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Contents

Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

can indicates that something is possible

cannot indicates that something is impossible

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will indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

will not indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

This Technical Report captures the outcomes from the Work Item on NR low band carrier aggregation via switching. The scope of the Work Item is to introduce physical layer procedures and requirements to enable low band carrier aggregation via switching according to the following objectives:

- Specify UE requirements, including at least switching gap (if needed), and corresponding physical layer procedures to allow switching between {case 1, case 2} [RAN4, RAN1]
  - Case 1: Tx/Rx on FDD carrier 1 and no Rx on SDL carrier 2
  - Case 2: Rx on SDL carrier 2 and no Tx/Rx on FDD carrier 1
  - RAN1 to specify only a semi-static switching pattern based on RRC configuration, liaising with RAN2 and RAN4 as necessary
  - Specify the switching delay and time mask for carrier switching [RAN4]
- Specify necessary RRM requirements [RAN4]
- Define the corresponding UE capabilities [RAN4, RAN2, RAN1]
- Consider the following deployment constraints:
  - The carrier frequency for all cases is <1 GHz
  - Co-located and synchronized network deployment for both carriers
  - Both carriers are in a single TAG
  - SCS 15KHz on both carriers

Note 1: Specify requirements for the feature with the following example band combination: CA_n5A-n29A in this WI, with additional band combinations to be handled via the basket work item approach

Note 2: Strive to minimize the RAN1 impact

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

3 Definitions of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

Definition format (Normal)

<defined term>: *<definition>.*

example: text used to clarify abstract rules by applying them literally.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

Symbol format (EW)

<symbol> <Explanation>

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

Abbreviation format (EW)

<ABBREVIATION> <Expansion>

4 Low NR band aggregation scenarios

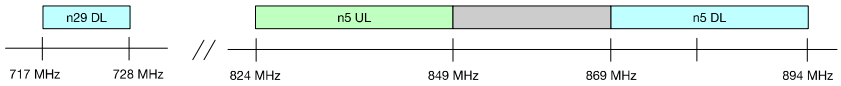
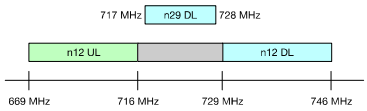
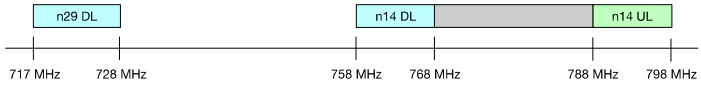
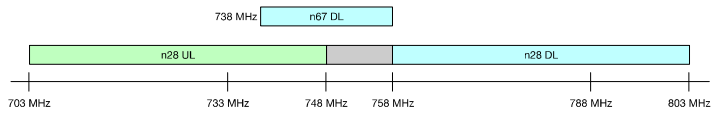
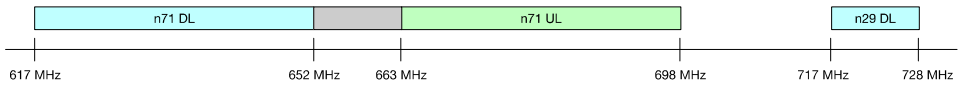
Operator interest for aggregating low band spectrum has always been high during the entire history of the carrier aggregation feature, spanning LTE and NR specifications. Considering the practicalities of handset RF front end architectures available in the market today, the operators have requested 3GPP to consider specifying a solution based on a switching scheme which can potentially accommodate the related limitations.

The following observations motivate the effort undertaken by this Work Item:

- The amount of mid-band spectrum an operator holds is typically 10-20 times greater than their low-band spectrum holdings.
- Mid-band spectrum is more effective closer to cell sites, while low-band spectrum propagates farther, making it more useful at greater distances from sites.
- Low-band spectrum carries significant traffic volumes in urban (indoor) and rural areas, leading to congestion that severely degrades customer experience.
- This issue is exacerbated by the fact that low-band SDL bands, which reach most poor coverage areas, cannot be paired with an UL, rendering them useless.
- Utilization of SDL bands via Low-Low band CA, where one low band serves as an SDL, could potentially solve this problem. However, this solution doesn't exist due to OEM challenges in supporting it.

In the context of the scope of this Work Item, where only CA_5A-n29A is handled as the example band combination, Table 4-1 below also illustrates other applicable operator-provided scenarios which can be specified in a separate basket work item once the feature is completed.

Table 4-1: Operator-provided scenarios for NR low band aggregation via switching

Configuration	Illustration	Notes
CA_n5A-n29A		(1), (2)
CA_n12A-n29A		(3)
CA_n14A-n29A		
CA_n28A-n67A		(4), (5)
CA_n29A-n71A		(6), (7)

NOTE 1: CA_n5A-n29A is already specified in TS38.101-1 [1] based on Rel-15 NR CA framework
NOTE 2: Fractional bandwidth of a single antenna to support this combination is 22% and represents a practical implementation challenge
NOTE 3: There is no incumbent narrowband service in the band gap between n29 and n12 DL (728~729 MHz) in Canada
NOTE 4: In Europe band n28 spectrum is restricted to 703-733 MHz UL and 758-788 MHz DL
NOTE 5: 3GPP will introduce requirements for band n28 assuming full band duplexer architecture in Rel-19
NOTE 6: CA_n29A-n71A is already specified in TS38.101-1 [1] based on Rel-15 NR CA framework
NOTE 7: Fractional bandwidth of a single antenna to support this combination is 16.5% and represents a practical implementation challenge

5 RF aspects

5.1 Switching periods

To accommodate different UE implementations, RAN4 has reached the agreement in RAN4#114 on the applicable switching periods of 35μs, 70μs, and 140μs for switching between Case 1 and Case 2 as an optional UE capability.

5.2 Switching period location

5.2.1 General

For what follows we consider switching between an FDD and SDL band for the CA-n5A-29A configuration in Table 4-1 but without loss of generality: one UL is configured in a paired band with the DL Scell configured in an SDL band and both bands belong to Sub-1GHz bands.

The switching period, defined in units of μs according to UE capability, is located within a switching gap located within the switched-from carrier. Switching gaps, expressed in units of symbols, are accommodated by the network according to the physical layer design of the feature.

The timing reference for the switching pattern and switching gap at the UE is the DL timing of the Pcell (in the FDD band). The uplink radio frame transmission on the Pcell takes place $T_{TA} = (N_{TA} + TA_{offset})T_c$ before the reception of the

first detected path (as defined in TS 38.133) in time on the corresponding DL radio frame. This means that the timing advance must be considered at switching events.

The duration of the switching gap is RRC configured. The network ensures that the switching gap is large enough to cover the switching period (35μs, 70μs, and 140μs according to the UE capability), transient periods and the TA, if needed, in both switch directions.

5.2.2 FDD to SDL switch

For the FDD to SDL switch the gNB configures a gap long enough to accommodate timing advance such that no collisions should occur. Figure 5.2.2-1 shows the case with T_{TA} > 0 µs. The figure illustrates the applicable transient periods, switching period (35μs, 70μs, and 140μs according to UE capability), and the applicability of ON and OFF power requirements.

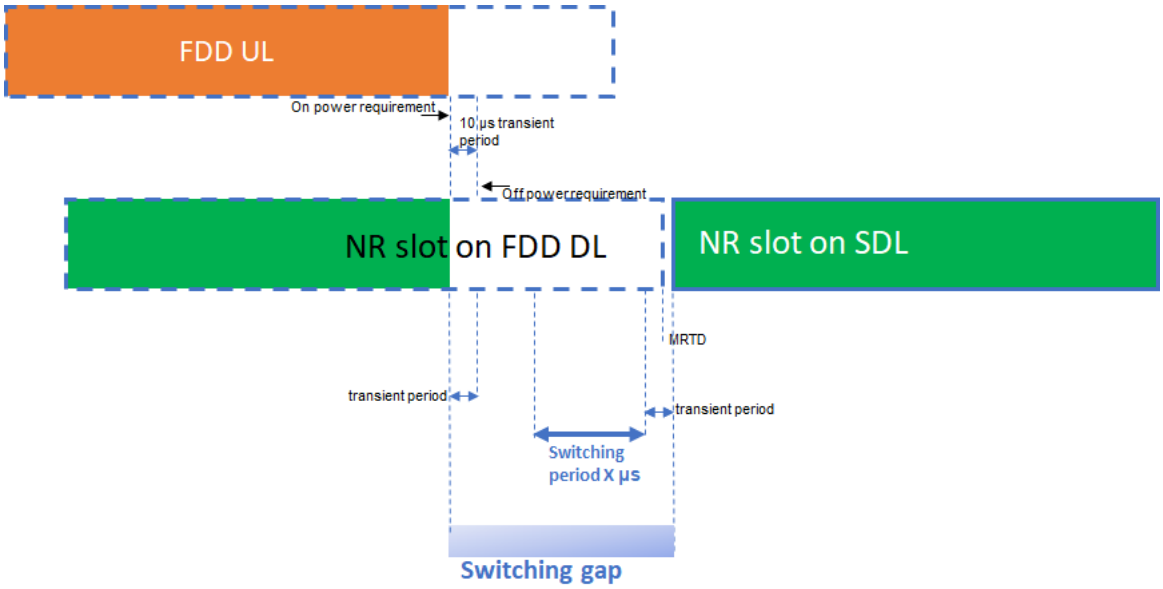


Figure 5.2.2-1: FDD to SDL switch with the switching gap on the switched-from carrier.

The UL slot will always end before the DL slot, neglecting any timing errors in case TA = 0 µs. The worst case in terms of switching is that in which T_{TA} = 0 µs, the DL and UL timing are the same (again neglecting the errors that are of the order of 1 µs) and the SDL starts RTD µs before the Pcell DL slot timing. Switching period is always after UL transient period. The switching gap with respect to the end of the last FDD DL symbol must therefore be at least

actual switching gap length > T_{switch} + MRTD + FDD UL trailing end transient period + SDL leading transient period.

where the MRTD = [CP length/TAE] assuming that the FDD and SDL carriers are colocated.

5.2.3 SDL to FDD switch

For the SDL to FDD switch, the switching gap *ends* at end of slot on “switch from” carrier (SDL). The timing advance must also be accounted for; Figure 5.2.3-1 illustrates this for all applicable switching periods T_{switch} (35µs, 70µs, and 140μs according to UE capability), by placing the switching period X. The applicability of ON and OFF power requirements is also shown.

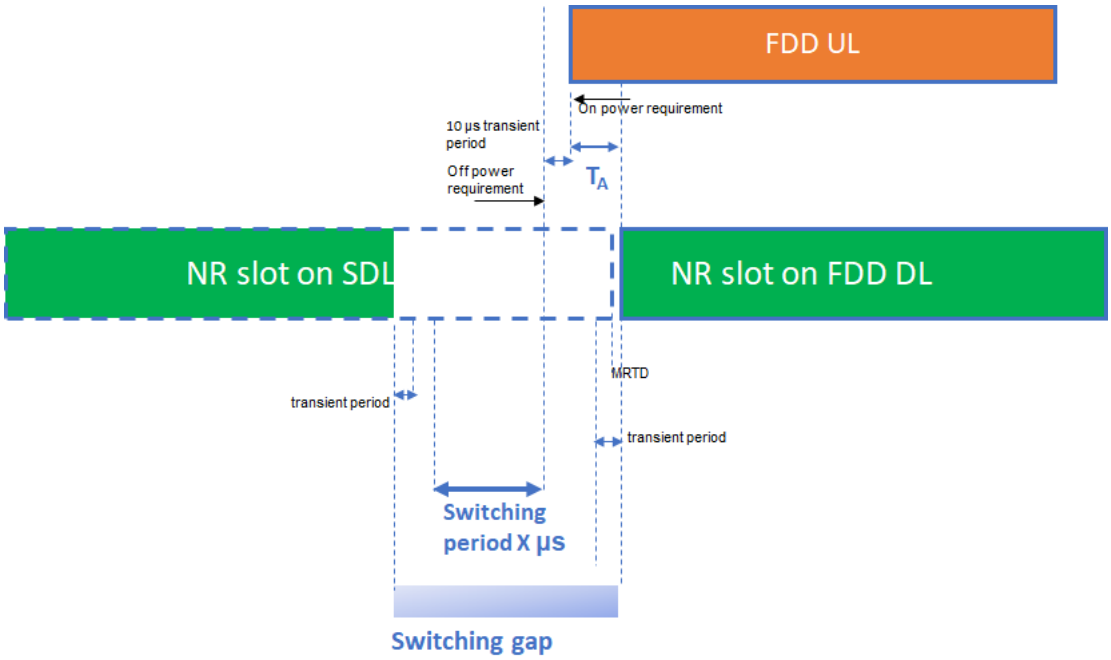


Figure 5.2.3-1: SDL to FDD switch with the switch occurring before the start of the UL slot.

The time mask could be devised such that the switching period occurs before the first symbol of the UL slot of the switched-to FDD carrier, this to avoid dropping symbols on the UL that starts T_{TA} before the first symbol of the FDD DL slot. Notwithstanding, the switching gap on the SDL carrier must be at least

Actual switching gap length > Tswitch + TTA + MRTD + SDL trailing transient period + FDD UL leading transient period

with account of the SDL received at maximum RTD of a [CPlength/TAE]. The worst case is when the SDL is traling the Pcell DL as shown in the figure.

Where RTD is the receiving timing difference with the range of negative MRTD to positive MRTD. And MRTD = 3us. assuming that the FDD and SDL carriers are colocated. UL transient period is assumed as 10us.

In the live network operation, timing advance for a UE in a cell is variable. It is the network task to adjust the length of the switching gap by [*LBCA-SwitchingGap-Duration-SCelltoPCell*] so that the UL transient period is not overlapping with switching period X.

5.3 Time mask for switching

5.3.1 General

The switching gap is configured by RRC in terms of number of symbols blanked by the network, while the actual location of the switch is specified by time masks similarly to UL Tx switching.

5.3.2 UL time mask

Figure 5.3.2-1 below illustrates the ON/OFF time mask for low NR band carrier aggregation via switching.

Figure 5.3.2-1: ON/OFF time mask for NR UL transmission for DL CA via switching with non-CA in the UL

5.4 Applicability of simultaneous Rx/Tx requirements

The following statement in section 5.2A.2 of TS38.101-1 captures the applicability of simultaneous Rx/Tx requirements when the UE supports the low NR band carrier aggregation via switching: “Concurrent operation between these bands is not applicable to UEs indicating support of low NR band aggregation via switching [supportedLowBandSwitching-r19] for this band combination.”

5.5 CA configurations

Low NR band inter-band CA configurations in which the UE is allowed to indicate support of the configuration via switching [*supportedLowBandSwitching-r19*] are indicated with the corresponding note in the configuration tables in sub-clause 5.5A.3.1 of TS38.101-1.

The following notes to be added in Table 5.5A.3.1-1d of TS38.101-1 next to the band combinations that support low NR band aggregation via switching: “The UEs is allowed to indicate support of low NR band carrier aggregation via switching [*supportedLowBandSwitching-r19*] for this NR CA configuration”.

The following notes to be added in Table 5.5A.3.1-1f of TS38.101-1 next to the band combinations that support low NR band aggregation via switching: “Applicable only for UEs which indicate support of low NR band carrier aggregation via switching [*supportedLowBandSwitching-r19*] for this NR CA configuration.”

5.6 MSD requirements

The following note to be added in Table 7.3A.6-1 and Table 7.3A.6-1a-1 of TS38.101-1 to indicate that the specified MSD is not applicable to UEs indicating support of low NR band carrier aggregation via switching :.”Not applicable to UEs indicating support of low NR band aggregation via switching [*supportedLowBandSwitching-r19*] for this band combination.”

5.7 $\Delta R_{IB,C}$ requirements

The following note to be added in Table 7.3A.3.2.1-1 of TS38.101-1 to indicate that the specified $\Delta R_{IB,c}$ is not applicable to UEs indicating support of low NR band carrier aggregation via switching: “Not applicable to UEs indicating support of low NR band aggregation only via switching [*supportedLowBandSwitching-r19*] for this band combination.”

NOTE: When introducing higher order CA with the LB CA switching as one of fallback configuration and/or different device type of LB CA switching (e.g., con-current DL CA, or FDD+FDD CA switching with concurrent DL CA) RAN4 should discuss $\Delta R_{IB,c}$ requirements. This discussion is out of scope of the current release.

6 RRM aspects

6.1 General

RAN4 has reached the following agreements on the switching pattern applicability for RRM requirement in R19 LB CA via switching in RAN4#114bis meeting:

For the SCell which has been activated(i.e., after UE reporting valid CQI for SCell activation in section 8.3.2 TS38.133),

- The switching pattern for SDL SCell is applied.

For the SCell which is in activation procedure,

- The switching pattern for SDL SCell is applied.
- RAN4 defines SCell activation requirement assuming UE utilizes the RS occasions to perform SDL SCell activation, where the RS occasions are FFS

For the SCell which is deactivated,

- The switching pattern for SDL SCell is not applied.
- If the deactivated SDL SCell measurement requirement is needed, FFS whether UE follows legacy deactivated SCell measurement requirements to perform deactivated SDL SCell measurement or follow a new measurement requirement for deactivated SDL SCell measurement.

Note: the above FFS parts will be discussed and decided in RAN4.

The necessity of requirement for SDL SCC was agreed in RAN4 #115 meeting, as summarized in Table 6.1-1.

Table 6.1-1. Necessity of requirement on SDL CC

Requirement	Whether or not RAN4 will have requirement
interruption requirement for CC switching	No (can be revisited if not aligned with RAN1 further agreement.)
Activated SDL SCell L3 measurement	Yes
Deactivated SDL SCell measurement [and corresponding interruption]	Yes
SDL SCell activation/deactivation and corresponding interruption	Yes
[BFD/CBD]	Yes
TCI state switch delay	Yes
PL-RS switch delay	No
L1-RSRP/SINR	Yes

Following SSB assumptions for R19 LB CA via switching are agreed in RAN4 #115:

The baseline assumption is:

- SDL SCell is transmitting SSB
  - RAN4 to use SSB based requirement as baseline for Rel-19 low band CA via switching
    - requirement of PCell will still use the existing principle as baseline but the impact of carrier switching in LB CA will be considered

Following MRTD assumptions for R19 LB CA via switching is agreed in RAN4 #115:

- The maximum receive timing difference for collocated FDD PCell and SDL SCell CA via switching is 3us.
- Whether or not above RTD can be used as side condition for SCell activation will be further discussed.

RAN4#116 meeting agreed that according to the WID, RAN4A only defines requirements for CA with FDD PCC and one SDL SCC.

6.2 Discussion of switching delay or interruption requirement

It was agreed in RAN4 #115 meeting that, for SDL to FDD switching and FDD to SDL switching, RAN4 will not define interruption or scheduling restriction requirement on SDL carrier and FDD carrier.

6.3 Discussion of SDL SCell related requirement

6.3.1 RRM requirement applicability for R19 LB CA via switching

RAN4#116 agreed the following RRM requirement applicability:

for gap-less based L3 measurement and L1 measurement of a serving carrier which can be either FDD PCC or activated SDL SCC:

a. If all {the SSB occasions in SMTC window} or {SSB occasions or CSI-RS for L1 measurement} are available based on the LB-CA switching pattern, no delay extension is allowed.

b. If a fraction of {the SSB occasions in SMTC window } or {SSB occasions or CSI-RS for L1 measurement} are not available based on the LB-CA switching pattern, the delay is extended in accordance to the fraction of available occasions.

c. If no {SSB occasions in SMTC window} or {SSB occasions or CSI-RS for L1 measurement} are available based on the LB-CA switching pattern, the corresponding requirements do not apply.

6.3.2 Activated SDL SCell L3 measurement requirement

RAN4 #115 agreed to define the requirement for activated SDL SCell L3 measurement. For activated SDL SCell measurement, UE performs the SDL SCell measurement on the overlapped occasions of SMTC window and SDL SCell reception duration indicated by switching pattern.

RAN4 #116 agreed followings:

- if the activated SCC measurement is MG-based in LB-CA, the legacy intra-frequency identification/measurement requirement with MG can be applied.
- reuse the existing measurement requirements with gap for inter-frequency measurement and inter-RAT measurement in LB-CA.
- Not consider the scenario and not define the requirement for measurement without gap for inter-frequency measurement and inter-RAT measurement in LB-CA.
- if the activated SCC measurement is MG-less in LB-CA, RAN4 to update Kp factor for activated SCC identification/measurement requirement (intra-frequency measurement without MG) for LB-CA.
- Kp factor for MG-less activated SCC identification/measurement requirement in LB-CA can be updated as following:
  - $Kp = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:
  - For a window W of duration max(SMTC period, xRP_max, switch pattern periodicity), where xRP_max is the maximum xRP across all configured per-UE GAPs, periodic MUSIM gaps, and/or per-FR GAPs within the same FR as the SSB frequency layer, and switch pattern periodicity is the periodicity of the NW configured switch pattern for LB CA via switching, and starting from the beginning of any SMTC occasion:
    - N_{total} is the total number of SMTC occasions within the window, including those overlapped with MG and those overlapped with FDD PCC duration based on the switching pattern within the window, and

- $N_{available}$ is the number of SMTC occasions that are not overlapped with any non-dropped GAP or non-dropped MUSIM gap occasions and not overlapped with FDD PCC duration based on the switching pattern within the window W.
- No requirement when $N_{available} = 0$.

6.3.3 Deactivated SDL SCell L3 measurement requirement

RAN4 #115 agreed to define the requirement for deactivated SDL SCell L3 measurement. The legacy deactivated SCell measurement delay requirements are applied for UE to perform deactivated SDL SCell measurement.

RAN4#116 agreed to define the interruption requirement as follows:

- For R19 LB CA via switching, interruption length on PCC due to measurements on deactivated SDL is (tuning time in slot level + $T_{SMTC\_duation}$ + retuning time in slot level),
  - Tuning time from PCell to SCell is equal to the RRC configured switching gap from PCell to SCell LBCA-SwitchingGap-Duration-PCelltoSCell-r19
  - Returning time from SCell to PCell is equal to the RRC configured switching gap from SCell to PCell, i.e., LBCA-SwitchingGap- SCelltoPCell-r19
- Missed ACK/NACK rate
  - For R19 LB CA via switching, missed ACK/NACK rate due to measurements on deactivated SDL are allowed with up to $X=\frac{Y}{measCycleSCell}$, where Y=2* interruption length.

6.3.4 SDL SCell activation/deactivation requirement

RAN4 #115 agreed that PUCCH SCell activation, Rel-19 fast SCell activation through EMR, and activation of multiple SCells is not in the scope of the WI. The side condition for SDL SCell activation/deactivation requirement follows the legacy case and side conditions for SSB based inter-band FR1 SCell activation in existing spec.

The following principle design for SDL SCell activation/deactivation delay requirement was agreed in RAN4#115:

- The R18 SSB based FR1 inter-band SCell activation delay requirement can be reused to SDL SCell activation in LB CA via switching if UE supports corresponding feature.
  - R16 Direct SCell activation with HO is not considered for R19 LB CA.
  - R17 PUCCH SCell activation is not considered for R19 LB CA.
  - R18 SSB-less SCell activation for NES is not considered for R19 LB CA.
  - R17 Fast SCell activation is not considered for R19 LB CA.
- Reuse the existing SCell deactivation delay requirement for SDL SCell deactivation.
- Known/unknown conditions are reused from existing SCell activation requirements

RAN4 #116 agreed follows:

- Revise the previous agreement in R4-2504895 issue 1-1-3 (RAN4 #114bis) for the SCell which is in activation procedure:
  - For the SCell which is in activation procedure,
    - The RRC configured switching pattern for SDL SCell is applied.
    - For MAC CE based SCell activation, UE shall apply the RRC configured switching pattern at slot n+(THARQ+3ms+TLBCA)/slot-length
    - For RRC based direct SCell activation, UE shall apply the RRC configured switching pattern at slot n+(TRRC_Process + TLBCA)/slot-length

    - Option 1: TLBCA =0ms
    - Option 2: TLBCA =1ms
    - Option 3: TLBCA =4ms
- In maintenance stage, RAN4 to FFS how UE performs switching according to the following two options.
    - For MAC CE based SCell activation, according to the switching pattern,
        - Option 1: UE switching to SCell immediately after n+(THARQ+3ms+ TLBCA)/slot-length.
        - Option 2: UE switching to SCell at the next switching period after n+(THARQ+3ms+ TLBCA)/slot-length.
        - Other options are not precluded.
    - For RRC based direct SCell activation, according to the switching pattern,
        - Option 1: UE switching to SCell immediately after n+(TRRC_Process + TLBCA)/slot-length.
        - Option 2: UE switching to SCell at the next switching period after n+(TRRC_Process + TLBCA)/slot-length.
        - Other options are not precluded.

    Note: if the timeline for application and for switching has ambiguity, RAN4 may revise the above application timeline.
- The switching pattern is NOT applied after UE completed the SCell deactivation (n+(THARQ+3ms+ TLBCA)/slot-length).
    - Option 1: TLBCA =0ms
    - Option 2: TLBCA =1ms
    - Option 3: TLBCA =4ms
- FFS in maintenance stage: If UE is on PCell after completion of SCell deactivation, UE keeps staying on PCell. If UE is on SCell after completion of SCell deactivation, UE switches to PCell immediately. The carrier switching, if applicable, shall be placed at the end of a slot.

6.3.5 SDL SCell L1 requirement

If RAN4 to define requirement for BFD/CBD for SDL SCell in LB CA via switching, the BFD/CBD on SDL carrier is performed on the overlapped occasions between SSB/CSI-RS and SDL duration in switch pattern.

The L1-RSRP measurement and T/F tracking for TCI switching on SDL carrier is performed on the overlapped occasions between SSB/CSI-RS and SDL duration in switch pattern.

RAN4 will not define requirement for PL-RS switch delay for SDL SCell in LB CA via switching

For L1-RSRP/SINR measurement requirement for SDL SCell, UE can only perform such measurement on the overlapped occasions of L1 RS and SDL SCell reception duration indicated by switching pattern.

RAN4 #116 agreed following requirement for BFD/CBD requirements for SDL SCell:

- RAN4 to define requirement for BFD/CBD for SDL SCell in LB CA via switching
    - P factor in the existing BFD/CBD requirement can be updated for LB-CA via switching, where,
        - W window is max(T_{L1}, xRP_max, switching pattern periodicity)
        - $P = N_{total} / N_{available}$
        - N_{total} is total number of BFD-RS or CBD-RS in W window.

- $N_{available}$ is number of available BFD-RS or CBD-RS in W window.

RAN4 #116 agreed following requirement for TCI state switch delay requirement for SDL SCell:

- RAN4 to define the TCI state switch delay requirement for LB-CA via switching
- In TCI state switch delay requirement for SDL SCell, $T_{first\text{-}SSB\_LB}$ is time to first available SSB reception based on switching pattern after MAC CE command is decoded by the UE.

RAN4 #116 agreed following requirement for L1-RSRP/SINR measurement requirements for SDL SCell:

- P factor in the existing L1-RSRP/SINR measurement requirements can be updated for LB-CA via switching, where,
  - W window is max(TL1, xRP_max, switching pattern periodicity)
  - $P = N_{total} / N_{available}$
  - N_{total} is total number of L1-RSRP/SINR RS of SCell in W window.

  $N_{available}$ is number of available L1-RSRP/SINR RS overlapping with SCell duration according to the RRC configured switching pattern in W window.

6.3.6 SDL SCell performance requirement

RAN4#116 meeting agreed follows for SDL SCell performance requirement:

Existing measurement accuracy requirements apply for LBCA operation through switching.

6.4 Discussion of impact on FDD PCell RRM

RAN4#115 meeting agreed that the existing Tx timing requirement for PCell with the same applicability condition (SSB is available in last 160ms) can apply for R19 LB CA via switching.

RAN4#116 meeting agreed follows for RLM requirement:

- P factor in the existing RLM measurement requirements can be updated, where,
  - W window is max(T_{L1}, xRP_max, switching pattern periodicity)
  - $P = N_{total}/ N_{available}$
  - N_{total} is total number of RLM-RS in W window.
  - $N_{available}$ is number of available RLM-RS in W window.
- FFS in maintenance stage: RAN4 to agree that the switch pattern is not applicable when the RLM or BFD is triggered on the PCell and UE should prioritize to receive RS for faster link recovery. Principle of scheduling restriction or interruption requirement agreed for the SCell activation to be reused for the link recovery procedure.

RAN4#116 meeting agreed follows for others RRM requirement of FDD PCell in LB CA via switching:

- The principle of agreed activated SDL SCell requirement in LB-CA can be reused for the corresponding PCell requirement in LB-CA.

Annex A (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2025-02	RAN4#114	R4-2502875				Initial skeleton	0.0.2
2025-04	RAN4#114 bis	R4-2505146				Implemented text proposals from the following: R4-2503477 TP to TR 38.768 on switching periods R4-2505147 TP to TR38.768 on operator provided scenarios for low band aggregation via switching	0.0.3
2025-05	RAN4#115	R4-2508119				Implemented text proposals from the following: R4-2506072 TP to TR 38.768 on clause 4 (Scenarios) R4-2507932 TP for 38.768: time masks for DL-only CA via switching R4-2508434 TP to TR38.768 on RRM requirements for low band aggregation via switching	0.0.4
2025-06	RAN#108	RP-251762				Presented for information to RAN	1.0.0
2025-08	RAN4#116	R4-2509202				Implemented text proposals from the following: R4-2509248 TP for TR 38.768 to modify the general description R4-2511905 TP to TR38.768 on low NR band aggregation via switching R4-2512241 TP to TR38.768 on RRM requirements for low band aggregation via switching	1.1.0
2025-09	RAN#109	RP-252351				Presented for approval to RAN	2.0.0

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2025-09	RAN#109					Approved by plenary – Rel-19 spec under change control	19.0.0

History

Document history		
V19.0.0	October 2025	Publication