YD

COMMUNICATION INDUSTRY STANDARD

OF THE PEOPLE'S REPUBLIC OF CHINA

ICS 33.060.99

M36

YD/T 3340-2018

Technical requirements of air interface of LTE-based vehicular communication

基于 LTE 的车联网无线通信技术空中接口技术要求

Issued on: December 21, 2018 **Implemented on: April 01, 2019**

Issued by: Ministry of Industry and Information Technology of PRC

Table of Contents

Technical requirements of air interface of LTE-based vehicular communication

1 Scope

This standard specifies the air interface technical requirements for the LTE-based vehicular communication technology, including the PC5 interface technical requirements for the sidelink communication mode between terminals, as well as the Uu interface technical requirements for the uplink/downlink communication mode between the terminal and the base station. It specifies the physical layer, MAC layer, RLC layer, PDCP layer, RRC layer as well as the UE process in idle mode under these two working modes.

This standard applies to LTE-based vehicular communication systems, including V2V, V2I, V2P, V2N communication scenarios.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) is applicable to this standard.

YD/T 3340-2018 Technical requirements of air interface of LTE-based vehicular communication

3GPP TS 23.285 (Release 14) Technical Specification Group Services and System Aspects; Architecture enhancements for V 2X services

3GPP TS 24.334 (Release 14) Proximity-services (ProSe) User Equipment (UE) to ProSe function protocol aspects; Stage 3

3GPP TS 24.386 (Release 14) User Equipment (UE) to V2X control function; protocol aspects; Stage 3

3GPP TS 36.101 (Release 14) Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception

3GPP TS 36.133 (Release 14) Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio management

3GPP TS 36.211 (Release 14) Evolved Universal Terrestrial Radio Access

(E-UTRA); Physical channels and modulation

3GPP TS 36.212 (Release 14) Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding

3GPP TS 36.213 (Release 14) Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures

3GPP TS 36.214 (Release 14) Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer - Measurements

3GPP TS 36.304 (Release 14) Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode

3GPP TS 36.321 (Release 14) Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification

3GPP TS 36.322 (Release 14) Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Link Control (RLC) protocol specification

3GPP TS 36.323 (Release 14) Evolved Universal Terrestrial Radio Access (E-UTRA); Packet Data Convergence Protocol (PDCP) Specification

3GPP TS 36.331 (Release 14) Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC) Protocol specification

3 Abbreviations

The following abbreviations apply to this document.

3GPP: The 3rd Generation Partnership Project

AM: Acknowledged Mode

BSR: Buffer Status Report

CBR: Channel Busy Ratio

CR: Channel Occupancy Ratio

CRC: Cyclic Redundancy Check

CSI: Channel Status Indicator

DCI: Downlink Control Information

DL: Downlink

PRACH: Physical Random Access Channel

PRB: Physical Resource Block

PSBCH: Physical Sidelink Broadcast Channel

PSCCH: Physical Sidelink Control Channel

PSSCH: Physical Sidelink Shared Channel

PSSS: Primary Sidelink Synchronization Signal

PUCCH: Physical Uplink Control Channel

PUSCH: Physical Uplink Shared Channel

QAM: Quadrature Amplitude Modulation

QPSK: Quadrature Phase Shift Keying

RB: Resource Block

RIV: Resource Indication Value

RLC: Radio Link Control

RNTI: Radio Network Temporary Identifier

RRC: Radio Resource Control

RSRP: Reference Signal Received Power

SBCCH: Sidelink Broadcast Control Channel

SCell: Secondary Cell

SCI: Sidelink Control Information

SC-FDMA: Single Carrier Frequency Division Multiplex Access

SDU: Service Data Unit

SFN: System Frame Number

SIB: System Information Block

SL: Sidelink

SL-BCH: Sidelink Broadcast Channel

SL-SCH: Sidelink Share Channel

interface; the other is the uplink/downlink communication mode between the terminal and the base station, where the air interface between the terminal and the base station is called Uu interface.

Chapter 5 specifies the technical requirements for the PC5 interface of the LTE-based wireless communication technology for vehicular networking. The sidelink's communication method includes two transmission modes. Among them, the sidelink transmission mode 3 is resource scheduling allocation, whilst the sidelink transmission mode 4 is the UE's independent resource selection. For specific definitions, see 7.2.2 of YD/T 3340-2018 Technical requirements of air interface of LTE-based vehicular communication.

The correspondence between the document structure and content of Chapter 5 and the 3GPP technical specifications is as follows.

- 5.1 specifies the technical requirements for the physical layer.

- 5.1.1 specifies the physical channel and modulation, corresponding to 3GPP TS 36.211 (Release 14).

- 5.1.2 specifies multiplexing and channel coding, corresponding to 3GPP TS 36.212 (Release 14).

- 5.1.3 specifies the physical layer process, corresponding to 3GPP TS 36.213 (Release 14).

- 5.1.4 specifies physical layer measurement, corresponding to 3GPP TS 36.214 (Release 14).

- 5.2 specifies the technical requirements for the Medium Access Control (MAC) layer, corresponding to 3GPP TS 36.321 (Release 14).

- 5.3 specifies the technical requirements for the Radio Link Control (RLC) layer, corresponding to 3GPP TS 36.322 (Release 14).

- 5.4 specifies the technical requirements of the Packet Data Convergence Protocol (PDCP) layer, corresponding to 3GPP TS 36.323 (Release 14).

- 5.5 specifies the technical requirements for the Radio Resource Control (RRC) layer, corresponding to 3GPP TS 36.331 (Release 14).

- 5.6 specifies the UE process technical requirements in idle mode, corresponding to 3GPP TS 36.304 (Release 14).

Chapter 6 specifies the technical requirements for the Uu interface of the LTE-based wireless communication technology for the vehicular networking.

The correspondence between the document structure and content of Chapter

$$n_{\mathrm{PRB}} = \left\lfloor \frac{k}{N_{\mathrm{sc}}^{\mathrm{RB}}} \right\rfloor \qquad \text{.....(1)}$$

5.1.1.2.5 Resource pool

The 5.1.3 defines the subframe pool and resource block pool.

For PSSCH, the current time slot number in the subframe pool is $n_{\mathrm{SSb}}^{\mathrm{PSSCH}} = 2n_{\mathrm{ssf}}^{\mathrm{PSSCH}} + i$, where $i \in \{0,1\}$ is the current time slot number in the current sidelink subframe $n_{\mathrm{ssf}}^{\mathrm{PSSCH}} = k \bmod 10$, where k is equal to the footnote of t_k^{SL}; t_k^{SL} is defined by the sidelink transmission mode 3 in 5.1.3.2.1.2, or defined by the sidelink transmission mode 4 in 5.1.3.2.1.3.

5.1.1.2.6 Guard interval

The last SC-FDMA symbol of the sidelink subframe is used as a guard interval and cannot be used for sidelink transmission.

5.1.1.3 Physical shared channel of sidelink

5.1.1.3.1 Scrambling

The bit block $b(0),\ldots,b(M_{\mathrm{bit}}-1)$ (where M_{bit} is the number of bits sent) transmitted on the PSSCH in a subframe shall be scrambled according to 5.3.1 of 3GPP TS 36.211 (Release 14).

The scrambling sequence shall be initialized at the beginning of each PSSCH subframe according to $c_{\mathrm{init}} = n_{\mathrm{ID}}^{\mathrm{X}} \cdot 2^{14} + n_{\mathrm{ssf}}^{\mathrm{PSSCH}} \cdot 2^{9} + 510$, where for the sidelink transmission mode 3 and the sidelink transmission mode 4, p and L are given by 5.1.1 of 3GPP TS 36.212 (Release 14), $n_{\mathrm{ID}}^{\mathrm{X}}$ is equal to the decimal representation of the CRC check code of the PSCCH as sent in the same subframe as the PSSCH.

5.1.1.3.2 Modulation

The modulation is performed according to 5.3.2 of 3GPP TS 36.211 (Release 14). The modulation mode of PSSCH is as shown in Table 3.

3GPP TS 36.211 (Release 14). For the sidelink transmission mode 3 and the sidelink transmission mode 4, it is assumed that the sequence is generated according to subframe 5.

Resource unit mapping: The sequence $d_i(n)$ is multiplied by the amplitude scaling factor β_{SSSS} to adjust the transmit power defined in 5.1.3.4; then mapped to the resource element in the second time slot of the subframe on the antenna port 1020. The mapping relationship is as shown in the formula (4).

$$\begin{aligned} a_{k,l} &= d_i(n), \qquad n = 0,\ldots,61 \\ k &= n - 31 + \frac{N_{RB}^{SL} N_{sc}^{RB}}{2} \\ l &= \begin{cases} 4,5 & \text{normal cyclic prefix} \\ 3,4 & \text{extended cyclic prefix} \end{cases} \end{aligned} \tag{4}$$

5.1.1.7 Demodulation reference signal

The demodulation reference signals related to PSSCH, PSCCH, PSBCH transmission shall be transmitted according to the PUSCH of 5.5.2.1 in 3GPP TS 36.211 (Release 14); it include the following special cases.

- It shall use the parameters in Table 6, Table 7, Table 8.
- Replace PUSCH with PSSCH, PSCCH or PSBCH according to the physical channel related to the reference signal.
- The antenna ports are given in Table 1.
- The physical resource block used in the mapping process shall be the same as the corresponding PSSCH, PSCCH or PSBCH transmission.
- 3GPP TS 36.211 (Release 14) 5.5.2.1.2 stipulates that the index k in the mapping process shall be the same as the corresponding PSSCH, PSCCH or PSBCH transmission.
  - ■For PSSCH and PSCCH in sidelink transmission mode 3 and sidelink transmission mode 4, when mapping in the first time slot of a subframe, it shall use the parameters l = 2 and l = 5; when mapping in the second time slot of a subframe, it shall use the parameters l = 1 and l = 4.
  - ■For PSBCH in sidelink transmission mode 3 and sidelink transmission mode 4, when mapping in the first time slot of a subframe, it shall use the parameters l = 4 and l = 6; when mapping in the second time slot of a subframe, it shall use the parameters l = 2.
- For sidelink transmission mode 3 and sidelink transmission mode 4, the

mapped to the highest significant bit of the transport block.

Set L=16bit, calculate and add CRC check bit according to 5.1.1 of 3GPP TS 36.212 (Release 14), to generate bit sequence c_0, c_1, c_2, c_3, …, c_{K-1}, where $c_k = b_k$ (for k = 0, 1, 2, …, K-1, and K = A + L).

5.1.2.3.1.3 Channel coding

The information bits are sent to the channel coding module, denoted as c_0, c_1, c_2, c_3, …, c_{K-1}, where K is the number of bits, which uses a tail-biting convolutional code with a code rate of 1/3 (according to the provisions of 5.1.3.1 of 3GPP TS 36.212 (Release 14).

The bit stream after channel coding is denoted as $d_0^{(i)},d_1^{(i)},d_2^{(i)},d_3^{(i)},...,d_{D-1}^{(i)}$, where i = 0, 1 or 2, D is the number of bits of bit stream after the i^{th} code, that is, D = K.

5.1.2.3.1.4 Rate matching

The code block after tail-biting convolutional coding is sent to the rate matching module, denoted as $d_0^{(i)},d_1^{(i)},d_2^{(i)},d_3^{(i)},...,d_{D-1}^{(i)}$, where i = 0, 1, or 2, i is the bit stream number, D is the number of bits in each coded bit stream. The code block is subject to rate matching in accordance with the method of 5.1.4.1 of 3GPP TS 36.212 (Release 14).

The bit stream after rate matching is denoted as $e_0,e_1,e_2,e_3,...,e_{E-1}$, where E is the total number of bits after rate matching.

5.1.2.3.2 Sidelink shared channel (SL-SCH)

The sidelink shared channel (SL-SCH) is processed according to the downlink shared channel processing procedure as specified in 5.3.2 of 3GPP TS 36.212 (Release 14), using code block concatenation coding with a code rate of 1/3 (according to 5.1.3.2 of 3GPP TS 36.212 (Release 14)), but with the following differences.

- Data arrives at the coding unit in the form of at most one transmission block per TTI.

- In the code block concatenation step, the coded bit sequence corresponding to a transmission block after the code block concatenation is regarded as a code word described in 5.1.1.3.1.

- According to 5.2.2.7 and 5.2.2.8 of 3GPP TS 36.212 (Release 14), PUSCH interleaving operation without any control information shall be performed in order to perform time domain first instead of frequency domain mapping,

- Time interval between initial transmission and retransmission: 4 bits, as defined in 5.1.3.2.1.4.

- Modulation and coding method: 5 bits, as defined in 5.1.3.3.1.

- Retransmission index: 1 bit, as defined in 5.1.3.3.1.

- Added reserved information bits, until the length of SCI format 1 is 32 bits. The value of the reserved information bit is 0.

5.1.2.3.4 DCI format 5A

DCI format 5A uses tail-biting convolutional coding with a code rate of 1/3 [as specified in 5.1.3.1 of 3GPP TS 36.212 (Release 14)], which is used to schedule PSCCH in sidelink transmission mode 3, meanwhile includes several fields of SCI format 1 for scheduling PSSCH.

The following information is sent in DCI format 5A.

- Carrier indicator: 3 bits, as defined in 5.1.3.3.1.

- The minimum index of the sub-channel assigned to the initial transmission: $\lceil \log_2(N_{\text{subchannel}}^{\text{SL}}) \rceil$ bits, as defined in 5.1.3.2.1.4.

- Field of SCI format 1, as defined in 5.1.2.3.3.3.

  ■ Frequency domain resource location for initial transmission and retransmission.

  ■ The time interval between initial transmission and retransmission.

- SL index: 2 bits, as defined in 5.1.3.3.1 (this field only appears in the case of TDD duplex mode with an uplink and downlink ratio of 0 ~ 6).

When the CRC of DCI format 5A is scrambled by SL-SPS-V-RNTI, the following fields are also included.

- SLSPS configuration index: 3 bits, as defined in 5.1.3.3.1.

- Activation/release indication: 1 bit, as defined in 5.1.3.3.1.

If the number of information bits in the DCI format 5A mapped to the search space is smaller than the payload size of the DCI format 0 mapped to the same search space, 0 shall be filled in the DCI format 5A, until the payload size of the format 5A is equal to the payload size of the DCI format 0 including padding bits.

If the CRC of DCI format 5A is scrambled by SL-V-RNTI, meanwhile the number

on a subframe, then the measured PSSCH-RSRP can be used for the subframes before receiving SCI format 1 indicated by the SCI format 1. If the SCI format 1 that schedules the same transport block is successfully decoded in only one subframe, then the PSSCH-RSRP measured by the UE on the subframe of the successfully decoded SCI format 1 can be used for another subframe as indicated by the SCI format 1. The UE does not need to decode the PSSCH before successfully decoding the corresponding SCI format 1.

5.1.3.2 Related processes of physical sidelink shared channel

5.1.3.2.1 UE procedure for transmitting PSSCH

5.1.3.2.1.1 Overview

If the UE sends SCI format 1 on the PSCCH of subframe n according to the PSCCH resource configuration, then for the corresponding PSSCH transmission on the same TB:

- For sidelink transmission mode 3.

  ■The determination of subframe set and resource block set shall be based on the subframe pool indicated by PSSCH resource configuration (specified in 5.1.3.2.3) and the "retransmission index and initial retransmission time interval" field in SCI format 1 and the "initial transmission and retransmission frequency domain resource location" field (as specified in 5.1.3.2.1.4).

- For sidelink transmission mode 4:

  ■The determination of subframe set and resource block set shall be based on the subframe pool indicated by PSSCH resource configuration (specified in 5.1.3.2.3) and the "retransmission index and initial retransmission time interval" field and "initial transmission and retransmission frequency domain resource location" field (specified in 5.1.3.2.1.4).

- The modulation order is determined according to the "modulation coding method" field (I_{MCS}) in SCI format 1. For $0 \leq I_{MCS} \leq 28$, the modulation order is set as $Q' = \min(4, Q'_m)$, wherein Q'_m shall be determined according to Table 11.

the measured value $E_{x,y}$ is defined as the linear average value of the subchannel $x+k$（$k=0,...,L_{subCH}-1$）S-RSSI measurement the partial subframe monitored in step b). When P_{rsvp_TX} ≥ 100, the subframe measured by $E_{x,y}$ is expressed as $t^{SL}_{y-P_{steps\times j}}$ and j is a negative integer; When P_{rsvp_TX} ≥ 100, the subframe measured by $E_{x,y}$ is expressed as $t^{SL}_{y-P'_{rsvp\_TX\times j}}$ and j is a negative integer.

i) The UE shall move the single subframe candidate resource with the smallest measurement value $E_{x,y}$ from the set S_A to the set S_B. This step shall be repeated before the number of single subframe candidate resources in the set S_B is greater than or equal to $0.2 \bullet M_{total}$.

UE will report the S_B to higher layer.

If the upper layer has configured partial perception, the following steps shall be performed.

a) A single subframe candidate resource $R_{x,y}$ used for PSSCH transmission is defined as a set of L_{subCH} consecutive subchannels x+j on the subframe t^{SL}_y, where $j=0,...,L_{subCH}-1$. The UE shall determine the set of subframes consisting of at least Y subframes on the time interval $[n+T_1, n+T_2]$ according to the implementation, where the selection of T_1 and T_2 depends on the UE implementation and shall satisfy $T_1 \le 4$ and $20 \le T_2 \le 100$. The UE's selection of T_2 shall meet the delay requirement and Y shall be greater than or equal to the upper layer parameter minNumCandidateSF. The UE shall assume any L_{subCH} consecutive subchannels in the corresponding PSSCH resource pool in the determined subframe set as single subframe candidate resources. The total number of candidate resources in a single subframe is denoted as M_{total}.

b) For a subframe t^{SL}_y included in the subframe set in step a), if the k^{th} bit of the high-level parameter gapCandidateSensing is set to 1, the UE shall monitor each subframe $t^{SL}_{y-k\times Pstep}$. The UE shall perform operations in accordance with the following steps based on the PSCCH decoding and S-RSSI measurement on these subframes.

c) The parameter $Th_{\alpha,b}$ is set to the i^{th} value in the SL-ThresPSSCH-RSRP field of the SL-ThresPSSCH-RSRP-List, where i = α x 8 + b + 1.

d) Initialize the set S_A as a set of all single-subframe candidate resources.

When a set of subframes $t^{SL}_{n+j\times P'_{rsvp\_TX}}$ $(j=0,1,...,J-1)$ is selected as a set of PSSCH transmission opportunities, then the set of subframes $t^{SL}_{n+k+j\times P'_{rsvp\_TX}}$ $(j=0,1,...,J-1)$ that is used as another set of PSSCH transmission opportunities shall satisfy the conditions -15 ≤ K ≤ 15 and k≠0. Among them, $P'_{rsvp\_TX} = P_{step} \times P_{rsvp\_TX}/100$ is the maximum value of PSSCH transmission opportunities in a selected subframe set, P_{rsvp_TX} is the resource reservation time interval provided by the higher layer.

5.1.3.2.2 UE process for receiving PSSCH

For the sidelink transmission mode 3, by detecting SCI format 1 on the PSCCH, the UE shall decode the PSSCH according to the detected SCI format 1, meanwhile the corresponding PSSCH resource is configured by the higher layer.

For the sidelink transmission mode 4, by detecting SCI format 1 on the PSCCH, the UE shall decode the PSSCH according to the detected SCI format 1, meanwhile the corresponding PSSCH resource is configured by the higher layer.

5.1.3.2.3 UE process for determining PSSCH resource pool and subframe pool for sidelink transmission mode 3 or 4

In sidelink transmission mode 3 or 4, the set of subframes that may belong to a PSSCH resource pool is denoted as $\left(t^{SL}_0, t^{SL}_1, ..., t^{SL}_{T_{max}}\right)$, where:

- 0 ≤ t^{SL}_i < 10240.

- The subframe index is related to the subframe #0 of the wireless structure, wherein the subframe #0 of the wireless structure is consistent with the SFN0 or DFN0 of the serving cell.

- The subframe set includes all subframes except the following subframes.

  ■The subframe which is set as SLSS resource.

  ■ The downlink subframes and special subframes when the sidelink transmission occurs in a TDD cell.

  ■Reserved subframes determined according to the following steps.

  Step 1) After the N_{slss} and N_{dssf} subframes shall be excluded from the set of all subframes, the index of the remaining subframes are arranged in ascending order, which is recorded as

$$n_{PRB} = n_{subCHRBstart} + m \times n_{subCHsize} + j \quad (17)$$

Where:

j - j = 0, 1, …, $n_{subCHsize}$ - 1;

$n_{subCHRBstart}$ - Given by the high-level parameter startRBSubchannel;

$n_{subCHsize}$ - Given by the high-level parameter sizeSubchannel.

5.1.3.3 Related processes of the physical sidelink control channel

5.1.3.3.1 UE process for transmitting PSCCH

5.1.3.3.1.1 UE process for transmitting PSCCH

For sidelink transmission mode 3.

- The UE shall determine the subframe and resource block for transmission SCI format 1 according to the following steps.

  ■ SCI format 1 is sent on each time slot of the corresponding PSSCH subframe; it shall use 2 physical resource blocks.

  ■ If the UE receives the SL-V-RNTI scrambled CRC's DCI format 5A on subframe n, then one transmission of PSCCH shall be performed on the PSCCH resource L_{Init} (specified in 5.1.3.3.3) of subframe n + k_{init}, where L_{Init} the value in the "lowest sub-channel index allocated to the initial transmission" field in the sidelink permit, k_{init} is the minimum integer which is greater than or equal to 4+m and satisfies the conditions that the subframe n + k_{init} is included in the $\left(t_0^{SL}, t_1^{SL}, t_2^{SL}, \ldots\right)$ determined according to 5.1.3.2.3. If the corresponding DCI format 5A contains the "SL Index" field determined according to Table 13, then the value of m is the value indicated in the "SL Index" field, otherwise m = 0.

  ■ If the “interval between initial transmission and retransmission” in the configured sidelink permit is not equal to 0, then another PSSCH transmission shall be performed on the PSCCH resource L_{ReTX} of subframe $t^{SL}_{n+k_{init}+SF_{gap}}$, where SF_{gap} is the value indicated in the "time interval between initial transmission and retransmission" field in the configured sidelink permit. L_{ReTX} corresponds to the value of n^{start}_{subCH} as determined according to the process of 5.1.3.2.1.4, which is the RIV value as set in the "initial transmission and retransmission frequency domain resource location" field in the configured sidelink permit.

■ If the UE receives the SL-SPS-V-RNTI scrambled CRC's DCI format 5A on subframe n, the UE shall consider the received DCI information as a valid sidelink semi-continuous activation or release, whilst the semi-continuous activation or release only corresponds to the SPS configuration as indicated by the SL SPS configuration index field. If the received DCI activates an SL SPS configuration, then one transmission of PSCCH shall be performed on the PSCCH resource L_{int} (specified in 5.1.3.3.3) of subframe $n+k_{init}$, where L_{int} is value indicated by the “lowest index of the sub-channel assigned to the initial transmission” in the configured sidelink permit, k_{init} is the smallest integer that is greater than or equal to 4+m and meets the condition that subframe $n+k_{init}$ is included in $\left(t_0^{SL}, t_1^{SL}, t_2^{SL}, \ldots\right)$, wherein $\left(t_0^{SL}, t_1^{SL}, t_2^{SL}, \ldots\right)$ is determined according to 5.1.3.2.3. If the corresponding DCI format 5A contains the "SL Index" field as determined according to Table 13, then the value of m is the value indicated by the "SL Index" field, otherwise m = 0.

■ If in the configured sidelink permit (3GPP TS 36.321 (Release 14)), the "time interval between initial transmission and retransmission" value is not equal to 0, then another PSCCH transmission shall be performed on the PSCCH resource L_{ReTX} of subframe $t^{SL}_{n+k_{init}+SF_{gap}}$, where SF_{gap} is the value indicated in the "time interval between initial transmission and retransmission" field in the configured sidelink permit. L_{ReTX} corresponds to the n^{start}_{subCH} value as determined according to 5.1.3.2.1.4, which is the RIV value as set in the "initial transmission and retransmission frequency domain resource location" field in the configured sidelink permit.

- UE shall set the content in SCI format 1 according to the following requirements.

■ The UE shall set the modulation and coding method according to the instructions of the higher layer.

■ The UE shall set the "Priority" field according to the highest priority among the corresponding transport block priorities indicated by the higher layers.

■ The UE shall set the "time interval between initial transmission and retransmission" field, the "initial transmission and retransmission frequency domain resource location" field, the "retransmission index" field. The time domain and frequency domain resources determined for PSSCH according to 5.1.3.2.1.4 shall be consistent with the PSSCH allocated resources as indicated by the configured sidelink permit.

■The UE shall set the value of the resource reservation field to 0.

■Each transmission of SCI format 1 shall be performed on two physical resource blocks in one subframe and each time slot of the subframe.

- The UE shall randomly select the cyclic shift bit $n_{cs,\lambda}$ from {0, 3, 6, 9} for each time of PSCCH transmission.

For sidelink transmission mode 4.

- The UE shall determine the subframes and resource blocks for SCI format transmission according to the following requirements.

■SCI format 1 shall be transmitted using two physical resource blocks in each time slot of the corresponding PSSCH subframe.

■If the sidelink permit configured by the higher layer indicates the PSCCH resource on subframe t_n^{SL}, then one transmission of PSCCH shall be performed on the PSCCH resource m (specified in 5.1.3.3.3) indicated on subframe t_n^{SL}.

■If the "time interval between initial transmission and retransmission" value in the configured sidelink permit is not equal to 0, then another PSCCH transmission shall be performed on the PSCCH resource L_{RcTX} of subframe $t_{n+SF_{gap}}^{SL}$, where SF_{gap} is the value as indicated in the "time interval between initial transmission and retransmission" field in the configured sidelink permit; L_{RcTX} corresponds to the value of n_{subCH}^{start} as determined in the process of 5.1.3.2.1.4. This value is the RIV value as set in the "initial transmission and retransmission frequency field resource location" in the configured sidelink permit.

- The UE shall set the content in SCI format 1 according to the following requirements.

■The UE shall set the modulation and coding method according to the instructions of the higher layer.

■The UE shall set the "Priority" field according to the highest priority among the corresponding transport block priorities indicated by the higher layers.

■The UE shall set the " time interval between initial transmission and retransmission" field, the "initial transmission and retransmission

synchronization signal resource configuration of the corresponding sidelink.

5.1.3.5 Priority processing between SL and Uu

When the V2X sidelink transmission overlaps the Uu uplink transmission, if the Uu uplink performs a random access procedure or the transmission priority is high (such as emergency calls specified in 3GPP TS 24.386 (Release 14)), the Uu uplink transmission is given priority (regardless of the PPPP value of the MAC PDU of the sidelink).

When the V2X sidelink transmission overlaps with the Uu uplink transmission, if the SCI "priority" field's setting value of the sidelink transmission is less than the high-level parameter thresSL-TxPrioritization (the PPPP value of the sidelink MAC PDU is lower than the (pre) configured PPPP threshold), the priority of sidelink transmission is higher than the priority of Uu uplink transmission, the sidelink transmission is given priority, or the UE reduces the uplink transmission power, to ensure that in any overlapping part, its total transmission power does not exceed the P_{CMAX} as defined in 3 GPP TS 36.101 (Release 14). In this case, the calculation of the uplink transmit power adjustment depends on the implementation.

When the V2X sidelink transmission overlaps with the Uu uplink transmission, if the SCI "priority" field's setting value of the sidelink transmission is greater than or equal to the higher-level parameters thresSL-TxPrioritization [The PPPP value of the sidelink MAC PDU is higher than or equal to the (pre) configured PPPP threshold], the priority of Uu uplink transmission is higher than the priority of sidelink transmission, then the Uu uplink transmission is given priority, or the UE reduces the transmission power of the sidelink, to ensure that in any overlap, the total transmission power does not exceed the P_{CMAX} as defined in 3GPP TS 36.101 (Release 14). In this case, the calculation of the sidelink transmission power's adjustment depends on the implementation.

5.1.4 Physical layer measurement

5.1.4.1 Overview

For V2X transmission based on the PC5 interface, the following UE physical layer measurement is used.

- Sidelink received signal strength indicator (S-RSSI).

- PSSCH-Reference signal reception power (PSSCH-RSRP).

- Channel busy rate (CBR).

- Channel occupancy rate (CR).

5.1.4.2 UE measurement capability

5.1.4.2.4 Channel occupancy rate (CR)

Definition: The channel occupancy rate (CR) evaluated at subframe n is defined as: the total number of subchannels used for transmission in subframe [n-α, n-l] and permitted in subframe [n, n+b] divided by the total number of subchannels configured on subframe [n-α, n+b] in the transmission resource pool.

Channel occupancy (CR) measurement is applicable to: RRC_IDLE same frequency, RRC_IDLE different frequency, RRC_CONNECTED same frequency, RRC_CONNECTED different frequency.

5.2 MAC layer

5.2.1 Overview

The services and functions provided by the MAC sublayer of the sidelink include: radio resource selection, data packet filtering of sidelink communication and V2X sidelink communication; the logical channel used for sidelink user plane data transmission is the sidelink traffic channel (STCH). STCH is a point-to-multipoint channel, which is used to transmit user information from one UE to one or more other UE. The sidelink's MAC layer mainly includes the sidelink share channel (SL-SCH)'s data transmission, the protocol data unit of sidelink shared channel, format and parameters and other related content. SBCCH uses MAC TM mode.

5.2.2 MAC process

5.2.2.1 Data transmission of sidelink share channel (SL-SCH)

5.2.2.1.1 Data transmission of sidelink shared channel

5.2.2.1.1.1 Sidelink permit reception and sidelink control information's SCI transmission

If the MAC entity is configured to dynamically receive the permit information of the sidelink on the PDCCH channel, meanwhile there is data to be sent on the STCH, the MAC layer entity shall:

- Determine the number of HARQ retransmissions and the set of subframes used to send SCI and SL-SCH according to the received sidelink permit information;

- Use the received sidelink permit as a configured sidelink permit.

If the upper layer configures the MAC layer entity to receive on the PDCCH the target address as the sidelink permit for the sidelink semi-persistent scheduling V-RNTI, for each sidelink semi-persistent scheduling configuration, the MAC

Note 2: If the delay requirement cannot be met, whether to perform single MAC PDU transmission or sidelink resource selection depends on the UE implementation.

- If the upper layer has configured or reconfigured the resource pool.

  ■ If there is a configured sidelink permit, clear the sidelink permit.

  ■ Select a value from the parameter restrictResourceReservationPeriod as configured in the upper layer; set the resource's reservation interval to the selected value multiplied by 100.

  Note 3: How the UE chooses the value depends on the UE implementation.

  ■ For the case that the resource reservation interval is greater than or equal to 100 ms, a value is randomly selected in [5, 15] with equal probability; for the case that the resource reservation interval is equal to 50 ms, a value is selected with equal probability in [10 30]; for resource reservation interval is equal to 20 ms, a value is randomly selected in [25, 75] with equal probability; meanwhile the SL-RESOURCE-RESELECTION-COUNTER is set to the selected value.

  ■ Based on 5.1.4.2.3, select the number of HARQ retransmissions from the range of the parameter allowedRetxNumberPSSCH as configured by the upper layer. If the upper-layer configures the parameter allowedRetxNumberPSSCH-CBR, the selected number of HARQ retransmission shall also be located within the range from the highest priority of the sidelink logical channel and the allowedRetxNumberPSSCH-CBR corresponding to the CBR measured value of the lower layer.

  ■ Based on 5.1.4.2.3, the frequency resource is selected between the parameters minRB-NumberPSSCH m RB-NumberPSSCH configured in the upper layer. If the upper layer configures minRB-NumberPSSCH-CBR and maxRB-NumberPSSCH-CBR, the selected frequency resource also needs to be located in the highest priority of the link logical channel and between the minRB-NumberPSSCH-CBR and maxRB-NumberPSSCH-CBR corresponding to the CBR measurement value of the lower layer.

  ■ Based on the number of selected frequency field resources, according to the provisions of 5.1.3.2.1.6, the time-frequency resources are randomly selected for a transmission opportunity in the resources indicated by the physical layer as available for transmission. The random function shall ensure that each selectable resources are selected by probability.

50 ms, a value is selected in [10 30] with equal probability; for the case that the resource reservation interval is equal to 20 ms, a value is selected in [25 75] with an equal probability; meanwhile SL_RESOURCE_ RESELECTION_COUNTER is set as the selected value.

■Choose the previously selected sidelink permit for multiple transmission of MAC PDU; the resource reservation interval is used to determine the transmission subframes used to transmit SCI and SL-SCH.

■ Use the selected sidelink permit as the configured sidelink permit.

If the upper layer configures the MAC layer entity to use the resources in the resource pool as specified in 5.10.13.1 of 3GPP TS 36.331 (Release 14) based on perception, partial perception or random method, the MAC entity creates a sidelink configuration corresponding to the transmission of a single MAC PDU; meanwhile STCH channel data is available, the MAC layer entity shall process the sidelink according to the following procedure.

- Based on 5.1.4.2.3, select the number of HARQ retransmissions from the allowedRetxNumberPSSCH parameter configured by the upper layer. If the upper layer configures the parameter allowedRetxNumberPSSCH-CBR, the selected number of HARQ retransmissions shall also be located within the range from the highest priority of the sidelink logical channel and the allowedRetxNumberPSSCH-CBR corresponding to the CBR measurement value of the lower layer.

- Based on 5.1.4.2.3, select the frequency resource between minRB-NumberPSSCH and RB-NumberPSSCH configured in the upper layer. If the upper layer configures minRB-NumberPSSCH-CBR and maxRB-NumberPSSCH-CBR, the selected frequency resource also needs to be located in the highest priority of the sidelink logical channel and between the minRB-NumberPSSCH-CBR and maxRB-NumberPSSCH-CBR corresponding to the CBR measurement value of the lower layer.

- If the upper layer configuration transmission is based on random selection

■ According to the number of selected frequency field resources, randomly select SCI and SL-SCH time-frequency resources from the resource pool for a transmission opportunity. The random function shall ensure that each resource that can be selected is selected by probability.

Otherwise:

■ According to the number of selected frequency field resources, the time-frequency resources of SCI and SL-SCH are randomly selected from the resources indicated by the physical layer in accordance with the

■ Generate a transmission according to the following description.

If the sidelink HARQ entity requests retransmission, the sidelink process shall:

- Follow the procedure below to generate a transmission.

To generate a transmission, the sidelink process shall:

- If there is no uplink transmission, or if the MAC entity can perform uplink and SL-SCH transmission at the same time; or if there is uplink MAC PDU transmission in this TTI, excluding the case where the uplink MAC PDU comes from the Msg3 buffer (in this case, the uplink transmission priority is higher than SL-SCH transmission), the highest priority value of the sidelink logical channel is lower than the configured ThresSLTXPrioritization (if configured).

■ Instruct the physical layer to generate a transmission; according to the stored sidelink permit, the redundancy version is the version corresponding to CURRENT_IRV.

■ Increase CURRENT_IRV by 1.

■ If the transmission corresponds to the last transmission of the MAC PDU.

♦SL_RESOURCE_RESELECTION_COUNTER minus 1.

5.2.2.1.1.3 Multiplexing combination

Multiplexing combination: For the PDU associated with an SCI, the MAC layer shall only consider logical channels with the same source layer 2 ID and destination ID. In V2X sidelink communication, multiple transmissions in different processes are allowed to be carried out independently on different subframes.

Logical channel priority: When a new transmission starts, the logical channel priority process is performed. For each sidelink's logical channel, there is an associated PPPP priority. Multiple sidelink's logical channels may have the same priority. The mapping between priority and LCID is determined by the implementation of the UE.

For each SCI of V2X communication, the MAC layer entity shall execute the logical channel priority process according to the following process.

- The MAC layer entity shall allocate resources according to the following steps.

■ Step 1: Select the ProSe address of the sidelink's logical channel with the highest priority among the selected sidelink logical channels with

- For a sidelink logical channel corresponding to a ProSe destination address, in the RLC entity or PDCP entity, there is arrival of sidelink data; if the priority of the sidelink logical channel of the new data is higher than the priority of the sidelink logical channel which has data to send of any LCG with the same ProSe destination address, or there is currently no data of any sidelink logical channel belonging to the same ProSe destination address waiting to be sent, in this case, the sidelink BSR is called "regular sidelink BSR".

- For the allocated uplink resources, the remaining padding bits are equal to or greater than the size of the triggered BSR MAC control unit of the sidelink. The BSR MAC control unit at least contains the buffer status and sub-header of one LCG of the ProSe destination address. In this case, the sidelink BSR is called the "sidelink padding BSR".

- If the retx-BSR-TimerSL times out, meanwhile there is data to be transmitted in any sidelink logical channel of the MAC entity, in this case, the sidelink BSR is called "regular sidelink BSR".

- If the periodic-BSR-TimerSL times out, in this case, the sidelink BSR is called "periodic sidelink BSR".

Otherwise.

- The upper layer is configured with SL-V-RNTI, meanwhile the sidelink data is available in the RLC entity or PDCP entity. In this case, the sidelink BSR is called the "regular sidelink BSR".

BSR for regular and periodic sidelinks.

- If the number of bits in the uplink permit is equal to or greater than the size of the BSR of the sidelink, it includes all LCG buffer status and sub-headers with data transmission.

  - Report the sidelink BSR including the buffer status of all LCG that have data to be transmitted.

- Otherwise, report the truncated sidelink BSR; considering the number of bits that can be included in the uplink license, include the buffer status of as many LCG that can transmit data.

For padded sidelink BSR.

- If the remaining padding bits are equal to or greater than the size of the BSR MAC control unit of the sidelink after the padding BSR is triggered, the BSR MAC control unit contains the buffer status and sub-headers of all LCG that have data to be sent.

The sidelink BSR transmitted in a TTI reflects the buffer status of all MAC PDU in this TTI after they have been constructed. Each LCG shall report at most one buffer status value per TTI; this value shall be reported in all BSR of sidelinks.

Note: Padding the sidelink BSR does not allow cancellation of the triggered regular/normal sidelink BSR. The padding link BSR is triggered only for a specific MAC PDU; the trigger is cancelled after the MAC PDU is constructed.

5.2.2.1.2 Data reception of sidelink shared channel

5.2.2.1.2.1 SCI reception of sidelink control information

The SCI transmitted on the PSCCH indicates whether there is data transmission on the SL-SCH and provides related HARQ information.

The MAC entity shall:

- For MAC monitor every subframe of PSCCH.

  ■ If the SCI transmitted on the PSCCH received in this subframe is used for V2X sidelink communication.

    ♦ According to the provisions of 5.1.3.2.2, determine the subframe set in which the transport block is located according to the SCI instruction.

    ♦ Store the SCI and the associated HARQ information.

- For each subframe where the MAC entity has a valid SCI.

  ■ Submit SCI and related HARQ information to the sidelink HARQ entity.

5.2.2.1.2.2 Sidelink HARQ process

For each subframe used for sidelink transmission, a TB and related HARQ information come from the sidelink HARQ entity.

The order of the redundancy version is 0, 2, 3, 1. The variable CURRENT_IRV is all the factors of the redundant version. The variable is updated according to modulo 4.

For each received transmission data block (TB) and related HARQ information, the sidelink process shall:

- If it is a new transmission.

  ■ Set CURRENT_IRV to 0.

  ■ Store the received data in the soft buffer and try to demodulate the received data according to CURRENT_IRV.

layer function for V2X sidelink communication.

- The HARQ reordering function of the RLC UM receiving entity is not used for STCH.

- The initial values of the parameters VR (UH) and VR (UR) maintained by each RLC UM receiving entity are set to the SN number of the first UMD PDU corresponding to the RLC UM received by the UE.

5.4 PDCP layer

5.4.1 Overview

In addition to the provisions of this standard, other requirements of the PDCP layer protocol of the PC5 interface shall comply with the provisions of 3GPP TS 36.323 (Release 14).

SBCCH does not use the PDCP protocol.

For STCH, it is stipulated as follows: Each sidelink radio bearer (SLRB) is associated with a PDCP entity. The PDCP protocol is used to map the SLRB bearer on the STCH type logical channel.

5.4.2 PDCP process

5.4.2.1 Sidelink data transmission process

For the sidelink data transmission, the UE has the following modifications based on the process specified in 5.1.1 of 3GPP TS 36.323 (Release 14).

- No need to maintain Next_PDCP_TX_SN and TX_HFN.

- If SDU Type is set to 000 (that is, IP SDU); if header compression is configured, then header compression will be performed.

5.4.2.2 Sidelink data reception process

For the sidelink data reception, the UE shall comply with the following provisions based on the process specified in 5.1.2.1.3 of 3GPP TS 36.323 (Release 14).

- No need to maintain Next_PDCP_RX_SN and RX_HFN.

- If SDU Type is set to 000 (i.e., IP SDU), if header compression is configured, header decompression shall be performed.

5.4.2.3 Header compression and decompression

For V2X sidelink data transmission and reception, if the SDU Type is set to 000

5.5 RRC layer

5.5.1 Overview

In addition to the provisions of this standard, other requirements of the RRC layer protocol of the PC5 interface shall comply with the provisions of 3GPP TS 36.331 (Release 14). The 5.5 specifies the messages and information elements specifically used for PC5 V2X. For the complete ASN.1, see 3 GPP TS 36.331 (Release 14).

5.5.2 Process

5.5.2.1 System information

5.5.2.1.1 System information that UE needs to read

UE will:

1> If the UE supports V2X sidelink communication and is configured by the upper layer to receive V2X sidelink communication on a frequency.

2> If the frequency of interest is the main frequency; or the SysemInformationBlockType21 of the serving cell/primary cell does not provide for sending or receiving resources for V2X sidelink communication on the frequency of interest; and

2> If the cell used for V2X sidelink communication meets the S criterion as defined by 3GPP TS 36.304 (Release 14); and

2> The schedulingInfoList on the frequency concerned indicates that SystemInformationBlockType21 exists and the UE does not store a valid version of SystemInformationBlockType21:

3> Read SystemInformationBlockType21.

5.5.2.1.2 Behavior when SystemInformationBlockType21 is received

When receiving SystemInformationBlockType21, the UE will:

1> If the SystemInformationBlockType21 message contains sl-V2X-ConfigCommon:

2> If it is configured to receive V2X sidelink communication:

3> Use the resource pool indicated by v2x-CommRxPool in sl-V2X-ConfigCommon to monitor V2X sidelink communication, according to the provisions of 5.5.2.6.6;

1> If the MAC layer indicates that a PDCCH transmission addressed by C-RNTI is successfully received and if rach-Skip is configured:

2> If the target primary cell broadcasts SystemInformationBlockType21; meanwhile the UE sends a SidelinkUEInformation message within 1 s before receiving the RRCConnectionReconfiguration message containing the mobilityControlInfo, meanwhile the SidelinkUEInformation message indicates some modifications of related parameters to V2X sidelink communication related to the target primary cell (such as the modifications of v2x-CommRxInterestedFreqList and v2x-CommTxResourceReq)

3> Send SidelinkUEInformation message according to the provisions of 5.5.2.6.2.

5.5.2.3 Radio resource configuration

V2X sidelink communication dedicated configuration.

UE will:

1> If the RRCConnectionReconfiguration message contains sl-V2X-ConfigDedicated:

2> If commTxResources is included and set to setup:

3> Use the resource indicated by commTxResource for V2X sidelink communication transmission, according to the provisions of 5.5.2.6.7;

3> Channel busy rate measurement shall be performed for V2X sidelink communication transmission in the transmission resource pool as indicated by commTxResources, according to the provisions of 5.5.2.4.3;

2> Otherwise, if commTxResource is included and set to release:

3> Release the resources previously allocated for V2X sidelink communication transmission based on commTxResource;

2> If v2x-CommRxPool is included：

3> On the frequencies contained in v2x-InterFreqInfoList, use the relevant synchronization configuration and resource configuration parameters for V2X sidelink communication, according to the provisions of 5.5.2.6.7;

3> For V2X sidelink communication, perform CBR measurement in the transmission resource pool indicated by v2x-InterFreqInfoList, according to the provisions of 5.5.2.4;

1> If the received measConfig contains measObjectToAddModList:

2> Perform the measurement object addition/modification process in 5.5.2.4.2.6;

1> If the received measConfig contains reportConfigToRemoveList:

2> Perform the report configuration deletion process in 5.5.2.4.2.7;

1> If the received measConfig contains reportConfigToAddModList:

2> Perform the report configuration addition/modification process of 5.5.2.4.2.8;

1> If the received measConfig contains measIdToRemoveList;

2> Perform the measurement identifier deletion process in 5.5.2.4.2.2;

1> If the received measConfig contains measIdToAddModList;

2> Perform the measurement identifier addition/modification process of 5.5.2.4.2.4;

1> If the received measConfig contains measGapConfig;

2> Perform the measurement interval configuration process of 5.5.2.4.2.9;

1> If the received measConfig contains s-Measure:

2> Set the value of the parameter s-Mearsure in VarMeasConfig to the lowest value of the RSRP range, which is indicated by the value of the received s-measure.

5.5.2.4.2.2 Deletion of measurement identifier

UE will:

1> For each measId in the received measIdToRemove, when the corresponding measId is included in the current configuration of the UE's VarMeasConfig:

2> Remove the entry matching measId from the measIdList of VarMeasConfig;

2> If there is a measurement report entry related to the measId in VarMeasReportList, delete it;

2> If the periodic timer or T321 timer is running, stop it and reset the relevant information of the measId (such as timeToTrigger);

3> Add a new entry for the measId in VarMeasConfig;

2> If VarMeasConfig contains the measurement report entry of the measId, delete the measurement report entry;

2> If the periodic report timer or T321 timer is running, stop it and reset the measId information (for example, timeToTrigger).

5.5.2.4.2.5 Deletion of measurement object

UE will:

1> In each measObjectId that is included in the received measObjectToRemoveList and belongs to the UE's current configuration in VarMeasConfig:

2> Remove the entry matching measObjectId from measObjectList in VarMeasConfig;

2> If the measIdList in VarMeasConfig contains the measId associated with the measObjectId, remove all the measIdList associated with the measIdList;

2> When measId is deleted from measIdList:

3> If the measurement report entry of the measId is included in VarMeasReportList, delete the measurement report entry;

3> If the periodic report timer or T321 timer is running, stop it and reset the information related to the measId (such as timeToTrigger);

Note: If measObjectToRemoveList contains a value that does not belong to the measObjectId configured by the current UE, the UE does not consider the message to be wrong.

5.5.2.4.2.6 Measurement object addition/modification

UE will:

1> For each measObjectId in the received measObjectToAddModList:

2> If there is an entry that matches measObjectId in the measObjectList in VarMeasConfig, then for this entry:

3> Reconfigure the entries of measObject with the received value, except for the fields tx-ResourcePoolToRemoveList and tx-ResourcePoolToAddList;

3> If the received measObject contains tx-ResourcePoolToRemoveList:

1> For each reportConfigId in the received reportConfigToAddModList:

2> If there is an entry that matches the reportConfigId in the reportConfigList of VarMeasConfig, for this entry:

3> Reset the entry with the value of reportConfig received;

3> For the reportConfigId contained in the measIdList in VarMeasConfig, if there is a measId related to it, then for each measId related to it:

4> If there is a measurement report entry for the measId in VarMeasReportList, delete the measurement report entry;

4> If the periodic timer or timer T321 is running, stop the timer; reset the information related to the measId (such as timerToTrigger);

2> Otherwise:

3> Add a new entry for the received reportConfig in the reportConfigList of VarMeasConfig.

5.5.2.4.2.9 Measurement interval configuration

UE will:

1> If measGapConfig is configured as setup:

2> If the measurement interval configuration has been set, release the measurement interval configuration;

2> Configure the measurement interval configuration indicated by measGapConfig according to the received gapoffset, that is, the first subframe of each interval when the system frame sequence number appears and the subframe meeting the following conditions (the system frame sequence number and subframe of the cell in the primary cell group):

System frame sequence number mod T = FLOOR (gapoffset/10);

Subframe number = gapoffset mod 10;

And T = MGRP/10 is as defined in 3GPP TS 36.133 (Release 14);

Note: The UE applies a single interval; its timing is related to the cells of the primary cell group, even when configured as DC.

1> Otherwise:

2> Release the measurement interval configuration.

CommTxPoolNormalDedicated or v2x-SchedulingPool, if SystemInformationBlockType21 contains v2x-CommTxPoolExceptional, if mobilityControlInfoV2X contains v2x-CommTxPoolExceptional, then perform channel busy rate measurement on these resource pools;

3> Otherwise, for the frequency of interest in RRCConnectionReconfiguration, if v2x-InterFreqInfoList contains v2x-CommTxPoolNormal v2x-SchedulingPool or v2x-CommTxPoolExceptional:

4> For the frequency concerned in RRCConnectionReconfiguration, if v2x_InterFreqInfoList contains v2x-CommTxPoolNormal and v2x-CommTxPoolExceptional, perform channel busy rate measurement on its resource pool;

3> Otherwise, if the frequency concerned broadcasts SystemInformationBlockType21:

4> If SystemInformationBlockType21 contains v2x-CommTxPoolNormalCommon and v2x-CominTxPoolExceptional, perform channel busy rate measurement on its resource pool;

1> Otherwise:

2> Perform channel busy rate measurement on the frequency of interest on the v2x-CommTxPoolList transmission pool of SL-V2X-Preconfiguration.

5.5.2.4.4 Triggering of measurement report

5.5.2.4.4.1 Overview

If security is successfully activated, the UE will:

1> For each measId contained in the measIdList in VarMeasConfig:

2> If the corresponding reportConfig contains purpose and is set to reportStrongestCellsForSON:

3> Consider that any neighboring cells detected on the relevant frequency are available;

2> Otherwise, if the corresponding reportConfig contains purpose and is set to reportCGI:

3> For a neighboring cell detected on any relevant frequency or frequency set (GERAN), if the physical cell ID of the neighboring cell matches the value of cellForWhichToReportCGI contained in the corresponding measObject in VarMeasConfig, it is considered available for any such cell;

2> If triggerType is set to event, and within the timeToTrigger defined for the event in VarMeasConfig, the poolsTriggeredList defined in VarMeasReportList contains one or more available transmission resource pools whose left and right measurement results meet the leaving conditions:

3> Remove the concerned transmission resource pool in the poolsTriggeredList defined in VarMeasReportList for this measId;

3> If the poolsTriggeredList defined for the measId in VarMeasReportList is empty:

4> Remove the measurement report entry in VarMeasReportList for measId;

4> If the periodic measurement timer of the measId is still running, stop it;

2> If measRSSI-ReportConfig is included, meanwhile if the (first) measurement result is valid:

3> Include a measurement report entry for the measId in VarMeasReport;

3> Set the numberOfReportsSent defined for the measId in VarMeasReport to 0;

3> After the first layer 1 measurement duration, when the physical layer reports the RSSI sampling value, it immediately initiates the measurement report process according to 5.5.2.4.5;

2> Otherwise, if purpose is included and it is set to sidelink, meanwhile if the (first) measurement result is valid:

3> Include a measurement report entry for the measId in VarMeasReportList;

3> Set the numberOdReportsSent defined for the measId in VarMeasReportList to 0;

4> When the measurement volume and channel busy rate measurement results reported for the PCell are valid, the measurement report process is initiated immediately according to 5.5.2.4.5.

2> When the periodic report timer of the measId times out:

3> Initiate the measurement report process according to the provisions of 5.5.2.4.5;

2> When the T321 of the measId times out:

3> Include a measurement report entry for the measId in VarMeasReportList;

Inequality V2-2 (leave condition):

Ms > Thresh;

The variables in the formula are defined as follows:

Ms: The measurement result of the channel busy rate of the transmission resource pool, without considering any offset;

Thresh: The threshold parameter of the event (i.e., v1-Threshold defined in ReportConfigEUTRA);

Ms: Steps from 0 to 1 in steps of 0.01 in decimal mode;

The representation unit of Thresh is the same as Ms.

5.5.2.4.5 Measurement report

The purpose of this process is to transmit measurement results from the UE to E-UTRAN, as shown in Figure 11. The UE will initiate this process only after successful and secured activation.

For measId, when the measurement report process is triggered, the UE will set the measResults in the MeasurementReport message as follows:

1> Set measId as the measurement identifier that triggers the measurement report;

1> Set measResultPCell as the measurement result of the primary cell;

1> If there is at least one available transmission resource pool to report:

2> Set measResultListCBR to include the channel busy rate measurement results as follows:

3> If triggerType is set to event:

4> Contain the corresponding transmission resource pool for this measId, the transmission resource pool is contained in the poolsTriggeredList defined in VarMeasReportList;

3> Otherwise:

4> Contains the transmission resource pool with new measurement results available since the last periodic report or measurement was initiated or reset;

3> For each transmission resource pool to be reported:

This is an excerpt of the PDF (Some pages are marked off intentionally)

------ The End ------