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Contents

Foreword

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

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1 Scope

The present document specifies and establishes the characteristics of the physical layer procedures for shared spectrum channel.

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 36.104: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception".

[3] 3GPP TS 36.101: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception".

[4] 3GPP TS 36.213: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures".

[5] 3GPP TS 36.212: "Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding".

[6] 3GPP TS 38.104: "NR; Base Station (BS) radio transmission and reception".

[7] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[8] 3GPP TS 38.214: "NR; Physical layer procedures for data".

[9] 3GPP TS 38.300: "NR; NR and NG-RAN Overall Description; Stage 2".

[10] 3GPP TS 38.212: "NR; Multiplexing and channel coding".

[11] 3GPP TS 38.211: "NR; Physical channels and Modulations".

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

3.2 Symbols

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

CW_p	Contention window for a given priority class
$CW_{\max,\ p}$	Maximum contention window for a given priority class
$CW_{\min,\ p}$	Minimum contention window for a given priority class
$T_{m\text{cot},p}$	Maximum channel occupancy time for a given priority class
$T_{ulm\text{cot},p}$	Maximum Uplink channel occupancy time for a given priority class
X_{Thresh}	Energy detection threshold
$X_{\text{Thresh\_max}}$	Maximum energy detection threshold

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].

AUL-DFI	Autonomous UL Downlink Feedback Indication
CAPC	Channel Access Priority Class
COT	Channel Occupancy Time
LAA	Licensed Assisted Access
MCOT	Maximum Channel Occupancy Time
SL	Sidelink

4 Channel access procedure

4.0 General

Unless otherwise noted, the definitions below are applicable for the following terminologies used in this specification:

- A channel refers to a carrier or a part of a carrier consisting of a contiguous set of resource blocks (RBs) on which a channel access procedure is performed in shared spectrum.

- A channel access procedure is a procedure based on sensing that evaluates the availability of a channel for performing transmissions. The basic unit for sensing is a sensing slot with a duration $T_{sl} = 9\mu s$. The sensing slot duration T_{sl} is considered to be idle if an eNB/gNB or a UE senses the channel during the sensing slot duration, and determines that the detected power for at least $4\mu s$ within the sensing slot duration is less than energy detection threshold X_{Thresh}. Otherwise, the sensing slot duration T_{sl} is considered to be busy.

- A *channel occupancy* refers to transmission(s) on channel(s) by eNB/gNB/UE(s) after performing the corresponding channel access procedures in this clause.

- A *Channel Occupancy Time* refers to the total time for which eNB/gNB/UE and any eNB/gNB/UE(s) sharing the channel occupancy perform transmission(s) on a channel after an eNB/gNB/UE performs the corresponding channel access procedures described in this clause. For determining a *Channel Occupancy Time*, if a transmission gap is less than or equal to $25\mu s$, the gap duration is counted in the channel occupancy time. A channel occupancy time can be shared for transmission between an eNB/gNB and the corresponding UE(s), or between a UE and other UE(s).

- A *DL transmission burst* is defined as a set of transmissions from an eNB/gNB without any gaps greater than $16\mu s$. Transmissions from an eNB/gNB separated by a gap of more than $16\mu s$ are considered as separate DL transmission bursts. An eNB/gNB can transmit transmission(s) after a gap within a *DL transmission burst* without sensing the corresponding channel(s) for availability.

- A *UL transmission burst* is defined as a set of transmissions from a UE without any gaps greater than $16\mu s$. Transmissions from a UE separated by a gap of more than 16μs are considered as separate UL transmission bursts. A UE can transmit transmission(s) after a gap within a *UL transmission burs*t without sensing the corresponding channel(s) for availability.

- A *SL transmission burst* is defined as a set of SL transmissions from a UE without any gaps greater than $16\mu s$. The SL transmissions from a UE separated by a gap of more than 16μs, are considered as separate SL transmission bursts. A UE can transmit SL transmission(s) after a gap within a *SL transmission burs*t without sensing the corresponding channel(s) for availability.

- A *discovery burst* refers to a DL transmission burst including a set of signal(s) and/or channel(s) confined within a window and associated with a duty cycle. The *discovery burst* can be any of the following:

  - Transmission(s) initiated by an eNB that includes a primary synchronization signal (PSS), secondary synchronization signal (SSS) and cell-specific reference signal(s)(CRS) and may include non-zero power CSI reference signals (CSI-RS).

  - Transmission(s) initiated by a gNB that includes at least an SS/PBCH block consisting of a primary synchronization signal (PSS), secondary synchronization signal (SSS), physical broadcast channel (PBCH) with associated demodulation reference signal (DM-RS) and may also include CORESET for PDCCH scheduling PDSCH with SIB1, and PDSCH carrying SIB1 and/or non-zero power CSI reference signals (CSI-RS).

4.1 Downlink channel access procedures

An eNB operating LAA Scell(s) on channel(s) and a gNB performing transmission(s) on channel(s) shall perform the channel access procedures described in this clause for accessing the channel(s) on which the transmission(s) are performed.

In this clause, X_{Thresh} for sensing is adjusted as described in clause 4.1.5 when applicable.

A gNB performs channel access procedures in this clause unless the higher layer parameter *channelAccessMode-r16* is provided and *channelAccessMode-r16 ='semiStatic'*.

4.1.1 Type 1 DL channel access procedures

This clause describes channel access procedures to be performed by an eNB/gNB where the time duration spanned by the sensing slots that are sensed to be idle before a downlink transmission(s) is random. The clause is applicable to the following transmissions:

- Transmission(s) initiated by an eNB including PDSCH/PDCCH/EPDCCH, or

- Any transmission(s) initiated by a gNB.

The eNB/gNB may transmit a transmission after first sensing the channel to be idle during the sensing slot durations of a defer duration T_d and after the counter N is zero in step 4. The counter N is adjusted by sensing the channel for additional sensing slot duration(s) according to the steps below:

1) set $N = N_{init}$, where N_{init} is a random number uniformly distributed between 0 and CW_p, and go to step 4;

2) if $N > 0$ and the eNB/gNB chooses to decrement the counter, set $N = N - 1$;

3) sense the channel for an additional sensing slot duration, and if the additional sensing slot duration is idle, go to step 4; else, go to step 5;

4) if $N = 0$, stop; else, go to step 2.

5) sense the channel until either a busy sensing slot is detected within an additional defer duration T_d or all the sensing slots of the additional defer duration T_d are detected to be idle;

6) if the channel is sensed to be idle during all the sensing slot durations of the additional defer duration T_d, go to step 4; else, go to step 5;

If an eNB/gNB has not transmitted a transmission after step 4 in the procedure above, the eNB/gNB may transmit a transmission on the channel, if the channel is sensed to be idle at least in a sensing slot duration T_{sl} when the eNB/gNB is ready to transmit and if the channel has been sensed to be idle during all the sensing slot durations of a defer duration T_d immediately before this transmission. If the channel has not been sensed to be idle in a sensing slot duration T_{sl} when the eNB/gNB first senses the channel after it is ready to transmit or if the channel has been sensed to be not idle during any of the sensing slot durations of a defer duration T_d immediately before this intended transmission, the eNB/gNB proceeds to step 1 after sensing the channel to be idle during the sensing slot durations of a defer duration T_d.

The defer duration T_d consists of duration $T_f = 16\mu s$ immediately followed by m_p consecutive sensing slot durations T_{sl}, and T_f includes an idle sensing slot duration T_{sl} at start of T_f.

$CW_{min,p} \leq CW_p \leq CW_{max,p}$ is the contention window. CW_p adjustment is described in clause 4.1.4.

$CW_{min,p}$ and $CW_{max,p}$ are chosen before step 1 of the procedure above.

m_p, $CW_{min,p}$, and $CW_{max,p}$ are based on a channel access priority class p associated with the eNB/gNB transmission, as shown in Table 4.1.1-1.

An eNB/gNB shall not transmit on a channel for a *Channel Occupancy Time* that exceeds $T_{m\,cot,p}$ where the channel access procedures are performed based on a channel access priority class p associated with the eNB/gNB transmissions, as given in Table 4.1.1-1.

If an eNB/gNB transmits discovery burst(s) as described in clause 4.1.2 when $N > 0$ in the procedure above, the eNB/gNB shall not decrement N during the sensing slot duration(s) overlapping with discovery burst(s).

A gNB may use any channel access priority class for performing the procedures above to transmit transmission(s) including discovery burst(s) satisfying the conditions described in this clause.

A gNB shall use a channel access priority class applicable to the unicast user plane data multiplexed in PDSCH for performing the procedures above to transmit transmission(s) including unicast PDSCH with user plane data.

For $p = 3$ and $p = 4$, if the absence of any other technology sharing the channel can be guaranteed on a long term basis (e.g. by level of regulation), $T_{m\,cot,p} = 10ms$, otherwise, $T_{m\,cot,p} = 8ms$.

Table 4.1.1-1: Channel Access Priority Class (CAPC)

Channel Access Priority Class (p)	m_p	$CW_{min,p}$	$CW_{max,p}$	$T_{m\,cot,p}$	allowed CW_p sizes
1	1	3	7	2 ms	{3,7}
2	1	7	15	3 ms	{7,15}
3	3	15	63	8 or 10 ms	{15,31,63}
4	7	15	1023	8 or 10 ms	{15,31,63,127,255,511,1023}

4.1.1.1 Regional limitations on channel occupancy time

In Japan, if an eNB/gNB has transmitted a transmission after $N = 0$ in step 4 of the procedure above, the eNB/gNB may transmit the next continuous transmission, for duration of maximum $T_j = 4ms$, immediately after sensing the channel to be idle for at least a sensing interval of $T_{js} = 34\mu s$ and if the total sensing and transmission time is not more than $1000 \cdot T_{mcot} + \left\lceil \frac{T_{mcot}}{T_j} - 1 \right\rceil \cdot T_{js}\ \mu s$. The sensing interval T_{js} consists of duration $T_f = 16\mu s$ immediately followed by two sensing slots and T_f includes an idle sensing slot at start of T_f. The channel is considered to be idle for T_{js} if it is sensed to be idle during the sensing slot durations of T_{js}.

4.1.2 Type 2 DL channel access procedures

This clause describes channel access procedures to be performed by an eNB/gNB where the time duration spanned by sensing slots that are sensed to be idle before a downlink transmission(s) is deterministic.

If an eNB performs Type 2 DL channel access procedures, it follows the procedures described in clause 4.1.2.1.

Type 2A channel access procedures as described in clause 4.1.2.1 are only applicable to the following transmission(s) performed by an eNB/gNB:

- Transmission(s) initiated by an eNB including discovery burst and not including PDSCH where the transmission(s) duration is at most $1ms$, or
- Transmission(s) initiated by a gNB with only discovery burst or with discovery burst multiplexed with non-unicast information, where the transmission(s) duration is at most $1ms$, and the discovery burst duty cycle is at most $1/20$, or
- Transmission(s) by an eNB/ gNB following transmission(s) by a UE after a gap of $25\mu s$ in a shared channel occupancy as described in clause 4.1.3.

Type 2B or Type 2C DL channel access procedures as described in clause 4.1.2.2 and 4.1.2.3, respectively, are applicable to the transmission(s) performed by a gNB following transmission(s) by a UE after a gap of $16\mu s$ or up to $16\mu s$, respectively, in a shared channel occupancy as described in clause 4.1.3.

4.1.2.1 Type 2A DL channel access procedures

An eNB/gNB may transmit a DL transmission immediately after sensing the channel to be idle for at least a sensing interval $T_{short\_dl} = 25\mu s$. T_{short_dl} consists of a duration $T_f = 16\mu s$ immediately followed by one sensing slot and T_f includes a sensing slot at start of T_f. The channel is considered to be idle for T_{short_dl} if both sensing slots of T_{short_dl} are sensed to be idle.

4.1.2.2 Type 2B DL channel access procedures

A gNB may transmit a DL transmission immediately after sensing the channel to be idle within a duration of $T_f = 16\mu s$. T_f includes a sensing slot that occurs within the last $9\mu s$ of T_f. The channel is considered to be idle within the duration T_f if the channel is sensed to be idle for a total of at least $5\mu s$ with at least $4\mu s$ of sensing occurring in the sensing slot.

4.1.2.3 Type 2C DL channel access procedures

When a gNB follows the procedures in this clause for transmission of a DL transmission, the gNB does not sense the channel before transmission of the DL transmission. The duration of the corresponding DL transmission is at most $584\mu s$.

4.1.3 DL channel access procedures in a shared channel occupancy

For the case where an eNB shares a channel occupancy initiated by a UE, the eNB may transmit a transmission that follows an autonomous PUSCH transmission by the UE as follows:

- If 'COT sharing indication' in AUL-UCI in subframe n indicates '1', an eNB may transmit a transmission in subframe $n + X$, where X is subframeOffsetCOT-Sharing, including PDCCH but not including PDSCH on the same channel immediately after performing Type 2A DL channel access procedures in clause 4.1.2.1, if the duration of the PDCCH is less than or equal to duration of two OFDM symbols and it shall contain at least AUL-DFI or UL grant to the UE from which the PUSCH transmission indicating COT sharing was received.

If a gNB shares a channel occupancy initiated by a UE using the channel access procedures described in clause 4.2.1.1 on a channel, the gNB may transmit a transmission that follows a UL transmission on scheduled resources or a PUSCH transmission on configured resources by the UE after a gap as follows:

- The transmission shall contain transmission to the UE that initiated the channel occupancy and can include non-unicast and/or unicast transmissions where any unicast transmission that includes user plane data is only transmitted to the UE that initiated the channel occupancy.
  - If the higher layer parameters *ul-toDL-COT-SharingED-Threshold-r16* is not provided, the transmission shall not include any unicast transmissions with user plane data and the transmission duration is not more than the

duration of 2, 4 and 8 symbols for subcarrier spacing of 15, 30 and 60 kHz of the corresponding channel, respectively.

- If the gap is up to $16\mu s$, the gNB can transmit the transmission on the channel after performing Type 2C DL channel access as described in clause 4.1.2.3.

- If the gap is $25\mu s$ or $16\mu s$, the gNB can transmit the transmission on the channel after performing Type 2A or Type 2B DL channel access procedures as described in clause 4.1.2.1 and 4.1.2.2, respectively.

For the case where a gNB shares a channel occupancy initiated by a UE with configured grant PUSCH transmission, the gNB may transmit a transmission that follows the configured grant PUSCH transmission by the UE as follows:

- If the higher layer parameter *ul-toDL-COT-SharingED-Threshold-r16* is provided, the UE is configured by *cg-COT-SharingList-r16* where *cg-COT-SharingList-r16* provides a table configured by higher layer. Each row of the table provides a channel occupancy sharing information given by higher layer parameter *CG-COT-Sharing-r16*. One row of the table is configured for indicating that the channel occupancy sharing is not available.

  - If the 'COT sharing information' in CG-UCI detected in slot *n* indicates a row index that corresponds to a *CG-COT-Sharing-r16* that provides channel occupancy sharing information, the gNB can share the UE channel occupancy assuming a channel access priority class *p= channelAccessPriority-r16*, starting from slot *n+O*, where *O=offset-r16* slots, for a duration of *D=duration-r16* slots where *duration-r16*, *offset-r16*, and *channelAccessPriority-r16* are higher layer parameters provided by *CG-COT-Sharing-r16*.

- If the higher layer parameter *ul-toDL-COT-SharingED-Threshold-r16* is not provided, and if 'COT sharing information' in CG-UCI indicates '1', the gNB can share the UE channel occupancy and start the DL transmission X= *cg-COT-SharingOffset-r16**14 symbols from the end of the slot where CG-UCI is detected, where *cg-COT-SharingOffset-r16* is provided by higher layer. The transmission shall not include any unicast transmissions with user plane data and the transmission duration is not more than the duration of 2, 4 and 8 symbols for subcarrier spacing of 15, 30 and 60 kHz of the corresponding channel, respectively.

For the case where a gNB uses channel access procedures as described in clause 4.1.1 to initiate a transmission and shares the corresponding channel occupancy with a UE that transmits a transmission as described in clause 4.2.1.2, the gNB may transmit a transmission within its channel occupancy that follows the UE's transmission if any gap between any two transmissions in the gNB channel occupancy is at most $25\mu s$. In this case the following applies:

- If the gap is $25\mu s$ or $16\mu s$, the gNB can transmit the transmission on the channel after performing Type 2A or 2B DL channel access procedures as described in clause 4.1.2.1 and 4.1.2.2, respectively.

- If the gap is up to $16\mu s$, the gNB can transmit the transmission on the channel after performing Type 2C DL channel access as described in clause 4.1.2.3.

4.1.4 Contention window adjustment procedures

If an eNB/gNB transmits transmissions including PDSCH that are associated with channel access priority class p on a channel, the eNB/gNB maintains the contention window value CW_p and adjusts CW_p before step 1 of the procedure described in clause 4.1.1 for those transmissions as described in this clause.

4.1.4.1 Contention window adjustment procedures for transmissions by eNB

If an eNB transmits transmissions including PDSCH that are associated with channel access priority class p on a channel, the eNB maintains the contention window value CW_p and adjusts CW_p before step 1 of the procedure described in clause 4.1.1 for those transmissions using the following steps:

1) for every priority class $p \in \{1,2,3,4\}$ set $CW_p = CW_{min,p}$

2) if at least $Z = 80\%$ of HARQ-ACK values corresponding to PDSCH transmission(s) in reference subframe k are determined as NACK, increase CW_p for every priority class $p \in \{1,2,3,4\}$ to the next higher allowed value and remain in step 2; otherwise, go to step 1.

Reference subframe k is the starting subframe of the most recent transmission on the channel made by the eNB, for which at least some HARQ-ACK feedback is expected to be available.

The eNB shall adjust the value of CW_p for every priority class $p \in \{1,2,3,4\}$ based on a given reference subframe k only once.

For determining Z,

- if the eNB transmission(s) for which HARQ-ACK feedback is available start in the second slot of subframe k, HARQ-ACK values corresponding to PDSCH transmission(s) in subframe $k+1$ are also used in addition to the HARQ-ACK values corresponding to PDSCH transmission(s) in subframe k.
- if the HARQ-ACK values correspond to PDSCH transmission(s) on an LAA SCell that are assigned by (E)PDCCH transmitted on the same LAA SCell,
  - if no HARQ-ACK feedback is detected for a PDSCH transmission by the eNB, or if the eNB detects 'DTX', 'NACK/DTX' or 'any' state, it is counted as NACK.
- if the HARQ-ACK values correspond to PDSCH transmission(s) on an LAA SCell that are assigned by (E)PDCCH transmitted on another serving cell,
  - if the HARQ-ACK feedback for a PDSCH transmission is detected by the eNB, 'NACK/DTX' or 'any' state is counted as NACK, and 'DTX' state is ignored.
  - if no HARQ-ACK feedback is detected for a PDSCH transmission by the eNB
    - if PUCCH format 1b with channel selection is expected to be used by the UE, 'NACK/DTX' state corresponding to 'no transmission' as described in Clauses 10.1.2.2.1, 10.1.3.1 and 10.1.3.2.1 is counted as NACK, and 'DTX' state corresponding to 'no transmission' is ignored in [4].
    - Otherwise, the HARQ-ACK for the PDSCH transmission is ignored.
- if a PDSCH transmission has two codewords, the HARQ-ACK value of each codeword is considered separately
- bundled HARQ-ACK across M subframes is considered as M HARQ-ACK responses.

If the eNB transmits transmissions including PDCCH/EPDCCH with DCI format 0A/0B/4A/4B and not including PDSCH that are associated with channel access priority class p on a channel starting from time t_0, the eNB maintains the contention window value CW_p and adjusts CW_p before step 1 of the procedure described in clause 4.1.1 for those transmissions using the following steps:

1) for every priority class $p \in \{1,2,3,4\}$ set $CW_p = CW_{min,p}$
2) if less than 10% of the UL transport blocks scheduled by the eNB using Type 2 channel access procedure (described in clause 4.2.1.2) in the time interval between t_0 and $t_0 + T_{CO}$ have been received successfully, increase CW_p for every priority class $p \in \{1,2,3,4\}$ to the next higher allowed value and remain in step 2; otherwise, go to step 1.

T_{CO} is computed as described in clause 4.2.1.0.3.

4.1.4.2 Contention window adjustment procedures for DL transmissions by gNB

If a gNB transmits transmissions including PDSCH that are associated with channel access priority class p on a channel, the gNB maintains the contention window value CW_p and adjusts CW_p before step 1 of the procedure described in clause 4.1.1 for those transmissions using the following steps:

1) For every priority class $p \in \{1,2,3,4\}$, set $CW_p = CW_{min,p}$.
2) If HARQ-ACK feedback is available after the last update of CW_p , go to step 3. Otherwise, if the gNB transmission after procedure described in clause 4.1.1 does not include a retransmission or would be transmitted within a duration T_w from the end of the *reference duration* corresponding to the earliest DL channel occupancy after the last update of CW_p, go to step 5; otherwise go to step 4.
3) The HARQ-ACK feedback(s) corresponding to PDSCH(s) in the reference duration for the latest DL channel occupancy for which HARQ-ACK feedback is available is used as follows:

a. If at least one HARQ-ACK feedback is 'ACK' for PDSCH(s) with transport block based feedback or at least 10% of HARQ-ACK feedbacks is 'ACK' for PDSCH CBGs transmitted at least partially on the channel with code block group based feedback, go to step 1; otherwise go to step 4.

4) Increase CW_p for every priority class $p \in \{1,2,3,4\}$ to the next higher allowed value.

5) For every priority class $p \in \{1,2,3,4\}$, maintain CW_p as it is; go to step 2.

The *reference duration* and duration T_w in the procedure above are defined as follows:

- The *reference duration* corresponding to a channel occupancy initiated by the gNB including transmission of PDSCH(s) is defined in this clause as a duration starting from the beginning of the channel occupancy until the end of the first slot where at least one unicast PDSCH is transmitted over all the resources allocated for the PDSCH, or until the end of the first transmission burst by the gNB that contains unicast PDSCH(s) transmitted over all the resources allocated for the PDSCH, whichever occurs earlier. If the channel occupancy includes a unicast PDSCH, but it does not include any unicast PDSCH transmitted over all the resources allocated for that PDSCH, then, the duration of the first transmission burst by the gNB within the channel occupancy that contains unicast PDSCH(s) is the *reference duration* for CWS adjustment.

- $T_w = \max(T_A, T_B + 1ms)$ where T_B is the duration of the transmission burst from start of the *reference duration* in ms and $T_A = 5ms$ if the absence of any other technology sharing the channel cannot be guaranteed on a long-term basis (e.g. by level of regulation), and $T_A = 10ms$ otherwise.

If a gNB transmits transmissions using Type 1 channel access procedures associated with the channel access priority class p on a channel and the transmissions are not associated with explicit HARQ-ACK feedbacks by the corresponding UE(s), the gNB adjusts CW_p before step 1 in the procedures described in clause 4.1.1, using the latest CW_p used for any DL transmissions on the channel using Type 1 channel access procedures associated with the channel access priority class p. If the corresponding channel access priority class p has not been used for any DL transmissions on the channel, $CW_p = CW_{min,p}$ is used.

4.1.4.3 Common procedures for CWS adjustments for DL transmissions

The following applies to the procedures described in clauses 4.1.4.1 and 4.1.4.2:

- If $CW_p = CW_{max,p}$, the next higher allowed value for adjusting CW_p is $CW_{max,p}$.

- If the $CW_p = CW_{max,p}$ is consecutively used K times for generation of N_{init}, CW_p is reset to $CW_{min,p}$ only for that priority class p for which $CW_p = CW_{max,p}$ is consecutively used K times for generation of N_{init}. K is selected by eNB/gNB from the set of values {1, 2, …,8} for each priority class $p \in \{1,2,3,4\}$.

4.1.5 Energy detection threshold adaptation procedures

An eNB/gNB accessing a channel on which transmission(s) are performed, shall set the energy detection threshold (X_{Thresh}) to be less than or equal to the maximum energy detection threshold $X_{\text{Thresh\_max}}$.

$X_{\text{Thresh\_max}}$ is determined as follows:

- If the absence of any other technology sharing the channel can be guaranteed on a long-term basis (e.g. by level of regulation) then:

  - $X_{\text{Thresh\_max}} = min\begin{Bmatrix} T_{max} + 10\text{dB}, \\ X_r \end{Bmatrix}$

    - X_r is maximum energy detection threshold defined by regulatory requirements in dBm when such requirements are defined, otherwise $X_r = T_{max} + 10dB$;

- otherwise,

  - $X_{\text{Thresh\_max}} = max\begin{Bmatrix} X_{reg} \\ \min\begin{Bmatrix} T_{\max}, \\ T_{\max} - T_A + (P_H + 10 \cdot log\,10(BWMHz\,/20MHz) - P_{TX}) \end{Bmatrix} \end{Bmatrix}$

    where:

In regulatory regions and bands where it is allowed,

- $X_{reg} = -67 + 10 \cdot log\,10(BWMHz\,/20MHz)\,dBm$;
- T_A=5dB for all transmissions;
- $P_H = 23dBm$;

Otherwise,

- $X_{reg} = -72 + 10 \cdot log\,10(BWMHz\,/20MHz)dBm$;
- T_A = 5dB for transmissions including discovery burst(s) as described in clause 4.1.2, and $T_A = 10dB$ otherwise;
- $P_H = 23dBm$ or in regions and bands where regulations allow, $24dBm$;

- P_{TX} is set to the maximum eNB/gNB output power in dBm for the channel;
  - eNB/gNB uses the set maximum transmission power over a single channel irrespective of whether single channel or multi-channel transmission is employed
- $T_{\max}$(dBm)= $10 \cdot log\,10\,(3.16228 \cdot 10^{-8}(mW/MHz)\ \cdot\ BWMHz\ (MHz))$;
- $BWMHz$ is the single channel bandwidth in MHz.

4.1.6 Channel access procedures for transmission(s) on multiple channels

An eNB/gNB can access multiple channels on which transmission(s) are performed, according to one of the Type A or Type B procedures described in this Clause.

4.1.6.1 Type A multi-channel access procedures

An eNB/gNB shall perform channel access on each channel $c_i \in C$, according to the procedures described in clause 4.1.1, where C is a set of channels on which the eNB/gNB intends to transmit, and $i = 0,1, \ldots q-1$, and q is the number of channels on which the eNB/gNB intends to transmit.

The counter N described in clause 4.1.1 is determined for each channel c_i and is denoted as N_{c_i}. N_{c_i} is maintained according to clause 4.1.6.1.1 or 4.1.6.1.2.

If a gNB configures a carrier without intra-cell guard bands as described in clause 7 in [8], the gNB may not transmit on channel $c_i \in C$ within the bandwidth of the carrier, if the gNB fails to access any of the channels of the carrier bandwidth.

4.1.6.1.1 Type A1 multi-channel access procedures

Counter N as described in clause 4.1.1 is independently determined for each channel c_i and is denoted as N_{c_i}.

If the absence of any other technology sharing the channel cannot be guaranteed on a long term basis (e.g. by level of regulation), when the eNB/gNB ceases transmission on any one channel $c_j \in C$, for each channel $c_i \neq c_j$, the eNB/gNB can resume decrementing N_{c_i} when idle sensing slots are detected either after waiting for a duration of $4 \cdot T_{sl}$, or after reinitializing N_{c_i}.

For determining CW_p for channel c_i, any PDSCH that fully or partially overlaps with channel c_i, is used in the procedures described in clause 4.1.4.2.

4.1.6.1.2 Type A2 multi-channel access procedures

Counter N is determined as described in clause 4.1.1 for channel $c_j \in C$, and is denoted as N_{c_j}, where c_j is the channel that has the largest CW_p value. For each channel c_i, $N_{c_i} = N_{c_j}$.

When the eNB/gNB ceases transmission on any one channel for which N_{c_i} is determined, the eNB/gNB shall reinitialize N_{c_i} for all channels.

For determining CW_p for channel c_i, any PDSCH that fully or partially overlaps with channel c_i, is used in the procedures described in clause 4.1.4.2.

4.1.6.2 Type B multi-channel access procedure

A channel $c_j \in C$ is selected by the eNB/gNB as follows:

- the eNB/gNB selects c_j by uniformly randomly choosing c_j from C before each transmission on multiple channels $c_i \in C$, or
- the eNB/gNB selects c_j no more frequently than once every 1 second,

where C is a set of channels on which the eNB/gNB intends to transmit, $i = 0,1, \ldots q-1$, and q is the number of channels on which the eNB/gNB intends to transmit.

To transmit on channel c_j

- the eNB/gNB shall perform channel access on channel c_j according to the procedures described in clause 4.1.1 with the modifications described in clause 4.1.6.2.1 or 4.1.6.2.2.

To transmit on channel $c_i \neq c_j$, $c_i \in C$

- for each channel c_i, the eNB/gNB shall sense the channel c_i for at least a sensing interval $T_{\text{mc}} = 25\mu s$ immediately before transmitting on channel c_j, and the eNB/gNB may transmit on channel c_i immediately after sensing the channel c_i to be idle for at least the sensing interval T_{mc}. The channel c_i is considered to be idle for T_{mc} if the channel is sensed to be idle during all the time durations in which such idle sensing is performed on the channel c_j in given interval T_{mc}.

The eNB/gNB shall not transmit a transmission on a channel $c_i \neq c_j$, $c_i \in C$, for a period exceeding $T_{m\,cot,p}$ as given in Table 4.1.1-1, where the value of $T_{m\,cot,p}$ is determined using the channel access parameters used for channel c_j.

For the procedures in this clause, the channel frequencies of the set of channels C selected by gNB, is a subset of one of the sets of channel frequencies defined in [6].

If a gNB configures a carrier without intra-cell guard band(s) as described in clause 7 in [8], the gNB may not transmit on channel $c_i \in C$ within the bandwidth of the carrier, if the gNB fails to access any of the channels of the carrier bandwidth.

4.1.6.2.1 Type B1 multi-channel access procedure

A single CW_p value is maintained for the set of channels C.

For determining CW_p for channel access on channel c_j, step 2 of the procedure described in clause 4.1.4.1 is modified as follows

- if at least $Z = 80\%$ of HARQ-ACK values corresponding to PDSCH transmission(s) in reference subframe k of all channels $c_i \in C$ are determined as NACK, increase CW_p for each priority class $p \in \{1,2,3,4\}$ to the next higher allowed value; otherwise, go to step 1.

For determining CW_p for a set of channels C, any PDSCH that fully or partially overlaps with any channel $c_i \in C$, is used in the procedure described in clause 4.1.4.2.

4.1.6.2.2 Type B2 multi-channel access procedure

A CW_p value is maintained independently for each channel $c_i \in C$ using the procedure described in clause 4.1.4.

For determining CW_p for channel c_i, any PDSCH that fully or partially overlaps with channel c_i, is used in the procedure described in clause 4.1.4.2.

For determining N_{init} for channel c_j, CW_p value of channel $c_{j1} \in C$ is used, where c_{j1} is the channel with largest CW_p among all channels in set C.

4.2 Uplink channel access procedures

A UE performing transmission(s) on LAA Scell(s), an eNB scheduling or configuring UL transmission(s) for a UE performing transmission(s) on LAA Scell(s), and a UE performing transmission(s) on channel(s) and a gNB scheduling or configuring UL transmission(s) for a UE performing transmissions on channel(s) shall perform the procedures described in this clause for the UE to access the channel(s) on which the transmission(s) are performed.

In this clause, transmissions from a UE are considered as separate UL transmissions, irrespective of having a gap between transmissions or not, and X_{Thresh} for sensing is adjusted as described in clause 4.2.3 when applicable.

A UE performs channel access procedures in this clause unless the higher layer parameter *channelAccessMode-r16* is provided and *channelAccessMode-r16 ='semiStatic'*.

If a UE fails to access the channel(s) prior to an intended UL transmission to a gNB, Layer 1 notifies higher layers about the channel access failure.

4.2.1 Channel access procedures for uplink transmission(s)

A UE can access a channel on which UL transmission(s) are performed according to one of Type 1 or Type 2 UL channel access procedures. Type 1 channel access procedure is described in clause 4.2.1.1. Type 2 channel access procedure is described in clause 4.2.1.2.

If a UL grant scheduling a PUSCH transmission indicates Type 1 channel access procedures, the UE shall use Type 1 channel access procedures for transmitting transmissions including the PUSCH transmission unless stated otherwise in this clause.

A UE shall use Type 1 channel access procedures for transmitting transmissions including the autonomous or configured grant PUSCH transmission on configured UL resources unless stated otherwise in this clause.

If a UL grant scheduling a PUSCH transmission indicates Type 2 channel access procedures, the UE shall use Type 2 channel access procedures for transmitting transmissions including the PUSCH transmission unless stated otherwise in this clause.

A UE shall use Type 1 channel access procedures for transmitting SRS transmissions not including a PUSCH transmission. UL channel access priority class $p = 1$ in Table 4.2.1-1 is used for SRS transmissions not including a PUSCH.

If a DL assignment triggering SRS but not scheduling a PUCCH transmission indicates Type 2 channel access procedures, the UE shall use Type 2 channel access procedures.

If a UE is scheduled by an eNB/gNB to transmit PUSCH and SRS in contiguous transmissions without any gaps in between, and if the UE cannot access the channel for PUSCH transmission, the UE shall attempt to make SRS transmission according to uplink channel access procedures specified for SRS transmission.

If a UE is scheduled by a gNB to transmit PUSCH and one or more SRSs by a single UL grant in non-contiguous transmissions, or a UE is scheduled by a gNB to transmit PUCCH and/or SRSs by a single DL assignment in non-contiguous transmissions, the UE shall use the channel access procedure indicated by the scheduling DCI for the first UL transmission scheduled by the scheduling DCI. If the channel is sensed by the UE to be continuously idle after the UE has stopped transmitting the first transmission, the UE may transmit further UL transmissions scheduled by the scheduling DCI using Type 2 channel access procedures or Type 2A UL channel access procedures without applying a CP extension if the further UL transmissions are within the gNB Channel Occupancy Time. Otherwise, if the channel sensed by the UE is not continuously idle after the UE has stopped transmitting the first UL transmission or the further UL transmissions are outside the gNB Channel Occupancy Time, the UE may transmit the further UL transmissions using Type 1 channel access procedure, without applying a CP extension.

A UE shall use Type 1 channel access procedures for PUCCH transmissions unless stated otherwise in this clause. If a DL grant determined according to Clause 9.2.3 in [7, TS38.213] or a random access response (RAR) message for successRAR scheduling a PUCCH transmission indicates Type 2 channel access procedures, the UE shall use Type 2 channel access procedures.

When a UE uses Type 1 channel access procedures for PUCCH transmissions or PUSCH only transmissions without UL-SCH, the UE shall use UL channel access priority class $p = 1$ in Table 4.2.1-1.

A UE shall use Type 1 channel access procedure for PRACH transmissions and PUSCH transmissions without user plane data related to random access procedure that initiate a channel occupancy. In this case, UL channel access priority class $p = 1$ in Table 4.2.1-1 is used for PRACH transmissions, and UL channel access priority class used for PUSCH transmissions is determined according to Clause 5.6.2 in [9].

When a UE uses Type 1 channel access procedures for PUSCH transmissions on configured resource, the UE determines the corresponding UL channel access priority p in Table 4.2.1-1 following the procedures described in Clause 5.6.2 in [9].

When a UE uses Type 1 channel access procedures for PUSCH transmissions with user plane data indicated by a UL grant or related to random access procedure where the corresponding UL channel access priority p is not indicated, the UE determines p in Table 4.2.1-1 following the same procedures as for PUSCH transmission on configured resources using Type 1 channel access procedures.

When a UE uses Type 2A, Type 2B, or Type 2C UL channel access procedures for PUSCH transmissions indicated by a UL grant or related to random access procedures, where the corresponding UL channel access priority p is not indicated, the UE assumes that the channel access priority class $p = 4$ is used by the gNB for the *Channel Occupancy Time*.

A UE shall not transmit on a channel for a *Channel Occupancy Time* that exceeds $T_{ulm\ cot,p}$ where the channel access procedure is performed based on the channel access priority class p associated with the UE transmissions, as given in Table 4.2.1-1.

The total *Channel Occupancy Time* of autonomous uplink transmission(s) obtained by the channel access procedure in this clause, including the following DL transmission if the UE sets 'COT sharing indication' in AUL-UCI to '1' in a subframe within the autonomous uplink transmission(s) as described in Clause 4.1.3, shall not exceed $T_{ulm\ cot,p}$, where $T_{ulm\ cot,p}$ is given in Table 4.2.1-1.

Table 4.2.1-1: Channel Access Priority Class (CAPC) for UL

Channel Access Priority Class (p)	m_p	$CW_{min,p}$	$CW_{max,p}$	$T_{ulm\ cot,p}$	allowed CW_p sizes
1	2	3	7	2 ms	{3,7}
2	2	7	15	4 ms	{7,15}
3	3	15	1023	6ms or 10 ms	{15,31,63,127,255,511,1023}
4	7	15	1023	6ms or 10 ms	{15,31,63,127,255,511,1023}
NOTE1: For $p = 3,4$, $T_{ulm\ cot,p} = 10ms$ if the higher layer parameter absenceOfAnyOtherTechnology-r14 or absenceOfAnyOtherTechnology-r16 is provided , otherwise, $T_{ulm\ cot,p} = 6ms$.					
NOTE 2: When $T_{ulm\ cot,p} = 6ms$ it may be increased to $8ms$ by inserting one or more gaps. The minimum duration of a gap shall be $100\mu s$. The maximum duration before including any such gap shall be $6ms$.					

4.2.1.0 Channel access procedures and UL related signaling

4.2.1.0.0 Channel access procedures upon detection of a common DCI

If a UE detects 'UL duration and offset' field in DCI Format 1C as described in clause 5.3.3.1.4 of [5], the following are applicable:

- If the 'UL duration and offset' field indicates an 'UL offset' l and an 'UL duration' d for subframe n, then the scheduled UE may use channel access procedures Type 2 for transmissions in subframes $n + l + i$ where $i = 0,1, \ldots d - 1$, irrespective of the channel access Type signalled in the UL grant for those subframes, if the end of UE transmission occurs in or before subframe $n + l + d - 1$.

- If the 'UL duration and offset' field indicates an 'UL offset' l and an 'UL duration' d for subframe n and the 'COT sharing indication for AUL' field is set to '1', then a UE configured with autonomous UL may use channel access procedures Type 2 for autonomous UL transmissions assuming any priority class in subframes $n + l + i$ where

$i = 0,1, \ldots d-1$, if the end of UE autonomous UL transmission occurs in or before subframe $n+l+d-1$ and the autonomous UL transmission between $n+l$ and $n+l+d-1$ shall be contiguous.

- If the 'UL duration and offset' field indicates an 'UL offset' l and an 'UL duration' d for subframe n and the 'COT sharing indication for AUL' field is set to '0', then a UE configured with autonomous UL shall not transmit autonomous UL in subframes $n+l+i$ where $i = 0,1, \ldots d-1$.

If a UE determines the duration in time domain and the location in frequency domain of a remaining channel occupancy initiated by the gNB from a DCI format 2_0 as described in clause 11.1.1 of [7], the following is applicable:

- The UE may switch from Type 1 channel access procedures as described in clause 4.2.1.1 to Type 2A channel access procedures as described in clause 4.2.1.2.1 for its corresponding UL transmissions within the determined duration in time and location in frequency domain of the remaining channel occupancy. In this case, if the UL transmissions are PUSCH transmissions on configured resources, the UE may assume any priority class for the channel occupancy shared with the gNB.

4.2.1.0.1 Channel access procedures for consecutive UL transmission(s)

For contiguous UL transmission(s), the following are applicable:

- If a UE is scheduled to transmit a set of UL transmissions using one or more UL grant(s) or DL assignment(s), and
  - if the UE cannot access the channel for a transmission in the set prior to the last transmission according to one of Type 1, Type 2, or Type 2A UL channel access procedures, the UE shall attempt to transmit the next transmission according to the channel access type indicated in the corresponding UL grant or DL assignment.
  - if the UE cannot access the channel for a transmission in the set prior to the last transmission according to Type 2B UL channel access procedure, the UE shall attempt to transmit the next transmission according to Type 2A UL channel access procedure.
- If a UE is scheduled by a gNB to transmit a set of UL transmissions including PUSCH or SRS symbol(s) using a UL grant, the UE shall not apply a CP extension for the remaining UL transmissions in the set after the first UL transmission after accessing the channel.
- If a UE is scheduled to transmit a set of consecutive UL transmissions without gaps including PUSCH using one or more UL grant(s), PUCCH using one or more DL grant(s), or SRS with one or more DL grant(s) or UL grant(s) and the UE transmits one of the scheduled UL transmissions in the set after accessing the channel according to one of Type 1, Type 2, Type 2A, Type 2B or Type 2C UL channel access procedures, the UE may continue transmission of the remaining UL transmissions in the set, if any.
- If a UE is configured to transmit a set of consecutive PUSCH or SRS transmissions on resources configured by the gNB, the time domain resource configuration defines multiple transmission occasions, and if the UE cannot access the channel according to Type 1 UL channel access procedure for transmitting in a transmission occasion prior to the last transmission occasion, the UE shall attempt to transmit in the next transmission occasion according to Type 1 UL channel access procedure. If the UE transmits in one of the multiple transmission occasions after accessing the channel according to Type 1 UL channel access procedure, the UE may continue transmission in the remaining transmission occasions in the set, wherein each transmission occasion starts at the starting symbol of a configured grant PUSCH within the duration of the COT.
- If a UE is configured by the gNB to transmit a set of consecutive UL transmissions without gaps including PUSCH, periodic PUCCH, or periodic SRS and the UE transmits one of the configured UL transmissions in the set after accessing the channel according to Type 1 UL channel access procedures, the UE may continue transmission of the remaining UL transmissions in the set, if any.
- A UE is not expected to be indicated with different channel access types for any consecutive UL transmissions without gaps in between the transmissions, except if Type 2B or Type 2C UL channel access procedures are identified for the first of the consecutive UL transmissions.

For UL transmission(s) with multiple starting positions scheduled by eNB, the following are applicable:

- If a UE is scheduled by an eNB to transmit transmissions including PUSCH Mode 1 using the Type 1 channel access procedure indicated in DCI, and if the UE cannot access the channel for a transmission according to the PUSCH starting position indicated in the DCI, the UE shall attempt to make a transmission at symbol 7 in the

same subframe according to Type 1 channel access procedure. There is no limit on the number of attempts the UE can make using Type 1 channel access procedure.

- If a UE is scheduled by an eNB to transmit transmissions including PUSCH Mode 1 using the Type 2 channel access procedure indicated in DCI, and if the UE cannot access the channel for a transmission according to the PUSCH starting position indicated in the DCI, the UE may attempt to make a transmission at symbol 7 in the same subframe and according to Type 2 channel access procedure. The number of attempts the UE should make within the consecutively scheduled subframes including the transmission is limited to $w + 1$, where w is the number of consecutively scheduled subframes using Type 2 channel access procedure.

For contiguous UL transmissions(s) including a transmission pause, the following are applicable:

- If a UE is scheduled to transmit a set of consecutive UL transmissions without gaps using one or more UL grant(s), and if the UE has stopped transmitting during or before one of these UL transmissions in the set and prior to the last UL transmission in the set, and if the channel is sensed by the UE to be continuously idle after the UE has stopped transmitting, the UE may transmit a later UL transmission in the set using Type 2 channel access procedures or Type 2A UL channel access procedures without applying a CP extension.

- If a channel sensed by a UE is not continuously idle after the UE has stopped transmitting, the UE may transmit a later UL transmission in the set using Type 1 channel access procedure with the UL channel access priority class indicated in the DCI corresponding to the UL transmission.

For UL transmission(s) following autonomous UL transmission(s), the following are applicable:

- If a UE is scheduled by an eNB to transmit on channel c_i by a UL grant received on channel c_j, $i \neq j$, and if the UE is transmitting using autonomous UL on channel c_i, the UE shall terminate the ongoing PUSCH transmissions using the autonomous UL at least one subframe before the UL transmission according to the received UL grant.

- If a UE is scheduled by a UL grant received from an eNB on a channel to transmit a PUSCH transmission(s) starting from subframe n on the same channel using Type 1 channel access procedure and if at least for the first scheduled subframe occupies $N_{\mathrm{RB}}^{\mathrm{UL}}$ resource blocks and the indicated PUSCH starting position is OFDM symbol zero, and if the UE starts autonomous UL transmissions before subframe n using Type 1 channel access procedure on the same channel, the UE may transmit UL transmission(s) according to the received UL grant from subframe n without a gap, if the priority class value of the performed channel access procedure is larger than or equal to priority class value indicated in the UL grant, and the autonomous UL transmission in the subframe preceding subframe n shall end at the last OFDM symbol of the subframe regardless of the higher layer parameter *endingSymbolAUL*. The sum of the lengths of the autonomous UL transmission(s) and the scheduled UL transmission(s) shall not exceed the maximum channel occupancy time corresponding to the priority class value used to perform the autonomous uplink channel access procedure. Otherwise, the UE shall terminate the ongoing autonomous UL transmission at least one subframe before the start of the UL transmission according to the received UL grant on the same channel.

For UL transmission(s) following configured grant UL transmission(s), the following are applicable:

- If a UE is scheduled to transmit UL transmission(s) starting from symbol i in slot n using Type 1 channel access procedures without CP extension with a corresponding CAPC, and if the UE starts configured grant UL transmissions before symbol i in slot n using Type 1 channel access procedures with a corresponding CAPC, and the scheduled UL transmission(s) occupies all the RBs of the same channels occupied by the configured grant UL transmission(s) or all the RBs of a subset thereof, the UE may directly continue to transmit the scheduled UL transmission(s) to the corresponding CAPC from symbol i in slot n without a gap, if the CAPC value of the performed channel access procedure is larger than or equal to the CAPC value corresponding to the scheduled UL transmission(s). The sum of the transmission durations of the configured grant UL transmission(s) and the scheduled UL transmission(s) shall not exceed the MCOT duration corresponding to the CAPC value used to transmit the configured grant UL transmission(s). Otherwise, the UE shall terminate the configured grant UL transmission(s) by dropping the transmission on the symbols of at least the last configured grant UL transmission before symbol i in slot n and attempt to transmit the scheduled UL transmission(s) according to the corresponding CAPC. The symbols of the PUSCH transmission with a configured grant in a slot is dropped according to the mechanism in Clause 11.1 of [7, TS 38.213] relative to a last symbol of a CORESET where the UE detected the scheduling DCI. In this case, if the UE cannot terminate the configured grant UL transmission(s), the UE ignores the scheduling DCI.

4.2.1.0.2 Conditions for maintaining Type 1 UL channel access procedures

If a UE receives a DCI indicating a UL grant scheduling a PUSCH transmission using Type 1 channel access procedures or indicating a DL assignment scheduling a PUCCH transmission using Type 1 channel access procedures, and if the UE has an ongoing Type 1 channel access procedures before the PUSCH or PUCCH transmission starting time:

- If the UL channel access priority class value p_1 used for the ongoing Type 1 channel access procedures is same or larger than the UL channel access priority class value p_2 indicated in the DCI, the UE may transmit the PUSCH transmission in response to the UL grant by accessing the channel by using the ongoing Type 1 channel access procedure.
- If the UL channel access priority class value p_1 used for the ongoing Type 1 channel access procedure is smaller than the UL channel access priority class value p_2 indicated in the DCI, the UE shall terminate the ongoing channel access procedure.
- The UE may transmit the PUCCH transmission in response to the DL grant by accessing the channel by using the ongoing Type 1 channel access procedures.

4.2.1.0.3 Conditions for indicating Type 2 channel access procedures

An eNB/gNB may indicate Type 2 channel access procedures in the DCI of a UL grant or DL assignment scheduling transmission(s) including PUSCH on one or more channels or PUCCH on a channel, respectively, as follows:

If the UL transmissions occur within the time interval starting at t_0 and ending at $t_0 + T_{CO}$, where

- $T_{CO} = T_{m\,cot,p} + T_g$,
- t_0 is the time instant when the eNB/gNB has started transmission on the carrier according to the channel access procedure described in clause 4.1.1,
- $T_{m\,cot,p}$ value is determined by the eNB/gNB as described in clause 4.1.1,
- T_g is the total duration of all gaps of duration greater than $25us$ that occur between the DL transmissions of the eNB/gNB and UL transmissions scheduled by the eNB/gNB, and between any two UL transmissions scheduled by the eNB/gNB starting from t_0,

then,

- the eNB/gNB may indicate Type 2 channel access procedures in the DCI if the eNB/gNB has transmitted on the channel(s) according to the channel access procedures described in clause 4.1.1 or the multi-channel access procedures in clause 4.1.6, or
- the eNB may indicate using the 'UL duration and offset' field that the UE may perform a Type 2 channel access procedure for transmissions(s) including PUSCH on a channel in a subframe n when the eNB has transmitted on the channel according to the channel access procedure described in clause 4.1.1, or
- the eNB may indicate using the 'UL duration and offset' field and 'COT sharing indication for AUL' field that a UE configured with autonomous UL may perform a Type 2 channel access procedure for autonomous UL transmissions(s) including PUSCH on a channel in subframe n when the eNB has transmitted on the channel according to the channel access procedure described in clause 4.1.1 and acquired the channel using the largest priority class value and the eNB transmission includes PDSCH, or
- the eNB/gNB may schedule UL transmissions on a channel, that follow a transmission by the eNB/gNB on that channel with Type 2A channel access procedures for the UL transmissions as described in clause 4.2.1.2.1 after a duration of $25\mu s$.

The eNB/gNB shall schedule UL transmissions between t_0 and $t_0 + T_{CO}$ without gaps between consecutive UL transmissions if they can be scheduled contiguously. For a UL transmission on a channel that follows a transmission by the eNB/gNB on that channel using Type 2A channel access procedures as described in clause 4.2.1.2.1, the UE may use Type 2A channel access procedure for the UL transmission.

If the eNB/gNB indicates Type 2 channel access procedure for the UE in the DCI, the eNB/gNB indicates the channel access priority class used to obtain access to the channel in the DCI.

For indicating a Type 2 channel access procedure, if the gap is at least $25\mu s$, or equal to $16\mu s$, or up to $16\mu s$, the gNB may indicate Type 2A, or Type 2B, or Type 2C UL channel procedures, respectively, as described in clauses 4.2.1.2.

4.2.1.0.4 Channel access procedures for UL multi-channel transmission(s)

If a UE

- is scheduled to transmit on a set of channels C, and if the UL transmissions are scheduled to start transmissions at the same time on all channels in the set of channels C, or
- intends to perform an uplink transmission on configured resources on the set of channels C, and if UL transmissions are configured to start transmissions at the same time on all channels in the set of channels C,

the following is applicable:

- if Type 1 channel access procedure is indicated or intended for the scheduled or configured UL transmissions, respectively, to be transmitted on the set of channels C,
  - the UE may transmit on channel $c_i \in C$ using Type 2A channel access procedure as described in clause 4.2.1.2.1,
    - if the channel frequencies of the set of channels C is a subset of the sets of channel frequencies defined in clause 5.7.4 in [2] or clause 5.4.2.3 in [6], as applicable, and
    - if Type 2A channel access procedure is performed on channel c_i immediately before the UE transmission on channel $c_j \in C$, $i \neq j$, and
    - if the UE has accessed channel c_j using Type 1 channel access procedure as described in clause 4.2.1.1,
      - where channel c_j is selected by the UE uniformly randomly from the set of channels C before performing Type 1 channel access procedure on any channel in the set of channels C.
  - the UE may transmit on channel $c_i \in C$ using Type 1 channel access procedure as described in clause 4.2.1.1
- the UE may not transmit on channel $c_i \in C$ within the bandwidth of a carrier, if the UE fails to access any of the channels, of the carrier bandwidth, on which the UE is scheduled or configured with UL resources.
- the UE may not transmit on a channel within the bandwidth of a carrier if the UE is configured without intra-cell guard band(s) on an UL bandwidth part as described in clause 7 of [8], and the UE fails to access any of the channels of the UL bandwidth part.

4.2.1.1 Type 1 UL channel access procedure

This clause describes channel access procedures by a UE where the time duration spanned by the sensing slots that are sensed to be idle before a UL transmission(s) is random. The clause is applicable to the following transmissions:

- PUSCH/SRS transmission(s) scheduled or configured by eNB/gNB, or
- PUCCH transmission(s) scheduled or configured by gNB, or
- Transmission(s) related to random access procedure.

A UE may transmit the transmission using Type 1 channel access procedure after first sensing the channel to be idle during the sensing slot durations of a defer duration T_d, and after the counter N is zero in step 4. The counter N is adjusted by sensing the channel for additional sensing slot duration(s) according to the steps described below.

1) set $N = N_{init}$, where N_{init} is a random number uniformly distributed between 0 and CW_p, and go to step 4;
2) if $N > 0$ and the UE chooses to decrement the counter, set $N = N - 1$;
3) sense the channel for an additional sensing slot duration, and if the additional sensing slot duration is idle, go to step 4; else, go to step 5;
4) if $N = 0$, stop; else, go to step 2.

5) sense the channel until either a busy sensing slot is detected within an additional defer duration T_d or all the sensing slots of the additional defer duration T_d are detected to be idle;

6) if the channel is sensed to be idle during all the sensing slot durations of the additional defer duration T_d, go to step 4; else, go to step 5;

If a UE has not transmitted a UL transmission on a channel on which UL transmission(s) are performed after step 4 in the procedure above, the UE may transmit a transmission on the channel, if the channel is sensed to be idle at least in a sensing slot duration T_{sl} when the UE is ready to transmit the transmission and if the channel has been sensed to be idle during all the sensing slot durations of a defer duration T_d immediately before the transmission. If the channel has not been sensed to be idle in a sensing slot duration T_{sl} when the UE first senses the channel after it is ready to transmit, or if the channel has not been sensed to be idle during any of the sensing slot durations of a defer duration T_d immediately before the intended transmission, the UE proceeds to step 1 after sensing the channel to be idle during the sensing slot durations of a defer duration T_d.

The defer duration T_d consists of duration $T_f = 16\mu s$ immediately followed by m_p consecutive sensing slot durations where each sensing slot duration is $T_{sl} = 9\mu s$, and T_f includes an idle sensing slot duration T_{sl} at start of T_f.

$CW_{min,p} \leq CW_p \leq CW_{max,p}$ is the contention window. CW_p adjustment is described in clause 4.2.2.

$CW_{min,p}$ and $CW_{max,p}$ are chosen before step 1 of the procedure above.

m_p, $CW_{min,p}$, and $CW_{max,p}$ are based on a channel access priority class p as shown in Table 4.2.1-1, that is signalled to the UE.

4.2.1.2 Type 2 UL channel access procedure

This clause describes channel access procedures by UE where the time duration spanned by the sensing slots that are sensed to be idle before a UL transmission(s) is deterministic.

If a UE is indicated by an eNB to perform Type 2 UL channel access procedures, the UE follows the procedures described in clause 4.2.1.2.1.

4.2.1.2.1 Type 2A UL channel access procedure

If a UE is indicated to perform Type 2A UL channel access procedures, the UE uses Type 2A UL channel access procedures for a UL transmission. The UE may transmit the transmission immediately after sensing the channel to be idle for at least a sensing interval $T_{\text{short\_ul}} = 25\mu s$. $T_{\text{short\_ul}}$ consists of a duration $T_f = 16\mu s$ immediately followed by one sensing slot and T_f includes a sensing slot at start of T_f. The channel is considered to be idle for $T_{\text{short\_ul}}$ if both sensing slots of $T_{\text{short\_ul}}$.are sensed to be idle.

4.2.1.2.2 Type 2B UL channel access procedure

If a UE is indicated to perform Type 2B UL channel access procedures, the UE uses Type 2B UL channel access procedure for a UL transmission. The UE may transmit the transmission immediately after sensing the channel to be idle within a duration of $T_f = 16\mu s$. T_f includes a sensing slot that occurs within the last $9us$ of T_f. The channel is considered to be idle within the duration T_f if the channel is sensed to be idle for total of at least $5us$ with at least $4us$ of sensing occurring in the sensing slot.

4.2.1.2.3 Type 2C UL channel access procedure

If a UE is indicated to perform Type 2C UL channel access procedures for a UL transmission, the UE does not sense the channel before the transmission. The duration of the corresponding UL transmission is at most $584us$.

4.2.2 Contention window adjustment procedures

If a UE transmits transmissions using Type 1 channel access procedures that are associated with channel access priority class p on a channel, the UE maintains the contention window value CW_p and adjusts CW_p for those transmissions before step 1 of the procedure described in clause 4.2.1.1, as described in this clause.

4.2.2.1 Contention window adjustment procedures for UL transmissions scheduled/configured by eNB

If a UE transmits transmissions using Type 1 channel access procedures that are associated with channel access priority class p on a channel, the UE maintains the contention window value CW_p and adjusts CW_p for those transmissions before step 1 of the procedure described in clause 4.2.1.1, using the following procedure:

- If the UE receives an UL grant or an AUL-DFI, the contention window size for all the priority classes is adjusted as following:
  - If the NDI value for at least one HARQ process associated with HARQ_ID_ref is toggled, or if the HARQ-ACK value(s) for at least one of the HARQ processes associated with HARQ_ID_ref received in the earliest AUL-DFI after n_{ref}+3 indicates ACK,
    - for every priority class $p \in \{1,2,3,4\}$, set $CW_p = CW_{min,p}$;
  - Otherwise, increase CW_p for every priority class $p \in \{1,2,3,4\}$ to the next higher allowed value;
- If there exists one or more previous transmissions $\{T_0, \dots, T_n\}$ using Type 1 channel access procedure, from the start subframe(s) of the previous transmission(s) of which, N or more subframes have elapsed and neither UL grant nor AUL-DFI was received, where N = max (*contentionWindowSizeTimer*, T_i burst length+1) if *contentionWindowSizeTimer* > 0 and N = 0 otherwise, for each transmission T_i, CW_p is adjusted as following:
  - increase CW_p for every priority class $p \in \{1,2,3,4\}$ to the next higher allowed value;
  - The CW_p is adjusted once
- Else if the UE transmits transmissions using Type 1 channel access procedure before N subframes have elapsed from the start of previous UL transmission burst using Type 1 channel access procedure and neither UL grant nor AUL-DFI is received,
  - the CW_p is unchanged.
- If the UE receives an UL grant or an AUL-DFI indicates feedback for one or more previous transmissions $\{T_0, \dots, T_n\}$ using Type 1 channel access procedure, from the start subframe(s) of the previous transmission(s) of which, N or more subframes have elapsed and neither UL grant nor AUL-DFI was received, where N = max (*contentionWindowSizeTimer*, T_i burst length+1) if *contentionWindowSizeTimer* > 0 and N = 0 otherwise, the UE may recompute CW_p as follows:
  - The UE reverts CW_p to the value used to transmit at n_{T0} using Type 1 channel access procedure.
  - The UE updates CW_p sequentially in the order of the transmission $\{T_0, \dots, T_n\}$
    - If the NDI value for at least one HARQ process associated with HARQ_ID_ref' is toggled, or if the HARQ-ACK value(s) for at least one of the HARQ processes associated with HARQ_ID_ref' received in the earliest AUL-DFI after n_{Ti}+3 indicates ACK,
      - for every priority class $p \in \{1,2,3,4\}$ set $CW_p = CW_{min,p}$.
    - Otherwise, increase CW_p for every priority class $p \in \{1,2,3,4\}$to the next higher allowed value.
- If the UE transmits transmissions using Type 1 channel access procedure before N subframes have elapsed from the start of previous UL transmission burst using Type 1 channel access procedure and neither UL grant nor AUL-DFI is received,
  - CW_p is unchanged.

HARQ_ID_ref is the HARQ process ID of UL-SCH in reference subframe n_{ref}. The reference subframe n_{ref} is determined as follows

- If the UE receives an UL grant or an AUL-DFI in subframe n_g , subframe n_w is the most recent subframe before subframe $n_g - 3$ in which the UE has transmitted UL-SCH using Type 1 channel access procedure.

- If the UE transmits transmissions including UL-SCH without gaps starting with subframe n_0 and in subframes $n_0, n_1, \cdots, n_w$ and the UL-SCH in subframe n_0 is not PUSCH Mode 1 that starts in the second slot of the subframe, reference subframe n_{ref} is subframe n_0.

- If the UE transmits transmissions including PUSCH Mode 1 without gaps starting with second slot of subframe n_0 and in subframes $n_0, n_1, \cdots, n_w$ and the, reference subframe n_{ref} is subframe n_0 and n_1,

- otherwise, reference subframe n_{ref} is subframe n_w.

HARQ_ID_ref' is the HARQ process ID of UL-SCH in reference subframe n_{Ti}. The reference subframe n_{Ti} is determined as the start subframe of a transmission T_i using Type 1 channel access procedure and of which, N subframes have elapsed and neither UL grant nor AUL-DFI was received.

If the AUL-DFI with DCI format 0A is indicated to a UE that is activated with AUL transmission and transmission mode 2 is configured for the UE for grant-based uplink transmissions, the spatial HARQ-ACK bundling shall be performed by logical OR operation across multiple codewords for the HARQ process not configured for autonomous UL transmission.

If CW_p changes during an ongoing channel access procedure, the UE shall draw a counter N_{init} and applies it to the ongoing channel access procedure.

The UE may keep the value of CW_p unchanged for every priority class $p \in \{1,2,3,4\}$, if the UE scheduled to transmit transmissions without gaps including PUSCH in a set subframes $n_0, n_1, \cdots, n_{w-1}$ using Type 1 channel access procedure, and if the UE is not able to transmit any transmission including PUSCH in the set of subframes.

The UE may keep the value of CW_p for every priority class $p \in \{1,2,3,4\}$ the same as that for the last scheduled transmission including PUSCH using Type 1 channel access procedure, if the reference subframe for the last scheduled transmission is also n_{ref}.

4.2.2.2 Contention window adjustment procedures for UL transmissions scheduled/configured by gNB

If a UE transmits transmissions using Type 1 channel access procedures that are associated with channel access priority class p on a channel, the UE maintains the contention window value CW_p and adjusts CW_p for those transmissions before step 1 of the procedure described in clause 4.2.1.1, using the following steps:

1) For every priority class $p \in \{1,2,3,4\}$, set $CW_p = CW_{min,p}$;

2) If HARQ-ACK feedback is available after the last update of CW_p, go to step 3. Otherwise, if the UE transmission after procedure described in clause 4.2.1.1 does not include a retransmission or would be transmitted within a duration T_w from the end of the *reference duration* corresponding to the earliest UL channel occupancy after the last update of CW_p, go to step 5; otherwise go to step 4.

3) The HARQ-ACK feedback(s) corresponding to PUSCH(s) in the *reference duration* for the latest UL channel occupancy for which HARQ-ACK feedback is available is used as follows:

   a. If at least one HARQ-ACK feedback is 'ACK' for PUSCH(s) with transport block (TB) based feedback or at least 10% of HARQ-ACK feedbacks are 'ACK' for PUSCH CBGs transmitted at least partially on the channel with code block group (CBG) based feedback, go to step 1; otherwise go to step 4.

4) Increase CW_p for every priority class $p \in \{1,2,3,4\}$ to the next higher allowed value;

5) For every priority class $p \in \{1,2,3,4\}$, maintain CW_p as it is; go to step 2.

The HARQ-ACK feedback, *reference duration* and duration T_w in the procedure above are defined as the following:

- For the purpose of contention window adjustment in this clause, HARQ-ACK feedback for PUSCH(s) transmissions are expected to be provided to UE(s) explicitly or implicitly where explicit HARQ-ACK is determined based on the valid HARQ-ACK feedback in a corresponding CG-DFI as described in clause 10.5 in [7], and implicit HARQ-ACK feedback is determined based on the indication for a new transmission or retransmission in the DCI scheduling PUSCH(s) as follows:

- If a new transmission is indicated, 'ACK' is assumed for the transport blocks or code block groups in the corresponding PUSCH(s) for the TB-based and CBG-based transmission, respectively.
- If a retransmission is indicated for TB-based transmissions, 'NACK' is assumed for the transport blocks in the corresponding PUSCH(s).
- If a retransmission is indicated for CBG-based transmissions, if a bit value in the code block group transmission information (CBGTI) field is '0' or '1' as described in clause 5.1.7.2 in [8], 'ACK' or 'NACK' is assumed for the corresponding CBG in the corresponding PUSCH(s), respectively.

- The *reference duration* corresponding to a channel occupancy initiated by the UE including transmission of PUSCH(s) is defined in this clause as a duration starting from the beginning of the channel occupancy until the end of the first slot where at least one PUSCH is transmitted over all the resources allocated for the PUSCH, or until the end of the first transmission burst by the UE that contains PUSCH(s) transmitted over all the resources allocated for the PUSCH, whichever occurs earlier. If the channel occupancy includes a PUSCH, but it does not include any PUSCH transmitted over all the resources allocated for that PUSCH, then, the duration of the first transmission burst by the UE within the channel occupancy that contains PUSCH(s) is the *reference duration* for CWS adjustment.
- $T_w = \max(T_A, T_B + 1ms)$ where T_B is the duration of the transmission burst from start of the *reference duration* in ms and $T_A = 5ms$ if the absence of any other technology sharing the channel cannot be guaranteed on a long-term basis (e.g. by level of regulation), and $T_A = 10ms$ otherwise.

If a UE transmits transmissions using Type 1 channel access procedures associated with the channel access priority class p on a channel and the transmissions are not associated with explicit or implicit HARQ-ACK feedbacks as described above in this clause, the UE adjusts CW_p before step 1 in the procedures described in clause 4.2.1.1, using the latest CW_p used for any UL transmissions on the channel using Type 1 channel access procedures associated with the channel access priority class p. If the corresponding channel access priority class p has not been used for any UL transmission on the channel, $CW_p = CW_{min,p}$ is used.

4.2.2.3 Common procedures for CWS adjustments for UL transmissions

The following applies to the procedures described in clauses 4.2.2.1 and 4.2.2.2:

- If $CW_p = CW_{max,p}$, the next higher allowed value for adjusting CW_p is $CW_{max,p}$.
- If the $CW_p = CW_{max,p}$ is consecutively used K times for generation of N_{init}, CW_p is reset to $CW_{min,p}$ only for that priority class p for which $CW_p = CW_{max,p}$ is consecutively used K times for generation of N_{init}. K is selected by UE from the set of values {1, 2, …,8} for each priority class $p \in \{1,2,3,4\}$.

4.2.3 Energy detection threshold adaptation procedure

A UE accessing a channel on which UL transmission(s) are performed, shall set the energy detection threshold (X_{Thresh}) to be less than or equal to the maximum energy detection threshold $X_{\text{Thresh\_max}}$.

$X_{\text{Thresh\_max}}$ is determined as follows:

- If the UE is configured with higher layer parameter *maxEnergyDetectionThreshold-r14* or *maxEnergyDetectionThreshold-r16*,
  - $X_{\text{Thresh\_max}}$ is set equal to the value signalled by the higher layer parameter;
- otherwise
  - the UE shall determine $X'_{\text{Thresh\_max}}$ according to the procedure described in clause 4.2.3.1;
  - if the UE is configured with higher layer parameter *energyDetectionThresholdOffset-r14* or *energyDetectionThresholdOffset-r16*
    - $X_{\text{Thresh\_max}}$ is set by adjusting $X'_{\text{Thresh\_max}}$ according to the offset value signalled by the higher layer parameter;
  - otherwise

- the UE shall set $X_{\text{Thresh\_max}} = X'_{\text{Thresh\_max}}$.

The UE is not expected to be configured with *ul-toDL-COT-SharingED-Threshold-r16* when the UE is provided with *ChannelAccessMode-r16 ='semiStatic'*,

If the higher layer parameter *absenceOfAnyOtherTechnology-r16* is not configured to a UE, and the higher layer parameter *ul-toDL-COT-SharingED-Threshold-r16* is configured to the UE, the gNB should use the gNB's transmit power in determining the resulting energy detection threshold *ul-toDL-COT-SharingED-Threshold-r16*.

For the case where a UE performs channel access procedures as described in clause 4.2.1.1 for a UL transmission and CG-UCI is absent in the UL transmission or CG-UCI is present in the UL transmission and indicates COT-sharing information other than 'COT sharing not available', $X_{\text{Thresh\_max}}$ is set equal to the value provided by the higher layer parameter *ul-toDL-COT-SharingED-Threshold-r16*, if provided.

4.2.3.1 Default maximum energy detection threshold computation procedure

If the higher layer parameter *absenceOfAnyOtherTechnology-r14* or *absenceOfAnyOtherTechnology-r16* is provided

- $X'_{\text{Thresh\_max}} = min\begin{Bmatrix} T_{max} + 10\text{dB} \\ X_r \end{Bmatrix}$ where
  - X_r is Maximum energy detection threshold defined by regulatory requirements in dBm when such requirements are defined, otherwise $X_r = T_{max} + 10dB$

Otherwise

- $X'_{\text{Thresh\_max}} = max\begin{Bmatrix} X_{reg} \\ \min\begin{Bmatrix} T_{\text{max}}, \\ T_{\text{max}} - T_A + (P_H + 10 \cdot log\,10(BWMHz\,/20MHz) - P_{TX}) \end{Bmatrix} \end{Bmatrix}$

  where
  - In regulatory regions and bands where it is allowed,
    - $X_{reg} = -67 + 10 \cdot log\,10(BWMHz\,/20MHz)\,dBm$;
    - T_A = 5dB;
    - $P_H = 23dBm$;
  - Otherwise,
    - $X_{reg} = -72 + 10 \cdot log\,10(BWMHz\,/20MHz)dBm$;
    - T_A = 10dB;
    - $P_H = 23dBm$ or in regions and bands where regulations allow, $24dBm$;
  - P_{TX} is set to the value of $P_{CMAX\_H,c}$ as defined in [3] or the value of $P_{CMAX\_H,f,c}$ as defined in [12], as applicable;
  - T_{max}(dBm)= $10 \cdot log\,10\,(3.16228 \cdot 10^{-8}(mW/MHz)\ \cdot\ BWMHz\ (MHz))$;
  - $BWMHz$ is the single channel bandwidth in MHz.

4.3 Channel access procedures for semi-static channel occupancy

Channel access procedures based on semi-static channel occupancy as described in this Clause, are intended for environments where the absence of other technologies is guaranteed e.g., by level of regulations, private premises policies, etc.

If a gNB provides UE(s) with higher layer parameters *ChannelAccessMode-r16 ='semiStatic'* by SIB1 or dedicated configuration for a serving cell, a periodic channel occupancy can be initiated by the gNB on a channel(s) within the bandwidth of the serving cell every T_x within every two consecutive radio frames, starting from the even indexed radio frame at $i \cdot T_x$ with a maximum channel occupancy time $T_y = 0.95T_x$, where T_x = *period* in ms, is a higher layer parameter provided in *SemiStaticChannelAccessConfig* and $i \in \left\{0,1, \dots, \frac{20}{T_x} - 1\right\}$. A duration of $T_z = \max(0.05T_x\ , 100us)$ at the end of a period is referred to as the *idle duration* of that period.

If the gNB additionally configures a UE with higher layer parameter *semiStaticChannelAccessConfigUE* consisting of *periodUE* and *offsetUE*, the UE can initiate a channel occupancy on a channel(s) within the bandwidth of the serving cell every T_u = *periodUE* in ms with corresponding maximum channel occupancy time $T_v = 0.95T_u$. The offset of the periodic channel occupancy is determined by T_o = *offsetUE* as the number of symbols from the beginning of an even indexed radio frame to the start of the first period in that radio frame in which the UE can initiate a channel occupancy. A duration of $T_w = \max(0.05T_u\ , 100us)$ at the end of a period is referred to as the *idle duration* of that period.

For determining a *Channel Occupancy Time* based on semi-static channel access procedures, duration of any transmission gap within a period excluding the corresponding idle duration is counted in the channel occupancy time.In the following procedures in this clause, when a gNB or UE performs sensing for evaluating a channel availability, the sensing is performed at least during a sensing slot duration $T_{sl} = 9\mu s$, unless longer sensing duration is required (e.g. by level of regulation), in which case sensing is performed within a duration of $T_{sl} = 16\mu s$. When sensing is performed within a duration of $T_{sl} = 16\mu s$, the channel is considered to be idle if the channel is sensed to be idle for total of at least $5\mu s$ with at least $4\mu s$ of sensing occurring in the last $9\mu s$ time interval in the sensing duration. The corresponding X_{Thresh} adjustment for performing sensing by a gNB or a UE is described in clauses 4.1.5 and 4.2.3, respectively.

4.3.1 Channel access procedures to initiate a channel occupancy

For semi-static channel occupancy, the procedures in Clause 4.3.1.1 are followed if *semiStaticChannelAccessConfigUE* is absent. Otherwise, the procedures in Clause 4.3.1.2 are applicable.

If a UE fails to access the channel(s) prior to an intended UL transmission to a gNB, Layer 1 notifies higher layers about the channel access failure.

4.3.1.1 Channel occupancy initiated only by gNB

A channel occupancy that is initiated by a gNB and is shared with UE(s), satisfies the following:

- The gNB shall transmit a DL transmission burst starting at the beginning of a period of duration T_x in which the channel occupancy is initiated immediately after sensing the channel to be idle for at least a sensing slot duration T_{sl}. If the channel is sensed to be busy, the gNB shall not perform any transmission during the current period.
- The gNB may transmit a DL transmission burst(s) within the channel occupancy time immediately after sensing the channel to be idle for at least a sensing slot duration T_{sl} if the gap between the DL transmission burst(s) and any previous transmission burst is more than $16\mu s$.
- The gNB may transmit DL transmission burst(s) after UL transmission burst(s) within the channel occupancy time without sensing the channel if the gap between the DL and UL transmission bursts is at most $16\mu s$.
- A UE may transmit UL transmission burst(s) after detection of a DL transmission burst(s) within the channel occupancy time as follows:
  - If the gap between the UL and DL transmission bursts is at most $16\mu s$, the UE may transmit UL transmission burst(s) after a DL transmission burst(s) within the channel occupancy time without sensing the channel.
  - If the gap between the UL and DL transmission bursts is more than $16\mu s$, the UE may transmit UL transmission burst(s) after a DL transmission burst(s) within the channel occupancy time after sensing the channel to be idle for at least a sensing slot duration T_{sl} within a $25\mu s$ interval ending immediately before transmission.
- A UE may be indicated by the gNB to transmit UL transmission burst(s) within the channel occupancy time without sensing the channel or after sensing the channel to be idle for at least a sensing slot duration T_{sl} within a $25\mu s$ interval ending immediately before transmission.

- The gNB and UEs shall not transmit any transmissions in a set of consecutive symbols for a duration of at least $T_z = \max(0.05T_x, 100\mu s)$ before the start of the next period.

4.3.1.2 Channel occupancy initiated by gNB or UE

4.3.1.2.1 Channel occupancy initiated by gNB and sensing procedures

The gNB initiates a channel occupancy in a period of duration T_x if the gNB transmits a DL transmission burst starting at the beginning of the period immediately after sensing the channel to be idle for at least a sensing slot duration T_{sl} and ends the transmission of the DL transmission burst before the start of the idle duration of that period. When the gNB initiates a channel occupancy in that period, the gNB shall not transmit any transmission(s) within the idle duration of that period. A UE determines that the gNB has initiated the channel occupancy in that period by detection of a DL transmission burst(s) in that period or an indication by a DCI as described in Clause 4.3.1.2.4.

When a UL or DL transmission burst(s) is associated with the channel occupancy that is initiated in that period by the gNB, the following are applicable:

- The UL or DL transmission burst(s) is confined within that period and ends before the start of the idle duration of that period.

- If the gap between the DL transmission burst(s) and any previous transmission burst in that period is more than $16\mu s$, the DL transmission burst(s) may be transmitted if the channel is sensed to be idle for at least a sensing slot duration T_{sl} immediately before the DL transmission.

- If the gap between the DL transmission burst(s) and any previous UL transmission burst in that period is at most $16\mu s$, the DL transmission burst(s) may be transmitted without sensing.

- If the gap between the UL transmission burst(s) and any previous DL transmission burst in that period is more than $16\mu s$, the UL transmission burst(s) may be transmitted if the channel is sensed to be idle for at least a sensing slot duration T_{sl} within a 25μs interval ending immediately before the UL transmission burst(s).

- If the gap between the UL transmission burst(s) and any previous DL transmission burst in that period is at most $16\mu s$, the UL transmission burst(s) may be transmitted without sensing.

4.3.1.2.2 Channel occupancy initiated by UE and sensing procedures

A UE initiates a channel occupancy in a period of duration T_u if the UE transmits a UL transmission burst starting at the beginning of the period immediately after sensing the channel to be idle for at least a sensing slot duration T_{sl} and ends the transmission of the UL transmission burst before the start of the idle duration of that period. When the UE initiates a channel occupancy in that period, the UE shall not transmit any transmission(s) within the idle duration of that period.

When a UL or DL transmission burst(s) is associated with the channel occupancy that is initiated in that period by the UE, the following are applicable:

- The UL or DL transmission burst(s) is confined within that period and ends before the start of the idle duration of that period.

- If the gap between the UL transmission burst(s) and any previous transmission burst in that period is more than $16\mu s$, the UL transmission burst(s) may be transmitted if the channel is sensed to be idle for at least a sensing slot duration T_{sl} immediately before the UL transmission burst(s).

- If the gap between the UL transmission burst(s) and any previous DL transmission burst in that period is at most $16\mu s$, the UL transmission burst(s) may be transmitted without sensing.

- If the gap between the DL transmission burst(s) and any previous UL transmission burst in that period is more than $16\mu s$, the DL transmission burst(s) may be transmitted if the channel is sensed to be idle for at least a sensing slot duration T_{sl} within a 25μs interval ending immediately before the DL transmission.

- If the gap between the DL transmission burst(s) and any previous UL transmission burst in that period is at most $16\mu s$, the DL transmission burst(s) may be transmitted without sensing.

When a DL transmission burst(s) is associated with a channel occupancy that is initiated in a period of duration T_u by a UE, the DL transmission burst(s) shall include unicast user plane data or control information intended for the UE that

has initiated the channel occupancy in that period. The gNB may include in the DL transmission burst(s) an additional transmission(s) intended to other UEs than the UE that has initiated the channel occupancy in that period or broadcast transmission(s), only if the gNB satisfies the condition that the detection of the additional DL transmission(s) at any UE will not be associated with a channel occupancy that is initiated by gNB following the procedures described in Clause 4.3.1.2.3 and 4.3.1.2.4.

When a UE is configured with a configured grant for which *cg-RetransmissionTimer-r16* is provided and if the UE is provided *cg-COT-SharingList-r16* by higher layers, the UE is configured with a table wherein each row is given by higher layer parameter *CG-COT-Sharing-r16*. One row of the table is configured for indicating that the channel occupancy sharing is not available and other rows of the table each provides a channel occupancy sharing information. In this case, each configured grant PUSCH transmission includes 'COT sharing information' in CG-UCI as described in [10] that indicates a row index to the table, which is chosen by the UE independently of the CAPC information that the row may carry. If the gNB shares a channel occupancy initiated by the UE and detects a CG-UCI in slot n that includes 'COT sharing information', the gNB may transmit a transmission that follows the configured grant PUSCH transmission starting from slot $n + O$, where $O =$ *offset-r16* slots, for a duration of $D =$*duration-r16* slots where *duration-r16* and *offset-r16* are higher layer parameters provided by *CG-COT-Sharing-r16*.

4.3.1.2.3 Association with initiated channel occupancy for configured UL transmissions

When a UE is configured with a UL transmission, the UE follows the following procedures to determine if the configured UL transmission is associated with a channel occupancy that is initiated by the gNB or the UE.

- If the configured UL transmission would occur at the beginning of a period of duration T_u and would end before the idle duration corresponding to that period, the following is applied:
  - If the configured UL transmission would occur within a period of duration T_x and would end before the idle duration corresponding to that period and if the UE has already determined that the gNB has initiated a channel occupancy in that period as described in Clause 4.3.1.2.1, the UE assumes that the configured UL transmission is associated with the channel occupancy that is initiated by the gNB.
  - Otherwise, the UE assumes that the configured UL transmission is associated with a channel occupancy to be initiated by the UE.
- If the configured UL transmission would occur at the beginning of a period of duration T_u and would overlap with the idle duration corresponding to that period, the following is applied:
  - If the configured UL transmission would occur within a period of duration T_x and would end before the idle duration corresponding to that period, and if the UE has already determined that the gNB has initiated a channel occupancy in that period as described in Clause 4.3.1.2.1, the UE assumes that the configured UL transmission is associated with the channel occupancy that is initiated by the gNB.
  - Otherwise, the UE drops the configured UL transmission.
- If the configured UL transmission would occur after the beginning of a period of duration T_u and would end before the idle duration corresponding to that period, the following is applied:
  - If the UE has already initiated a channel occupancy in that period as described in Clause 4.3.1.2.2, the UE assumes that the configured UL transmission is associated with the channel occupancy that is initiated by the UE.
  - If the UE has not already initiated a channel occupancy in that period as described in Clause 4.3.1.2.2, then if the configured UL transmission would occur within a period of duration T_x and would end before the idle duration corresponding to that period and if the UE has already determined that the gNB has initiated a channel occupancy in that period as described in Clause 4.3.1.2.1, the UE assumes that the configured UL transmission is associated with the channel occupancy that is initiated by the gNB; otherwise, the UE drops the configured UL transmission(s).
- If the configured UL transmission would occur after the beginning of a period of duration T_u and would overlap with the idle duration corresponding to that period, the following is applied:
  - If the UE has not already initiated a channel occupancy in that period as described in Clause 4.3.1.2.2:
    - If the configured UL transmission would occur within a period of duration T_x and would end before the idle duration corresponding to that period and the UE has already determined that the gNB has initiated a

channel occupancy in that period as described in Clause 4.3.1.2.1, the UE assumes that the configured UL transmission is associated with the channel occupancy that is initiated by the gNB.

- Otherwise, the UE drops the configured UL transmission.

- Otherwise, the UE drops the configured UL transmission.

If the configured UL transmission is a PUSCH with PUSCH repetition type B that does not overlap with an idle duration corresponding to a period of duration T_u or a period of duration T_x, the above procedures are applicable to its corresponding nominal repetition as described in [8]. Otherwise, the following procedures are applicable to its corresponding nominal repetition.

- If the configured UL transmission would occur at the beginning of a period of duration T_u and within a period of duration T_x the following is applied:

  - If the UE has already determined that the gNB has initiated channel occupancy in that period as described in Clause 4.3.1.2.1, the UE assumes that the configured UL transmission is associated with the channel occupancy that is initiated by the gNB.

  - Otherwise, the UE assumes that the configured UL transmission is associated with a channel occupancy to be initiated by the UE.

- If the configured UL transmission would occur after the beginning of a period of duration T_u and within a period of duration T_x the following is applied:

  - If the UE has already initiated a channel occupancy in the period of duration T_u as described in Clause 4.3.1.2.2, the UE assumes that the configured UL transmission is associated with the channel occupancy that is initiated by the UE.

  - Otherwise,

    - if the UE has already determined that the gNB has initiated a channel occupancy in the period of duration T_x as described in Clause 4.3.1.2.1, the UE assumes that the configured UL transmission is associated with the channel occupancy that is initiated by the gNB.

    - Otherwise, the UE drops the configured UL transmission.

4.3.1.2.4 Association with initiated channel occupancy for scheduled UL transmissions

When a UL transmission(s) is scheduled by a DCI or a RAR message, the scheduling DCI or the RAR message indicates the channel access parameters for the UL transmission(s) as described in [10]. Based on the DCI or the RAR message, the UE determines if the scheduled UL transmission(s) is associated with a channel occupancy that is initiated by the gNB or the UE, and whether sensing and CP extension are applicable.

4.3.1.2.4.1 Intra-period scheduled UL transmissions

The procedures in this clause are applicable when a scheduled UL transmission and the corresponding scheduling DCI or the corresponding RAR transmission are confined within the same period of duration T_x corresponding to the carrier within which the UL transmission is scheduled and regardless of whether they are transmitted on the same carrier or different carriers**.**

If the UE is indicated that the scheduled UL transmission is associated with a channel occupancy that is initiated by the gNB, and the UE is indicated to perform the UL transmission without sensing, the UE applies CP extension if applicable following the procedures described in [11] and is expected to transmit the scheduled UL transmission without sensing as described in Clause 4.3.1.2.1.

If the UE is indicated that the scheduled UL transmission is associated with a channel occupancy that is initiated by the gNB and the UE is indicated to perform the UL transmission after sensing, the following are applied:

- If the UE determines that the UL transmission follows a previous transmission after a gap of at most 16us, the UE is expected to transmit the UL transmission without sensing. Otherwise, the UE senses the channel for at least a sensing slot duration T_{sl} within a 25μs interval immediately before the scheduled UL transmission as described in Clause 4.3.1.2.1. If the channel is sensed to be idle, the UE is expected to transmit the scheduled UL transmission, and drop otherwise.

If the UE is indicated that the scheduled UL transmission is associated with a channel occupancy that is initiated by the UE, the following are applied:

- If the UL transmission would occur at the beginning of a period of duration T_u, the UE is expected to sense the channel for at least a sensing slot duration T_{sl} immediately before the UL transmission as described in Clause 4.3.1.2.2. If the channel is sensed to be idle, the UE is expected to transmit the UL transmission, and drop otherwise.

- If the UL transmission would occur after the beginning of a period of duration T_u

  - if the UE has not initiated a channel occupancy in that period as described in Clause 4.3.1.2.2, the UE is expected to drop the transmission;

  - otherwise, if the UE has already initiated a channel occupancy in that period as described in Clause 4.3.1.2.2:

    - if the UE determines that the UL transmission would follow a previous transmission after a gap of at most 16us, the UE is expected to transmit the UL transmission without sensing;

    - otherwise, if the UE determines that the UL transmission would follow a previous transmission, if any, after a gap of more than 16us, the UE is expected to sense the channel for at least a sensing slot duration T_{sl} immediately before the UL transmission as described in Clause 4.3.1.2.2 where the UE is expected to transmit the UL transmission if the channel is sensed to be idle, and drop the UL transmission otherwise.

4.3.1.2.4.2 Cross-period scheduled UL transmissions

The procedures in this clause are applicable when a scheduled UL transmission and the corresponding scheduling DCI or the corresponding RAR transmission are confined within different periods of duration T_x corresponding to the carrier within which the UL transmission is scheduled and regardless of whether they are transmitted on the same carrier or different carriers.

If the UE is indicated that the scheduled UL transmission is associated with a channel occupancy that is initiated by the gNB and the UE is indicated to perform the UL transmission without sensing, the following are applied:

- If the scheduled UL transmission starts after the beginning of a period of duration T_x corresponding to the carrier within which the UL transmission is scheduled and ends before the start of the idle duration corresponding to that period and if the UE has determined that a channel occupancy corresponding to that period is initiated by the gNB as described in Clause 4.3.1.2.1, the UE applies CP extension if applicable and is expected to transmit the scheduled UL transmission without sensing as described in Clause 4.3.1.2.1.

- Otherwise, the UE drops the scheduled UL transmission.

If the UE is indicated that the scheduled UL transmission is associated with a channel occupancy that is initiated by the gNB and the UE is indicated to perform the UL transmission after sensing, the following are applied:

- If the scheduled UL transmission starts after the beginning of a period of duration T_x corresponding to the carrier within which the UL transmission is scheduled and ends before the start of the idle duration corresponding to that period and if the UE has determined that a channel occupancy corresponding to the period is initiated by the gNB as described in Clause 4.3.1.2.1,

  - if the UE determines that the UL transmission follows a previous transmission after a gap of at most 16us, the UE is expected to transmit the UL transmission without sensing. Otherwise, the UE senses the channel for at least a sensing slot duration T_{sl} within a 25μs interval immediately before the scheduled UL transmission as described in Clause 4.3.1.2.1 where the UE is expected to transmit the scheduled UL transmission if the channel is sensed to be idle and drop the scheduled UL transmission otherwise.

- Otherwise, the UE drops the scheduled UL transmission.

If the UE is indicated that the scheduled UL transmission is associated with a channel occupancy that is initiated by the UE the following are applied:

- If the UL transmission would start at the beginning of a period of duration T_u and would end before the start of the idle duration corresponding to that period, the UE is expected to sense the channel for at least a sensing slot

duration T_{sl} immediately before the UL transmission as described in Clause 4.3.1.2.2 where the UE is expected to transmit the UL transmission if the channel is sensed to be idle, and drop the UL transmission otherwise.

- If the UL transmission would start after the beginning of a period of duration T_u and would end before the start of the idle duration corresponding to that period,
  - if the UE has already initiated a channel occupancy in that period as described in Clause 4.3.1.2.2 the following is applied:
    - If the UE determines that the UL transmission follows a previous transmission after a gap of more than 16us, the UE is expected to sense the channel for at least a sensing slot duration T_{sl} immediately before the UL transmission as described in Clause 4.3.1.2.2 where the UE is expected to transmit the UL transmission if the channel is sensed to be idle, and drop otherwise.
    - If the UE determines that the UL transmission follows a previous transmission after a gap of at most 16us, the UE is expected to transmit the UL transmission without sensing.
  - Otherwise, the UE drops the transmission.

4.3.2 Channel access related procedures for UL transmissions

For semi-static channel occupancy, the following channel access procedures for consecutive scheduled UL transmissions are applicable:

- If a UE is scheduled by a gNB to transmit a set of UL transmissions including PUSCH or SRS symbol(s) using a UL grant, the UE shall not apply a CP extension for the remaining UL transmissions in the set after the first UL transmission after accessing the channel.
- If a UE is scheduled to transmit a set of consecutive UL transmissions without gaps including PUSCH using one or more UL grant(s), PUCCH using one or more DL grant(s), or SRS with one or more DL grant(s) or UL grant(s) and the UE transmits one of the scheduled UL transmissions in the set after accessing the channel, the UE may continue transmission of the remaining UL transmissions in the set, if any.

For semi-static channel occupancy, when a UE is provided with higher layer parameter *semiStaticChannelAccessConfigUE* the following are applicable:

- The UE may assume that any scheduled or configured UL transmission(s) within a UL transmission burst is associated with the same channel occupancy that is initiated either by the gNB or by the UE.
- If the UE is scheduled by a DCI to transmit multiple UL transmissions, the UE assumes that the indicated initiator of the associated channel occupancy in the DCI is applied for all the UL transmissions scheduled by the DCI.
- If the UE would transmit a nominal repetition of a PUSCH transmission with repetition type B as described in [8] and the UE has already determined based on the procedures in Clause 4.3.1.2.4 or based on the procedures in Clause 4.3.1.2.3 and/or the above rules in this clause, that the nominal repetition is associated with a channel occupancy that is initiated either by the gNB or by the UE, the followings are applicable:
  - If the UE has already initiated a channel occupancy in a period of duration T_u as described in Clause 4.3.1.2.2 and the nominal repetition would overlap with the idle duration corresponding to that period and if the UE has already determined that the nominal repetition is associated with a channel occupancy that is initiated by the gNB corresponding to a period of duration T_x and if the nominal repetition would overlap with the idle duration corresponding to that period of duration T_x, the UE drops the nominal repetition of the PUSCH transmission.
  - If the UE has already determined that the nominal repetition is associated with a channel occupancy that is initiated by the gNB corresponding to a period of duration T_x and if the nominal repetition overlaps with an idle duration corresponding to that period, all the symbols during the idle duration are considered as invalid symbols as described in [8] and the corresponding actual repetition after the idle period, if any, is dropped.
  - If the UE has already determined that the nominal repetition is associated with a channel occupancy that is initiated by the UE corresponding to a period of duration T_u and if the nominal repetition overlaps with an idle duration corresponding to that period, all the symbols during the idle duration are considered as invalid symbols as described in [8].

- The UE is not expected to transmit a UL transmission(s) that is associated with a channel occupancy initiated by the UE corresponding to a period of duration T_u during the contention-based random access procedures.

4.3.3 Channel access procedures for transmission(s) on multiple channels

For semi-static channel occupancy, if a gNB/UE intends to transmit on a set of channels C a transmission that starts at the same time on the set of channels C, the gNB/UE shall perform channel access on each channel $c_i \in C$, according to the procedures described in clause 4.3.1.1 to 4.3.1.2 when applicable. The following are applicable for the transmission on a channel within the bandwidth of a carrier:

- If the transmission is a UL transmission, the UE may not transmit on channel $c_i \in C$ within the bandwidth of the carrier, if the UE fails to access any of the channels, of the carrier bandwidth, on which the UE is scheduled or configured by UL resources for the UL transmission.

- If the transmission is a UL transmission, the UE may not transmit on a channel within the bandwidth of the carrier if the UE is configured without intra-cell guard band(s) on a UL bandwidth part as described in clause 7 in [8] and if the UE fails to access any of the channels of the UL bandwidth part.

- If the transmission is a nominal repetition of a configured PUSCH transmission with repetition type B as described in [8], the transmission is dropped if the UE determines that the nominal repetition is not associated with a same channel occupancy for all of the channels and the nominal repetition would overlap with an idle duration corresponding to a period of duration T_u and/or a period of duration T_x.

- If the transmission is a DL transmission, the gNB may not transmit on a channel within the bandwidth of the carrier if the gNB configures the carrier without intra-cell guard band(s) on a DL bandwidth part as described in clause 7 in [8] and if the gNB fails to access any of the channels of the DL bandwidth part.

4.4 Channel access procedures for frequency range 2-2

When a gNB is required by regulations to sense a channel(s) for availability for performing transmission(s) on the channel(s) or when a gNB provides UE(s) with higher layer parameters *channelAccessMode2-r17* by SIB1 or dedicated configuration indicating that the channel access procedures would be performed by UE before transmission(s) on a channel(s), the channel access procedures described in this clause for accessing the channel(s) on which the transmission(s) are performed by the gNB/UE(s), are applied.

When a gNB/UE senses a channel for availability to perform DL/UL transmission(s), the channel for sensing includes at least the corresponding active DL/UL bandwidth part(s) for the DL/UL transmission(s).

In this clause, when sensing is applicable, the basic unit to perform sensing is a sensing slot with a duration $T_{sl} = 5\mu s$. The channel is considered to be idle for the sensing slot duration T_{sl} if a gNB or a UE senses the channel during the sensing slot duration and determines that the detected energy after the antenna assembly within the sensing slot duration is less than energy detection threshold X_{Thresh} as described in Clause 4.4.7. Otherwise, the channel is considered busy for the sensing slot duration T_{sl}.

In this clause, a maximum gap among a set of DL or UL transmissions in a DL or UL transmission burst, respectively, is $8\mu s$. For determining a *Channel Occupancy Time*, if a transmission gap is less than or equal to $8\mu s$, the gap duration is counted in the channel occupancy time.

The spatial domain filter for sensing beam(s) during the sensing slot duration at the gNB, or at a UE when the UE does not indicate a capability for beam correspondence without the uplink beam sweeping, or at a UE when the UE uses a different beam for sensing than the beam used for transmission, covers the transmission beam(s) of the intended transmission(s) within the channel occupancy.

If a UE indicates a capability for beam correspondence without the uplink beam sweeping and if the UE selects the same sensing beam(s) as the transmission beam(s), the spatial domain filter for sensing beam is determined as described in Clause 5.1.5 of [8].

If a channel occupancy includes transmission(s) in different beams that are multiplexed in spatial domain, one of the followings is applicable for the corresponding sensing to perform the transmission(s) within the channel occupancy:

- Type 1 channel access procedure as described in Clause 4.4.1 is applied before the start of the channel occupancy using a single sensing beam where the single beam covers all the transmission beams within the

channel occupancy. When the channel is accessed, the transmission(s) within the channel occupancy across different beams can occur.

- Type 1 channel access procedure as described in Clause 4.4.1 is applied before the start of the channel occupancy simultaneously per sensing beam where each sensing beam covers a transmission beam within the channel occupancy. When the channel is accessed, the transmission(s) within the channel occupancy across different beams can occur.

If a channel occupancy includes transmissions in different beams that are multiplexed in time domain, one of the followings is applicable for the corresponding sensing to perform the transmissions within the channel occupancy:

- Type 1 channel access procedure as described in Clause 4.4.1 is applied before the start of the channel occupancy using a single sensing beam where the single beam covers all the transmissions beams within the channel occupancy. When the channel is accessed, the transmissions within the channel occupancy across different beams can occur following the procedures described in Clause 4.4.3.

- When the gNB/UE can perform simultaneous sensing in different beams, Type 1 channel access procedure as described in Clause 4.4.1 is applied before the start of the channel occupancy per sensing beam where each sensing beam covers a transmission beam within the channel occupancy. When the channel is accessed, the transmission within the channel occupancy across different beams can occur following the procedures described in Clause 4.4.3.

- When the gNB/UE can perform simultaneous sensing in different beams, Type 1 channel access procedure as described in Clause 4.4.1 is applied before the start of the channel occupancy per sensing beam where each sensing beam covers a transmission beam within the channel occupancy. When the channel is accessed, the transmission within the channel occupancy can occur following the procedures in Clause 4.4.2 before switching to a different beam within the channel occupancy.

When the gNB intends to transmit a DL transmission(s) across multiple transmission beams, if the gNB performs sensing on the corresponding sensing beam(s) independently, the DL transmission(s) can occur on a transmission beam(s) among the multiple transmission beams if the channel access procedures on the corresponding sensing beam(s) have succeeded, and the channel occupancy would start at the same time across the multiple transmission beams.

When a UE is scheduled by a DCI to transmit a UL transmission(s), the scheduling DCI may indicate the corresponding channel access procedures for the UL transmission(s) as described in [10]. The UE determines based on the DCI if Type 1, or Type 2, or Type 3 channel access procedures described in Clause 4.4.1, Clause 4.4.2 and Clause 4.4.3, respectively, is applicable.

When a UE is scheduled with a set of consecutive UL transmissions, the following are applicable:

- The UE is not expected to be indicated with different channel access types for any consecutive UL transmissions without gaps in between the transmissions.

- If the UE cannot access the channel for a transmission in the set prior to the last transmission according to one of Type 1 or Type 2 channel access procedures, the UE shall attempt to transmit the next transmission according to the channel access type indicated in the corresponding UL grant or DL assignment.

- If a UE is scheduled to transmit a set of consecutive UL transmissions without gaps including PUSCH using one or more UL grant(s), PUCCH using one or more DL grant(s), or SRS with one or more DL grant(s) or UL grant(s) and the UE transmits one of the scheduled UL transmissions in the set after accessing the channel according to one of Type 1, Type 2, or Type 3 channel access procedures, the UE may continue transmission of the remaining UL transmissions in the set, if any.

4.4.1 Type 1 channel access procedures

This clause describes channel access procedures to be performed by a gNB/UE where the time duration spanned by the sensing slots that are sensed to be idle before a transmission(s) is random based on a fixed contention window size. The clause is applicable to any transmission initiating a channel occupancy by the gNB/UE.

The gNB/UE may transmit a transmission after first sensing the channel to be idle during the sensing slot duration of a defer duration T_d and after the counter N is zero in step 4. The counter N is adjusted by sensing the channel for additional sensing slot duration(s) according to the steps below:

1) set $N = N_{init}$, where N_{init} is a random number uniformly distributed between 0 and CW, and go to step 4;

2) if $N > 0$ and the gNB/UE chooses to decrement the counter, set $N = N - 1$;

3) sense the channel for an additional sensing slot duration, and if the channel is idle for the additional sensing slot duration, go to step 4; else, go to step 5;

4) if $N = 0$, stop; else, go to step 2.

5) sense the channel until either it is detected busy within an additional defer duration T_d or it is detected to be idle for the sensing slot of the additional defer duration T_d;

6) if the channel is sensed to be idle during the sensing slot duration of the additional defer duration T_d, go to step 4; else, go to step 5;

If the gNB/UE has not transmitted a transmission after step 4 in the procedure above, the gNB/UE may transmit a transmission on the channel if the channel is sensed to be idle at least in a sensing slot duration T_{sl} immediately before this transmission. If the channel has not been sensed to be idle in a sensing slot duration T_{sl} immediately before this intended transmission, the gNB/UE proceeds to step 1 after sensing the channel to be idle during the sensing slot durations of a defer duration T_d.

In the above procedures, CW is the contention window and $CW = 3$.

The defer duration is $T_d = 8\mu s$ that ends with a sensing slot of a duration $T_{sl} = 5\mu s$ for performing at least a single measurement to determine whether the channel is idle.

A gNB/UE shall not transmit on a channel for a *Channel Occupancy Time* that exceeds $5ms$.

A UE may be scheduled to apply Type 1 channel access procedures for a UL transmission(s) before indicating the corresponding capability. The UE discards the UL transmission(s) if it is not capable of performing Type 1 channel access procedures.

4.4.2 Type 2 channel access procedures

This clause describes channel access procedures to be performed by a gNB/UE where the time duration spanned by sensing slots that are sensed to be idle before a DL/UL transmission(s) is deterministic.

A gNB/UE may transmit a transmission(s) on a channel immediately after T_d that ends with a sensing slot of a duration $T_{sl} = 5\mu s$ for performing at least a single measurement to determine the channel is sensed to be idle.

A UE is not expected to be scheduled to apply Type 2 channel access procedures for a UL transmission(s) before indicating the corresponding capability.

4.4.3 Type 3 channel access procedures

A gNB/UE may transmit a transmission on a channel without sensing the channel.

4.4.4 Channel access procedures in an initiated channel occupancy

If a gNB/UE initiates a channel occupancy using the channel access procedures described in clause 4.4.1 on a channel, the gNB/UE may transmit a DL/UL transmission(s) that is followed by a UL/DL transmission(s) within the maximum *Channel Occupancy Time* described in Clause 4.4.1. The followings are applicable to the UL/DL transmission(s):

- The transmission bandwidth(s) corresponding to the UL/DL transmission(s) shall be within the DL/UL bandwidth part(s) where in the channel occupancy is initiated:

- Regardless of the duration of the gap between the UL/DL transmission(s) and previous DL/UL transmission(s) on the channel, the UL/DL transmission(s) occurs following the procedures described in Clause 4.4.3; or

- if the gap between the UL/DL transmission(s) and previous DL/UL transmission(s) on the channel is more than a threshold that is determined by the gNB and is at least $8\mu s$, the UL/DL transmission(s) occurs following the procedures described in Clause 4.4.2. Otherwise, the UL/DL transmission(s) occurs following the procedures described in Clause 4.4.3.

If a gNB initiates a channel occupancy using the channel access procedures described in clause 4.4.1 on a channel, the gNB may transmit a DL transmission(s) on the channel within the maximum *Channel Occupancy Time* described in Clause 4.4.1 on the channel after the DL transmission(s) initiating the channel occupancy. The followings are applicable to the DL transmission(s):

- Regardless of the duration of the gap between the DL transmission(s) and any previous transmission(s) corresponding to the channel occupancy initiated by the gNB, the DL transmission(s) occurs following the procedures described in Clause 4.4.3; or
- if the gap between the DL transmission(s) and any previous transmission(s) corresponding to the channel occupancy initiated by the gNB is more than a threshold that is determined by the gNB and is at least $8\mu s$, the DL transmission(s) occurs following the procedures described in Clause 4.4.2.

If a gNB shares a channel occupancy initiated by a UE using the channel access procedures described in clause 4.4.1 on a channel, the gNB may transmit a transmission on the channel that follows a scheduled UL transmission or a configured PUSCH transmission by the UE if the following conditions are satisfied:

- The DL transmission shall contain transmission to the UE that initiated the channel occupancy and can include non-unicast and/or unicast transmissions where any unicast transmission that includes user plane data is only transmitted to the UE that initiated the channel occupancy.

When a UE is provided *cg-COT-SharingList-r17* by higher layers, the UE is configured with a table wherein each row is given by higher layer parameter *CG-COT-Sharing-r17*. One row of the table is configured for indicating that the channel occupancy sharing is not available and other rows of the table each provides a channel occupancy sharing information. In this case, each configured grant PUSCH transmission includes 'COT sharing information' in CG-UCI as described in [10] that indicates a row index to the table.

If a gNB shares a channel occupancy initiated by a UE using configured grant PUSCH transmission and the UE is configured by *cg-COT-SharingList-r17*, the gNB may transmit a transmission that follows the configured grant PUSCH transmission by the UE if the following conditions are satisfied:

- If the gNB determines that the 'COT sharing information' in CG-UCI in slot *n* indicates a row index that corresponds to a *CG-COT-Sharing-r17* that provides channel occupancy sharing information, the gNB can share the UE channel occupancy starting from slot $n + O$, where $O = offset\text{-}r17$ slots, for a duration of $D = duration\text{-}r17$ slots where *duration-r17*, and *offset-r17* are higher layer parameters provided by *CG-COT-Sharing-r17*.

4.4.5 Exempted transmissions from sensing

In regions where channel sensing is required to access a channel for transmission and short control signalling exemption is allowed by regulation, a gNB/UE may transmit the following transmission(s) on a channel without sensing the channel:

- Transmission(s) of the discovery burst by the gNB
- If the higher layer parameter *ra-ChannelAccess-r17* is not configured, transmission(s) of the first message in a random access procedure by the UE

When the gNB/UE transmits the above transmission(s) without sensing on a channel by utilizing the exemption above, the total duration of such transmission(s) by the gNB/UE shall not occupy the corresponding channel more than $10ms$ over any $100ms$ interval.

4.4.6 Channel access procedures for transmission(s) on multiple channels or beams

When a gNB/UE intends to transmit a transmission(s) that starts at the same time on a set of channels C, the gNB/UE performs the channel access procedures described in Clause 4.4.1 on each channel $c_i \in C$ independently. When the channel access procedures in Clause 4.4.1 are applied on any channel $c_i \in C$, the corresponding counter N in step 1 shall be initialized independently and the corresponding sensing on the channel c_i shall be performed after the end of any previous transmission(s) by the gNB/UE occupying any channel $c_j \in C$.

When a gNB/UE intends to transmit a transmission(s) that starts at the same time across multiple transmission beams, if the gNB/UE performs sensing on the corresponding sensing beam(s) independently, the gNB/UE performs the channel

access procedures described in Clause 4.4.1 on each sensing beam independently. When the channel access procedures in Clause 4.4.1 are applied on any sensing beam, the corresponding counter N in step 1 shall be initialized independently and the corresponding sensing on the sensing beam shall be performed after the end of any previous transmission(s) by the gNB/UE occupying any beam.

4.4.7 Energy detection threshold adaptation procedures

A gNB/UE accessing a channel on which transmission(s) on beam(s) are performed within a channel occupancy, shall set the energy detection threshold X_{Thresh} to be less than or equal to the maximum energy detection threshold $X_{\text{Thresh\_max}}$ that is determined as follows:

$$X_{\text{Thresh\_max}} = -80dBm + P_{max} - P_{out} + 10 \cdot log\,10(BW)$$

where:

- P_{max} is the RF output power limit in dBm.
- P_{out} is the maximum EIRP of the intended transmission(s) by the gNB/UE to acquire a channel occupancy in dBm where $P_{out} \leq P_{max}$. The maximum EIRP used for the transmission(s) by the initiating gNB/UE during the channel occupancy is limited to P_{out}.
- BW is the channel bandwidth in MHz.

4.5 Sidelink channel access procedures

A UE operating in sidelink resource allocation mode 1 or mode 2 and performing SL transmission(s) on channel(s) shall perform the procedures described in this clause for the UE to access the channel(s) on which the transmission(s) are performed.

In this clause, transmissions from a UE are considered as separate SL transmissions, irrespective of having a gap between transmissions or not, and X_{Thresh} for sensing is adjusted as described in clause 4.5.5 when applicable.

A UE can access a channel on which SL transmission(s) are performed according to one of Type 1 or Type 2 SL channel access procedures as described in clauses 4.5.1 and 4.5.2, respectively.

When a UE applies Type 1 channel access procedures to transmit SL transmission(s), the applicable channel access priority class (CAPC) is defined in Table 4.5-1.

When a UE applies Type 1 channel access procedures to transmit SL transmission(s) including PSSCH with user plane data and associated PSCCH, the UE determines the corresponding SL channel access priority class p in Table 4.5-1 following the procedures described in Clause 16.9.9.2 in [9].

When a UE applies Type 1 channel access procedures to transmit SL transmission(s) including PSFCH or S-SSB transmission(s), the applicable channel access priority class for the PSFCH and S-SSB is $p = 1$ in Table 4.5-1.

A UE shall not transmit on a channel for a *Channel Occupancy Time* that exceeds $T_{slm\ cot,p}$ where the channel access procedure is performed based on the channel access priority class p associated with the UE transmissions, as given in Table 4.5-1.

When a UE applies Type 1 channel access procedure or multi-channel access procedure to initiate a channel occupancy for multiple SL transmissions over one slot or multiple consecutive slots, the highest CAPC value among the associated CAPC values with the multiple SL transmissions is used for performing the Type 1 channel access procedure or multi-channel access procedure.

If a UE fails to access the channel(s) prior to an intended SL transmission(s), Layer 1 notifies higher layers about the channel access failure and the channel(s) that the UE fails to access.

Table 4.5-1: Channel Access Priority Class (CAPC) for SL

Channel Access Priority Class (p)	m_p	$CW_{min,p}$	$CW_{max,p}$	$T_{slm\,cot,p}$	allowed CW_p sizes
1	2	3	7	2 ms	{3,7}
2	2	7	15	4 ms	{7,15}
3	3	15	1023	6ms or 10 ms	{15,31,63,127,255,511,1023}
4	7	15	1023	6ms or 10 ms	{15,31,63,127,255,511,1023}
NOTE1: For $p = 3,4$, $T_{slm\,cot,p} = 10ms$ if the higher layer parameter *absenceOfAnyOtherTechnology-r18* is provided, otherwise, $T_{slm\,cot,p} = 6ms$.					
NOTE 2: When $T_{slm\,cot,p} = 6ms$ it may be increased to $8ms$ by inserting one or more gaps. The minimum duration of a gap shall be $100\mu s$. The maximum duration before including any such gap shall be $6ms$.					

For contiguous SL transmission(s), the following are applicable:

- If a UE is scheduled or autonomous selected to transmit a set of SL transmissions using one or more selected SL grant(s), and
  - if the UE cannot access the channel for a transmission in the set prior to the last transmission according to Type 1 or Type 2A SL channel access procedures, the UE shall attempt to transmit the next transmission according to Type 1 or Type 2A SL channel access procedures.
  - if the UE cannot access the channel for a transmission in the set prior to the last transmission according to Type 2B SL channel access procedure, the UE shall attempt to transmit the next transmission according to Type 2A SL channel access procedure.

For SL transmission(s) with multiple starting positions in a slot, the following are applicable:

- If a UE intends to transmit PSCCH/PSSCH in sidelink resource allocation mode 1 or mode 2 using a Type 1 SL channel access procedure, and if the UE cannot access the channel for the transmission from the 1st starting symbol of a slot, the UE shall attempt to transmit PSCCH/PSSCH from the 2nd starting symbol in the same slot according to Type 1 SL channel access procedure. There is no limit on the number of attempts the UE can make using Type 1 SL channel access procedure.
- If a UE intends to transmit PSCCH/PSSCH in sidelink resource allocation mode 1 or mode 2 using a Type 2 SL channel access procedure, and if the UE cannot access the channel for the transmission from the 1st starting symbol of a slot, the UE shall attempt to transmit PSCCH/PSSCH from the 2nd starting symbol in the same slot and according to Type 2A SL channel access procedure.

4.5.1 Type 1 SL channel access procedure

This clause describes channel access procedures by a UE where the time duration spanned by the sensing slots that are sensed to be idle before a SL transmission(s) is random. The clause is applicable to the SL transmission(s) including at least any of PSSCH/PSCCH or PSFCH or S-SSB.

A UE may transmit the transmission using Type 1 channel access procedure after first sensing the channel to be idle during the sensing slot durations of a defer duration T_d, and after the counter N is zero in step 4. The counter N is adjusted by sensing the channel for additional sensing slot duration(s) according to the steps described below.

1) set $N = N_{init}$, where N_{init} is a random number uniformly distributed between 0 and CW_p, and go to step 4;
2) if $N > 0$ and the UE chooses to decrement the counter, set $N = N - 1$;
3) sense the channel for an additional sensing slot duration, and if the additional sensing slot duration is idle, go to step 4; else, go to step 5;
4) if $N = 0$, stop; else, go to step 2.
5) sense the channel until either a busy sensing slot is detected within an additional defer duration T_d or all the sensing slots of the additional defer duration T_d are detected to be idle;

6) if the channel is sensed to be idle during all the sensing slot durations of the additional defer duration T_d, go to step 4; else, go to step 5;

If a UE has not transmitted a SL transmission on a channel on which SL transmission(s) are performed after step 4 in the procedure above, the UE may transmit a transmission on the channel, if the channel is sensed to be idle at least in a sensing slot duration T_{sl} when the UE is ready to transmit the transmission and if the channel has been sensed to be idle during all the sensing slot durations of a defer duration T_d immediately before the transmission. If the channel has not been sensed to be idle in a sensing slot duration T_{sl} when the UE first senses the channel after it is ready to transmit, or if the channel has not been sensed to be idle during any of the sensing slot durations of a defer duration T_d immediately before the intended transmission, the UE proceeds to step 1 after sensing the channel to be idle during the sensing slot durations of a defer duration T_d.

The defer duration T_d consists of duration $T_f = 16\mu s$ immediately followed by m_p consecutive sensing slot durations where each sensing slot duration is $T_{sl} = 9\mu s$, and T_f includes an idle sensing slot duration T_{sl} at start of T_f.

$CW_{min,p} \leq CW_p \leq CW_{max,p}$ is the contention window. CW_p adjustment is described in clause 4.5.4.

$CW_{min,p}$ and $CW_{max,p}$ are chosen before step 1 of the procedure above.

m_p, $CW_{min,p}$, and $CW_{max,p}$ are based on a channel access priority class p as shown in Table 4.5-1.

If a UE transmits S-SSB(s) as described in clause 4.5.2 when $N > 0$ in the procedure above, the UE shall not decrement N during the sensing slot duration(s) overlapping with the S-SSB(s).

4.5.2 Type 2 SL channel access procedure

This clause describes channel access procedures by UE where the time duration spanned by the sensing slots that are sensed to be idle before a SL transmission(s) is deterministic.

Type 2A SL channel access procedure as described in clause 4.5.2.1 is applicable to the following transmission(s) performed by a UE:

- If a UE intends to transmit a SL transmission at least $25\mu s$ after a SL transmission by another UE in a shared channel occupancy as described in clause 4.5.3, the UE uses Type 2A SL channel access procedures for the SL transmission.
- If a UE intends to transmit only S-SSB in transmission(s) where the time duration of S-SSB transmission(s) is at most $1ms$ with a duty cycle of at most $1/20$, the UE uses Type 2A SL channel access procedures for the SL transmission(s).
- When a UE initiates a channel occupancy on a channel to transmit SL transmission(s) within the channel occupancy, if the UE stops transmitting on the channel, the UE can resume SL transmission(s) within the channel occupancy on the channel after performing Type 2A SL channel access procedures as described in clause 4.5.2.1 if the UE continuously senses the channel to be idle before resuming transmission.

Type 2B or Type 2C SL channel access procedures as described in clauses 4.5.2.2 and 4.5.2.3, respectively, are applicable to the transmission(s) performed by a UE following transmission(s) by a UE after a gap of $16\mu s$ or up to $16\mu s$, respectively, in a shared channel occupancy as described in clause 4.5.3.

4.5.2.1 Type 2A SL channel access procedure

When a UE uses Type 2A SL channel access procedures for a transmission, the UE may transmit the transmission immediately after sensing the channel to be idle for at least a sensing interval $T_{\text{short\_sl}} = 25\mu s$. The interval $T_{\text{short\_sl}}$ consists of a duration $T_f = 16\mu s$ immediately followed by one sensing slot and T_f includes a sensing slot at start of T_f. The channel is considered to be idle for $T_{\text{short\_sl}}$ if both sensing slots of $T_{\text{short\_sl}}$ are sensed to be idle.

4.5.2.2 Type 2B SL channel access procedure

When a UE uses Type 2B SL channel access procedures for a transmission, the UE may transmit the transmission immediately after sensing the channel to be idle within a duration of $T_f = 16\mu s$. T_f includes a sensing slot that occurs

within the last $9us$ of T_f. The channel is considered to be idle within the duration T_f if the channel is sensed to be idle for total of at least $5us$ with at least $4us$ of sensing occurring in the sensing slot.

4.5.2.3 Type 2C SL channel access procedure

When a UE uses Type 2C SL channel access procedures for a transmission, the UE does not sense the channel before the transmission. The duration of the corresponding SL transmission is at most $584us$.

4.5.3 SL channel access procedures in a shared channel occupancy

When a UE initiates a channel occupancy using the channel access procedures described in clause 4.5.1 or clause 4.5.6.3 on a channel(s) to transmit SL transmission(s) including PSCCH/PSSCH(s), the UE can provide a channel occupancy sharing information in SL control information that includes at least the Layer 1 source and destination IDs, the corresponding channel access priority class, the remaining channel occupancy duration, and the frequency domain information for the applicable RB set(s) of the channel occupancy. The channel occupancy sharing information can also include additional IDs and associated cast type. The additional IDs includes one pair of Layer 1 source and destination IDs for all cast types, where the source ID is set to the source ID of the UE initiating channel occupancy for unicast and to the reserved bits for groupcast and broadcast. The channel occupancy sharing information transmitted in slot n indicates the remaining channel occupancy duration in a number of physical slot(s) K. If $K = 0$, the initiated channel occupancy by the UE shall not be shared for SL transmission(s) by other UE(s). Otherwise, the initiated channel occupancy by the UE can be shared for SL transmission(s) by other UE(s) within a duration starting $T_{proc,0}^{SL}$ from the end of slot n and ending at slot $n + K$.

For the case when a UE transmits SL transmission(s) in a shared channel occupancy initiated by another UE, the channel access priority class value corresponding to the SL transmission(s) is at most equal to the channel access priority class value provided by the channel access priority class in the channel occupancy sharing information.

For the case when a UE receives channel occupancy sharing information, the processing time is $T_{proc,0}^{SL}$ as defined by Table 8.1.4-1 in [8, TS 38.214], and the processing time starts from the end of the slot that carries channel occupancy sharing information.

When a UE initiates a channel occupancy to transmit SL transmission(s) within a RB set(s) and provides channel occupancy sharing information with a unicast PSCCH/PSSCH transmission within the RB set(s), another UE may transmit unicast PSCCH/PSSCH transmission(s) sharing the initiated channel occupancy within the RB set(s), if the destination and source IDs in the corresponding SL control information match the source and destination IDs, respectively, in the unicast PSCCH/PSSCH transmission carrying the channel occupancy sharing information or match a pair of additional source and destination IDs and associated cast type if provided by the channel occupancy sharing information and the corresponding COT sharing cast type indicates '10' value for unicast cast type. Another UE may transmit groupcast or broadcast PSCCH/PSSCH transmissions sharing the initiated channel occupancy within the RB set(s), if the destination ID in the corresponding SL control information matches an additional destination ID and associated cast type if provided by the channel occupancy sharing information and the corresponding COT sharing cast type indicates '01' or '00' value for groupcast or broadcast cast type, respectively.

When a UE initiates a channel occupancy to transmit SL transmission(s) within a RB set(s) and provides channel occupancy sharing information with a groupcast or broadcast PSCCH/PSSCH transmission within the RB set(s), another UE may transmit a groupcast or broadcast PSCCH/PSSCH transmission(s) sharing the initiated channel occupancy within the RB set(s), if the destination ID in the corresponding SL control information matches the destination ID in the groupcast or broadcast PSCCH/PSSCH transmission carrying the channel occupancy sharing information or matches an additional destination ID and associated cast type if provided by the channel occupancy sharing information and the corresponding COT sharing cast type indicates '01' or '00' value for groupcast or broadcast cast type, respectively. Another UE may transmit unicast PSCCH/PSSCH transmissions sharing the initiated channel occupancy within the RB set(s), if the destination and source IDs in the corresponding SL control information match a pair of additional source and destination IDs and associated cast type if provided by the channel occupancy sharing information and the corresponding COT sharing cast type indicates '10' value for unicast cast type.

When a UE initiates a channel occupancy to transmit SL transmission(s) within a RB set(s) and provides channel occupancy sharing information with a PSSCH/PSCCH transmission within the RB set(s), another UE may transmit a S-SSB transmission(s) sharing the initiated channel occupancy within the RB set(s).

When a UE initiates a channel occupancy to transmit SL transmission(s) within a RB set(s) and provides channel occupancy sharing information with a unicast PSCCH/PSSCH transmission within the RB set(s), for a given PSFCH transmission occasion, another UE may transmit PSFCH(s) within the RB set(s) sharing the initiated channel occupancy

using the channel access procedures described in clause 4.5.2, if for at least one PSFCH in the given transmission occasion, the source and destination IDs in the corresponding unicast PSCCH/PSSCH's SL control information match the source and destination IDs, respectively, in the unicast PSCCH/PSSCH transmission carrying the channel occupancy sharing information or match a pair of additional source and destination IDs and associated cast type if provided by the channel occupancy sharing information and the corresponding COT sharing cast type indicates '10' value for unicast cast type.

When a UE initiates a channel occupancy to transmit SL transmission(s) within a RB set(s) and provides channel occupancy sharing information with a groupcast PSCCH/PSSCH transmission within the RB set(s), for a given PSFCH transmission occasion, another UE may transmit PSFCH(s) within the RB set(s) sharing the initiated channel occupancy using the channel access procedures described in clause 4.5.2, if for at least one PSFCH in the given transmission occasion, the source and destination ID in the corresponding groupcast PSCCH/PSSCH's SL control information matches the source and destination ID in the groupcast PSCCH/PSSCH transmission carrying the channel occupancy sharing information. For a given PSFCH transmission occasion, another UE may transmit PSFCH(s) within the RB set(s) sharing the initiated channel occupancy using the channel access procedures described in clause 4.5.2, if for at least one PSFCH in the given transmission occasion, the source and destination IDs in the corresponding unicast PSCCH/PSSCH's SL control information match a pair of additional source and destination IDs and associated cast type if provided by the channel occupancy sharing information and the corresponding COT sharing cast type indicates '10' value for unicast cast type.

If a UE shares a channel occupancy initiated by another UE using the channel access procedures described in clause 4.5.1 on a channel to transmit SL transmission(s), the UE may transmit a SL transmission that follows the SL transmission by the UE that has initiated the channel occupancy after a transmission gap as follows:

- If the transmission gap is at least $25\mu s$, the UE can transmit the SL transmission on the channel after performing Type 2A channel access procedures as described in clause 4.5.2.1.
- If the transmission gap is $16\mu s$, the UE can transmit the SL transmission on the channel after performing Type 2B channel access procedures as described in clause 4.5.2.2.
- If the transmission gap is up to $16\mu s$, the UE can transmit the SL transmission on the channel after performing Type 2C channel access as described in clause 4.5.2.3.

When a UE uses channel access procedures to initiate a channel occupancy to transmit SL transmission(s) and shares the corresponding channel occupancy with another UE that transmits a SL transmission(s), the UE that has initiated the channel occupancy may transmit a SL transmission(s) within its channel occupancy that follows the SL transmission(s) from the other UE, as the following.

- If the UE determines a transmission gap from the other UE's SL transmission(s), the followings are applicable:
  - If the transmission gap is at least $25\mu s$, the UE can transmit the SL transmission on the channel after performing Type 2A channel access procedures as described in clause 4.5.2.1.
  - If the transmission gap is $16\mu s$, the UE can transmit the SL transmission on the channel after performing Type 2B channel access procedures as described in clause 4.5.2.2.
  - If the transmission gap is up to $16\mu s$, the UE can transmit the SL transmission on the channel after performing Type 2C channel access as described in clause 4.5.2.3.
- Otherwise, the UE can transmit the SL transmission on the channel after performing Type 2A channel access procedures as described in clause 4.5.2.1.

When a UE initiates a channel occupancy using the channel access procedures described in clause 4.5.6.3 to transmit SL transmission(s) on a set of channels, the channel occupancy can be shared with other UEs when the initiating UE transmits PSCCH/PSSCH in the SL transmission(s), and the channel occupancy time of each channel(s) is the same.

4.5.4 Contention window adjustment procedures for SL transmissions

If a UE transmits a SL transmission(s) including at least one PSSCH enabled with explicit HARQ-ACK feedback including 'ACK/NACK' using Type 1 channel access procedures associated with the channel access priority class p on a channel, the UE maintains the contention window value CW_p and adjusts CW_p before step 1 of the procedure described in clause 4.5.1 for the SL transmission(s) applying the following procedures:

1) For every priority class $p \in \{1,2,3,4\}$, set $CW_p = CW_{min,p}$.

2) If HARQ-ACK feedback corresponding to the PSSCH(s) for unicast SL transmission(s) in the *reference duration* for the latest channel occupancy initiated by the UE, is available:

   - If the HARQ-ACK feedback includes only 'ACK', go to step 1; otherwise go to step 5.

3) If HARQ-ACK feedback corresponding to the PSSCH(s) for groupcast SL transmission(s) in the *reference duration* for the latest channel occupancy initiated by the UE, is available:

   - If *harq-ACK-FeedbackRatioforCW-AdjustmentGC-Option2-r18* is provided by higher layers:

     - The UE calculates the ratio between the number of received 'ACK' in the HARQ-ACK feedback and the number of UE(s) from which the corresponding 'ACK'/'NACK' in the HARQ-ACK feedback is expected. If the calculated ratio is equal to or larger than *harq-ACK-FeedbackRatioforCW-AdjustmentGC-Option2-r18*, go to step 1; otherwise go to step 5.

   - Otherwise:

     - If the HARQ-ACK feedback includes at least an 'ACK', go to step 1; otherwise go to step 5.

4) If HARQ-ACK feedback corresponding to the PSSCH(s) in the *reference duration* for the latest channel occupancy initiated by the UE is not available or *reference duration* for the latest channel occupancy initiated by the UE is not available, go to step 6.

5) Increase CW_p for every priority class $p \in \{1,2,3,4\}$ to the next higher allowed value.

6) For every priority class $p \in \{1,2,3,4\}$, maintain CW_p as it is; go to step 2.

The *reference duration* in the procedure above is defined as follows:

- The *reference duration* corresponding to a channel occupancy initiated by the UE including SL transmission(s) of PSSCH(s) is defined in this clause as a duration starting from the beginning of the channel occupancy initiated by the UE including SL transmission (s) of PSSCH(s) until the end of the first slot where at least one PSSCH with HARQ-ACK feedback(s) including 'ACK'/'NACK' is transmitted.

If a UE transmits a SL transmission(s) using Type 1 channel access procedures associated with the channel access priority class p on a channel and the SL transmission(s) is not associated with explicit HARQ-ACK feedback(s) by the corresponding UE(s), the UE adjusts CW_p before step 1 in the procedures described in clause 4.5.1, using the latest CW_p used for any SL transmissions on the channel using Type 1 channel access procedures associated with the channel access priority class p. If the corresponding channel access priority class p has not been used for any SL transmissions on the channel, $CW_p = CW_{min,p}$ is used. For the channel, if the latest $CW_p \neq CW_{max,p}$ value is consecutively used for X times provided by higher layers parameter *sl-CWS-ForPsschWithoutHarqAck-r18* for generation of N_{init} as described in clause 4.5.1 for PSSCH transmission(s) without associated explicit HARQ-ACK feedback(s), the CW_p is increased for every priority class $p \in \{1,2,3,4\}$ to the next higher allowed value.

The following applies to the procedures described in this clause for contention window adjustment:

- If $CW_p = CW_{max,p}$, the next higher allowed value for adjusting CW_p is $CW_{max,p}$.

- If the $CW_p = CW_{max,p}$ is consecutively used K times for generation of N_{init}, CW_p is reset to $CW_{min,p}$ only for that priority class p for which $CW_p = CW_{max,p}$ is consecutively used K times for generation of N_{init}. K is selected by UE from the set of values {1, 2, …,8} for each priority class $p \in \{1,2,3,4\}$.

4.5.5 Energy detection threshold adaptation procedure

A UE accessing a channel on which SL transmission(s) are performed, shall set the energy detection threshold (X_{Thresh}) to be less than or equal to the maximum energy detection threshold $X_{\text{Thresh\_max}}$.

$X_{\text{Thresh\_max}}$ is determined as follows:

- If the UE is configured with higher layer parameter *sl-MaxEnergyDetectionThreshold-r18*,

  - $X_{\text{Thresh\_max}}$ is set equal to the value signalled by the higher layer parameter;

- otherwise

- the UE shall determine $X'_{\text{Thresh\_max}}$ according to the procedure described in clause 4.5.5.1;
- if the UE is configured with higher layer parameter *sl-EnergyDetectionThresholdOffset-r18*
  - $X_{\text{Thresh\_max}}$ is set by adjusting $X'_{\text{Thresh\_max}}$ according to the offset value signalled by the higher layer parameter;
- otherwise
  - the UE shall set $X_{\text{Thresh\_max}} = X'_{\text{Thresh\_max}}$.

If the higher layer parameter *absenceOfAnyOtherTechnology-r18* is not configured to a UE, the UE that performs channel access procedures to initiate a channel occupancy to be shared to other UE(s), and another UE that shares the initiated channel occupancy as described in clause 4.5.3 shall use the (pre-)configured *ue-ToUE-COT-SharingED-Threshold-r18* for accessing the channel(s).

For the case where a UE performs channel access procedures as described in clause 4.5.1 for SL transmission(s) and indicates channel occupancy sharing information, X_{Thresh_max} is set equal to the value provided by the higher layer parameter *ue-ToUE-COT-SharingED-Threshold-r18*.

4.5.5.1 Default maximum energy detection threshold computation procedure

If the higher layer parameter *absenceOfAnyOtherTechnology-r18* is provided

- $X'_{\text{Thresh\_max}} = min\begin{Bmatrix} T_{max} + 10\text{dB} \\ X_r \end{Bmatrix}$ where
  - X_r is Maximum energy detection threshold defined by regulatory requirements in dBm when such requirements are defined, otherwise $X_r = T_{max} + 10dB$

otherwise

- $X'_{\text{Thresh\_max}} = max\begin{Bmatrix} X_{reg} \\ \min\begin{Bmatrix} T_{\max}, \\ T_{\max} - T_A + (P_H + 10 \cdot log\,10(BWMHz\,/20MHz) - P_{TX}) \end{Bmatrix} \end{Bmatrix}$

where

In regulatory regions and bands where it is allowed,

- $X_{reg} = -67 + 10 \cdot log\,10(BWMHz\,/20MHz)\,dBm$;
- T_A=5dB for all transmissions;
- $P_H = 23dBm$;

Otherwise,

- $X_{reg} = -72 + 10 \cdot log\,10(BWMHz\,/20MHz)dBm$;
- $T_A = 5dB$ if Type 2A SL channel access procedures is performed for a SL transmission(s) that initiates a channel occupancy and includes only S-SSB as described in clause 4.5.2; otherwise $T_A = 10dB$;
- $P_H = 23dBm$ or in regions and bands where regulations allow, $24dBm$;

- P_{TX} is set to the value of $P_{CMAX\_H,f,c}$ as defined in [12];
- $T_{\max}$(dBm)= $10 \cdot log\,10\,(3.16228 \cdot 10^{-8}(mW/MHz) \cdot BWMHz\,(MHz))$;
  - $BWMHz$ is the single channel bandwidth in MHz.

The higher layer parameter *absenceOfAnyOtherTechnology-r18* is not expected to be provided if the channel(s) where UE performing SL transmission(s) is overlapped with either an LAA Scell(s) on channel(s) or channel(s) where gNB/UE performing DL/UL transmission(s).

4.5.6 Channel access procedures for transmission(s) on multiple channels

If a UE

- is scheduled to transmit on a set of channels *C*, and if the SL transmissions are scheduled to start transmissions at the same time on all channels in the set of channels *C*, or
- intends to perform sidelink transmissions on configured resources on the set of channels *C*, and if the SL transmissions are configured to start transmissions at the same time on all channels in the set of channels *C*, or
- intends to perform sidelink transmissions on selected resources on the set of channel *C*, and if SL transmissions are to start at the same time on all channels in the set of channels *C*

the followings are applicable:

- Type A or Type B procedures described in clause 4.5.6.1 and 4.5.6.2 can be used for accessing multiple channels only for PSFCH or S-SSB transmissions.
- A UE can access multiple channels on which SL transmissions are performed, according to the procedures described in clause 4.5.6.3.

When a UE performs Type A or Type B channel access procedures to transmit PSFCH transmissions on multiple channels after performing associated prioritization for the PSFCH as described in clauses 16.2.3, 16.2.4.2 and 16.2.4.3 of [7], if the channel access procedures fail on part of the channel(s) but succeed on other part of the channel(s), the UE may transmit the PSFCH transmission(s) on the part of the channel(s) where the corresponding channel access was successful.

4.5.6.1 Type A multi-channel access procedures for PSFCH or S-SSB transmissions

The procedures described in this clause are applicable for PSFCH/S-SSB transmissions.

A UE shall perform channel access on each channel $c_i \in C$, according to the procedures described in clause 4.5.1, where C is a set of channels on which the UE intends to transmit, and $i = 0,1, \ldots q-1$, and q is the number of channels on which the UE intends to transmit.

The counter N described in clause 4.5.1 is determined for each channel c_i and is denoted as N_{c_i}. N_{c_i} is maintained according to clause 4.5.6.1.1 or 4.5.6.1.2.

4.5.6.1.1 Type A1 multi-channel access procedures

Counter N as described in clause 4.5.1 is independently determined for each channel c_i and is denoted as N_{c_i}.

If the absence of any other technology sharing the channel cannot be guaranteed on a long term basis (e.g. by level of regulation), when the UE ceases transmission on any one channel $c_j \in C$, for each channel $c_i \neq c_j$, the UE can resume decrementing N_{c_i} when idle sensing slots are detected either after waiting for a duration of $4 \cdot T_{sl}$, or after reinitializing N_{c_i}, for performing channel access procedures, respectively.

4.5.6.1.2 Type A2 multi-channel access procedures

Counter N is determined as described in clause 4.5.1 for channel $c_j \in C$, and is denoted as N_{c_j}, where c_j is the channel that has the largest CW_p value. For each channel c_i, $N_{c_i} = N_{c_j}$.

When the UE ceases the PSFCH or S-SSB transmissions, on any one channel for which N_{c_i} is determined, the UE shall reinitialize N_{c_i} for all channels, respectively.

4.5.6.2 Type B multi-channel access procedures for PSFCH or S-SSB transmissions

The procedures described in this clause are applicable for PSFCH/S-SSB transmissions.

A channel $c_j \in C$ is selected by the UE as follows:

- the UE selects c_j by uniformly randomly choosing c_j from C before each transmission on multiple channels $c_i \in C$, or

- the UE selects c_j no more frequently than once every 1 second,

where C is a set of channels on which the UE intends to transmit, $i = 0,1, \ldots q-1$, and q is the number of channels on which the UE intends to transmit PSFCH or S-SSB transmissions.

To transmit on channel c_j

- the UE shall perform channel access on channel c_j according to the procedures described in clause 4.5.1 with the modifications described in clause 4.5.6.2.1 or 4.5.6.2.2, for accessing the channel to perform PSFCH or S-SSB transmissions.

To transmit on channel $c_i \neq c_j$, $c_i \in C$

- for each channel c_i, the UE shall sense the channel c_i for at least a sensing interval $T_{\text{mc}} = 25\mu s$ immediately before transmitting on channel c_j, and the UE may transmit on channel c_i immediately after sensing the channel c_i to be idle for at least the sensing interval T_{mc}, for accessing the channel to perform PSFCH or S-SSB transmissions. The channel c_i is considered to be idle for T_{mc} if the channel is sensed to be idle during all the time durations in which such idle sensing is performed on the channel c_j in given interval T_{mc}.

The UE shall not transmit a transmission on a channel $c_i \neq c_j$, $c_i \in C$, for a period exceeding $T_{m\,cot,p}$ as given in Table 4.5-1, where the value of $T_{m\,cot,p}$ is determined using the channel access parameters used for channel c_j, for accessing the channel to perform PSFCH or S-SSB transmissions.

For the procedures in this clause, the channels of the set of channels C selected by the UE for PSFCH transmissions, is a subset of channels that include the RB sets in the (pre-)configured sidelink resource pool.

For the procedures in this clause, the channels of the set of channels C selected by the UE for S-SSB transmissions, is a subset of the RB sets including (pre-)configured S-SSB resources in the sidelink BWP.

4.5.6.2.1 Type B1 multi-channel access procedure

A single CW_p value is maintained for the set of channels C.

4.5.6.2.2 Type B2 multi-channel access procedure

A CW_p value is maintained independently for each channel $c_i \in C$ using the procedure described in clause 4.5.4.

For determining N_{init} for channel c_j, CW_p value of channel $c_{j1} \in C$ is used, where c_{j1} is the channel with largest CW_p among all channels in set C.

4.5.6.3 Multi-channel access procedures for SL transmissions

The procedures described in this clause are applied for PSCCH/PSSCH/S-SSB transmission(s) and may be applied for PSFCH transmission.

A UE can access multiple channels on which SL transmissions are performed, according to the procedures described in this clause.

If a UE intends to transmit SL transmissions on a set of channels C, the following is applicable:

- if Type 1 channel access procedure is used for SL transmissions on the set of channels C,

  - the UE may transmit on channel $c_i \in C$ using Type 2A channel access procedure as described in clause 4.5.2.1,

    - if Type 2A channel access procedure is performed on channel c_i immediately before the UE transmission on channel $c_j \in C$, $i \neq j$, and

    - if the UE has accessed channel c_j using Type 1 channel access procedure as described in clause 4.5.1,

- where channel c_j is selected by the UE uniformly randomly from the set of channels C before performing Type 1 channel access procedure on any channel in the set of channels C.

- the UE may transmit on channel $c_i \in C$ using Type 1 channel access procedure as described in clause 4.5.1.

- the UE may not transmit on channel $c_i \in C$ within the bandwidth of a carrier, if the UE fails to access any of the channels, of the carrier bandwidth, on which the UE is scheduled or configured with or selects SL resources.

- the UE may not transmit on a channel within the bandwidth of a carrier if the UE is configured without intra-cell guard band(s) on an SL bandwidth part as described in clause 7 of [8], and the UE fails to access any of the channels of the SL bandwidth part.

A CW_p value is maintained independently for each channel $c_i \in C$ using the procedure described in clause 4.5.4. For determining CW_p for channel c_i, any PSSCH transmission that fully or partially overlaps with any channel $c_i \in C$ is used in the procedures described in clause 4.5.4.

After a UE successfully performs a multi-channel access procedure for a set of channels C, a channel occupancy is initiated for the set of channels and the UE can use the initiated channel occupancy for own subsequent transmissions (including any of S-SSB, PSFCH or PSCCH/PSSCH).

The UE shall not transmit a transmission on a channel $c_i \in C$, for a period exceeding $T_{m\,cot,p}$ as given in Table 4.5-1, where the value of $T_{m\,cot,p}$ is determined using the channel access parameters used for channel c_j, for accessing the channel.

Annex X (Informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2018-04	RAN1#92bis	R1-1804453				First version	0.0.1
2018-04	RAN1#92bis	R1-1805351				Removal of FeLAA agreements	0.0.2
2018-04	RAN1#92bis	R1-1805352				Addition of FeLAA agreements	0.0.3
2018-04	RAN1#92bis	R1-1805416				First endorsed version	0.1.0
2018-05	RAN1#92bis	R1-1805788				Correction to FeLAA agreements and alignment with other specifications	0.1.1
2018-05	RAN1#92bis	R1-1805790				Second endorsed version	0.2.0
2018-05	RAN1#93	R1-1807911				Update based on agreements at RAN1 #93	0.2.1
2018-06	RAN1#93	R1-1807932				Endorsed version	1.0.0
2018-06	RAN#80					Spec under change control further to RAN approval decision	15.0.0
2018-09	RAN#81	RP-181795	0001	1	F	Correction on RRC parameters for FeLAA in 37.213	15.1.0
2018-09	RAN#81	RP-181795	0002	-	F	Correction on starting position of Partial PUSCH Mode 1 for FeLAA in 37.213	15.1.0
2018-09	RAN#81	RP-181795	0003	-	F	Correction on COT length for AUL transmission	15.1.0
2019-03	RAN#83	RP-190444	0004	-	F	Corrections on channel access procedures in 37.213	15.2.0
2019-12	RAN#86	RP-192636	0005	-	B	Introduction of channel access procedures to unlicensed spectrum for NR-based access	16.0.0
2020-03	RAN#87-e	RP-200185	0007	-	F	Corrections to NR-based access to unlicensed spectrum	16.1.0
2020-06	RAN#88-e	RP-200687	0008	-	F	Corrections to NR-based access to unlicensed spectrum	16.2.0
2020-06	RAN#88-e	RP-200687	0009	-	F	Additional corrections to NR-based access to unlicensed spectrum	16.2.0
2020-09	RAN#89-e	RP-201805	0010	-	F	Corrections to NR-based access to unlicensed spectrum	16.3.0
2020-12	RAN#90-e	RP-202381	0011	-	F	CR to 37.213 to correct CP extension and LBT type for SRS	16.4.0
2020-12	RAN#90-e	RP-202381	0012	-	F	CR to 37.213 CR to correct CAPC for RACH	16.4.0
2020-12	RAN#90-e	RP-202381	0013	-	F	CR to 37.213 to correct channel access for SRS	16.4.0
2021-03	RAN#91-e	RP-210049	0014	-	F	Correction on LBT for consecutive UL transmission triggered by DL assignments	16.5.0
2021-03	RAN#91-e	RP-210049	0015	-	F	Correction on LBT Type and CP Extension Indication for Semi-Static Channel Occupancy	16.5.0
2021-03	RAN#91-e	RP-210049	0016	-	F	Correction on Channel Occupancy Time for Semi-Static Channel Access	16.5.0
2021-03	RAN#91-e	RP-210049	0017	-	F	Correction on Channel Access for Multi-Channel transmission	16.5.0
2021-06	RAN#92-e	RP-211234	0018	-	F	Correction on the conditions for DL channel access procedure	16.6.0
2021-06	RAN#92-e	RP-211234	0019	-	F	Clarifying the conditions for indicating Type 2 LBT for wideband scheduled PUSCH	16.6.0
2021-12	RAN#94-e	RP-212961	0020	-	F	UL transmissions in wideband operation	16.7.0
2021-12	RAN#94-e	RP-212961	0021	-	F	Changes of channel access procedure in TS 37.213 according to MIIT regulation	16.7.0
2021-12	RAN#94-e	RP-212961	0024	-	F	Alignment CR for TS 37.213	16.7.0
2021-12	RAN#94-e	RP-212967	0022	-	B	Introduction of features to extend current NR operation to 71 GHz	17.0.0
2021-12	RAN#94-e	RP-212968	0023	-	B	Introduction of UE initiating a channel occupancy in semi-static channel access mode for enhanced IIoT and URLLC operation on shared spectrum for NR	17.0.0
2022-03	RAN#95-e	RP-220247	0026	-	A	Correction on channel access procedures for consecutive UL transmissions	17.1.0
2022-03	RAN#95-e	RP-220251	0027	-	F	Corrections of the features extending NR operation to 71 GHz	17.1.0
2022-03	RAN#95-e	RP-220252	0028	-	F	Corrections of the semi-static channel access mode with UE initiating channel occupancy	17.1.0
2022-03	RAN#95-e	RP-220247	0030	-	A	Rel-16 editorial corrections for TS 37.213 mirrored to Rel-17	17.1.0

2022-06	RAN#96	RP-221601	0031	-	F	Corrections of the features extending NR operation to 71 GHz	17.2.0
2022-06	RAN#96	RP-221602	0032	-	F	Correction to semi-static channel access procedures for PUSCH scheduled via RAR	17.2.0
2022-06	RAN#96	RP-221599	0034	-	A	Rel-16 editorial corrections for TS 37.213 (mirrored to Rel-17)	17.2.0
2022-09	RAN#97-e	RP-222401	0035	1	F	Corrections to the conditions for channel sensing in FR2-2 in TS37.213	17.3.0
2022-09	RAN#97-e	RP-222422	0036	-	F	RRC parameter corrections for TS 37.213	17.3.0
2022-09	RAN#97-e	RP-222399	0037	-	A	Rel-16 editorial corrections for TS 37.213 (mirrored to Rel-17)	17.3.0
2022-12	RAN#98-e	RP-222871	0040	-	A	Rel-16 Corrections for sensing slot in channel access procedures (mirrored to Rel-17)	17.4.0
2023-03	RAN#99	RP-230454	0043	-	A	Corrections to type 2 channel access for UL multi channel access	17.5.0
2023-06	RAN#100	RP-231220	0044	-	F	Correction on the indication of short control signal	17.6.0
2023-06	RAN#100	RP-231232	0045	1	F	Correction on contention window adjustments	17.6.0
2023-09	RAN#101	RP-232469	0046	-	B	Introduction of NR Sidelink operation on shared spectrum	18.0.0
2023-12	RAN#102	RP-233703	0049	-	A	CR on energy detection threshold formula for shared spectrum channel access for Rel-18	18.1.0
2023-12	RAN#102	RP-233706	0050	-	F	Maintenance of NR Sidelink operation on shared spectrum	18.1.0
2024-03	RAN#103	RP-240519	0051	-	F	Maintenance of NR Sidelink operation on shared spectrum	18.2.0
2024-06	RAN#104	RP-241074	0054	-	A	CR for Correcting Channel Access Procedures in NR-U (Mirrored to Rel-18)	18.3.0
2024-06	RAN#104	RP-241072	0055	-	F	Correction on restrictions of performing multi-channel access	18.3.0
2024-06	RAN#104	RP-241072	0056	-	F	Correction on CAPC determination in multi-channel access procedure	18.3.0
2024-06	RAN#104	RP-241072	0057	-	F	Correction on contention window adjustment procedures for PSCCH/PSSCH transmission	18.3.0
2024-06	RAN#104	RP-241072	0058	-	F	Maintenance of NR Sidelink operation on shared spectrum	18.3.0
2024-09	RAN#105	RP-242213	0059	-	F	Correction on reference section numbers for PSFCH prioritization in multi-channel access procedures	18.4.0
2024-09	RAN#105	RP-242213	0060	-	F	Correction on applicable CAPC for PSFCH and S-SSB transmissions	18.4.0
2024-09	RAN#105	RP-242213	0061	-	F	Correction on SL-U reference duration	18.4.0
2024-09	RAN#105	RP-242213	0062	-	F	Maintenance of NR Sidelink operation on shared spectrum	18.4.0
2024-12	RAN#106	RP-242931	0063	-	F	CR on transmission attempt from the 2nd starting symbol	18.5.0

History

Document history		
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V18.3.0	August 2024	Publication
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