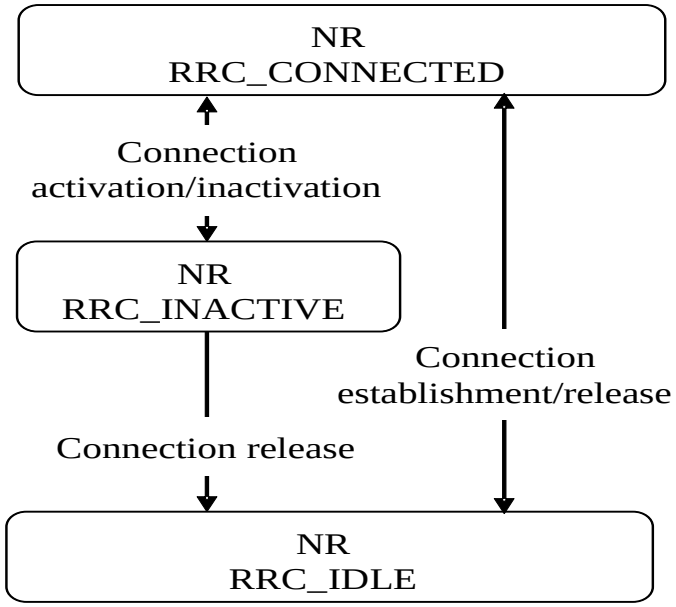
Energy efficiency

- 5.2.3.2.25 Energy efficiency
  - Network energy efficiency
    - Related to always-on transmissions, i.e., SSB ➔ See details in TR37.910
  - Device energy efficiency
    - Discontinuous reception (DRX)
    - BWP adaptation for NR
    - RRC_INACTIVE state for NR

Ex). BWP adaptation



NR RRC state



Summary

- Describe overview of characteristics template
  - Description template is separately drafted for SRIT and RIT
    - SRIT: NR Component RIT + LTE component RIT
    - RIT: NR RIT
- Describe new and key functionalities that are the basis for ITU evaluation
  - Current template provided detailed descriptions of SRIT and RIT for most of 27 items
  - Will continue to be updated until the final submission