**3GPP TSG-RAN WG2 Meeting #109-e *R2-200xxxx***

**Online, 24th Feb - 6th Mar, 2020**

|  |
| --- |
| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **36.302** | **CR** | **1202** | **rev** | **1** | **Current version:** | **15.2.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
|  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

|  |
| --- |
|  |
| ***Title:***  | Introduction of additional enhancements for NB-IoT in TS 36.302 |
|  |  |
| ***Source to WG:*** | Huawei |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | NB\_IOTenh3-Core |  | ***Date:*** | 2020-03-06 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)Rel-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
|  |  |
| ***Reason for change:*** | Introduction of additional enhancements for NB-IoT in TS 36.302. |
|  |  |
| ***Summary of change:*** | Introduction of additional enhancements for NB-IoT in TS 36.302:* PUR
 |
|  |  |
| ***Consequences if not approved:*** | The additional NB-IoT enhancements are not captured in TS 36.302 |
|  |  |
| ***Clauses affected:*** | 2, 3.1, 3.2, 8.2 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **Y** |  |  Other core specifications  | TS 36.300 CR1259TS 36.331 CR4192TS 36.321 CR1466 |
| ***affected:*** |  | **N** |  Test specifications |  |
| ***(show related CRs)*** |  | **N** |  O&M Specifications |  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

|  |
| --- |
| Start of change |

# 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] Void

[2] Void

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

[4] Void

[5] Void

[6] Void

[7] Void

[8] 3GPP TS 36.211: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation".

[9] Void

[10] Void

[11] 3GPP TS 36.214: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer; Measurements".

[12] 3GPP TS 36.321: "Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification".

[13] 3GPP TS 36.306: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio access capabilities".

[14] 3GPP TS 23.303: "Technical Specification Group Services and System Aspects; Proximity-based services (ProSe)".

[15] Void

[16] 3GPP TS 23.285: "Technical Specification Group Services and System Aspects; Architecture enhancements for V2X services".

[xx] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access (E-UTRAN); Overall description; Stage 2".

|  |
| --- |
| Next change |

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [3] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [3].

**Carrier frequency:** center frequency of the cell.

**Frequency layer:** set of cells with the same carrier frequency.

**NB-IoT:** NB-IoT allows access to network services via E-UTRA with a channel bandwidth limited to 200 kHz.

**Short Processing Time**: For 1 ms TTI length, the operation with short processing time in UL data transmission and DL data reception.

**Short TTI**: TTI length based on a slot or a subslot.

**Sidelink:** UE to UE interface for sidelink communication, V2X sidelink communication and sidelink discovery. The sidelink corresponds to the PC5 interface as defined in TS 23.303 [14].

**Sidelink communication**: AS functionality enabling ProSe Direct Communication as defined in TS 23.303 [14], between two or more nearby UEs, using E-UTRA technology but not traversing any network node. In this version, the terminology "sidelink communication" without "V2X" prefix only concerns PS unless explicitly stated otherwise.

**Sidelink discovery**: AS functionality enabling ProSe Direct Discovery as defined in TS 23.303 [14], using E-UTRA technology but not traversing any network node.

**Transmission using PUR:**  Allows one uplink data transmission using preconfigured uplink resource from RRC\_IDLE mode as specified in TS 36.300 [xx]. Transmission using PUR refers to both CP transmission using PUR and UP transmission using PUR.

**V2X Sidelink communication**: AS functionality enabling V2X Communication as defined in TS 23.285 [16], between nearby UEs, using E-UTRA technology but not traversing any network node.

**Timing Advance Group:** See the definition in TS 36.321 [12].

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [3] 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 [3].

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

ACK Acknowledgement

ARQ Automatic Repeat Request

BCCH Broadcast Control Channel

BCH Broadcast Channel

BL Bandwidth reduced Low complexity

BLER Block Error Rate

CG Cell Group

CMAS Commercial Mobile Alert System

CP Cyclic Prefix

C-plane Control Plane

CRC Cyclic Redundancy Check

CSI Channel State Information

DC Dual Connectivity

DCCH Dedicated Control Channel

DL Downlink

DRX Discontinuous Reception

DTCH Dedicated Traffic Channel

DTX Discontinuous Transmission

eNB E-UTRAN NodeB

eIMTA Enhanced Interference Management and Traffic Adaptation

EPDCCH Enhanced physical downlink control channel

E-UTRA Evolved UTRA

E-UTRAN Evolved UTRAN

FDD Frequency Division Duplex

FDM Frequency Division Multiplexing

FS Frame Structure

GERAN GSM EDGE Radio Access Network

GSM Global System for Mobile communication

HARQ Hybrid ARQ

LAA Licensed-Assisted Access

LTE Long Term Evolution

MAC Medium Access Control

MBMS Multimedia Broadcast Multicast Service

MBSFN Multimedia Broadcast multicast service Single Frequency Network

MCCH Multicast Control Channel

MCH Multicast Channel

MCS Modulation and Coding Scheme

MIMO Multiple Input Multiple Output

MTCH Multicast Traffic Channel

MWUS MTC Wake Up Signal

NACK Negative Acknowledgement

NB-IoT Narrow Band Internet of Things

NPBCH Narrow Band Physical Broadcast Channel

NPDCCH Narrow Band Physical Downlink Control Channel

NPDSCH Narrow Band Physical Downlink Shared Channel

NPRACH Narrow Band Physical Random Access Channel

NPUSCH Narrow Band Physical Uplink Shared Channel

NWUS Narrow Band Wake Up Signal

OFDM Orthogonal Frequency Division Multiplexing

OFDMA Orthogonal Frequency Division Multiple Access

PBCH Physical broadcast channel

PDCCH Physical downlink control channel

PDSCH Physical downlink shared channel

PHY Physical layer

PMCH Physical multicast channel

PRACH Physical random access channel

PRB Physical Resource Block

ProSe Proximity based Services

PSBCH Physical Sidelink Broadcast CHannel

PSCCH Physical Sidelink Control Channel

PSCell Primary SCell

PSDCH Physical Sidelink Discovery Channel

PSSCH Physical Sidelink Shared CHannel

PUCCH Physical uplink control channel

PUR Preconfigured Uplink Resource

PUSCH Physical uplink shared channel

QAM Quadrature Amplitude Modulation

RACH Random Access Channel

RF Radio Frequency

RRC Radio Resource Control

SAP Service Access Point

SBCCH Sidelink Broadcast Control CHannel

SC-FDMA Single Carrier – Frequency Division Multiple Access

SCell Secondary Cell

SC-PTM Single Cell Point to Multipoint

SL-BCH Sidelink Broadcast Channel

SL-DCH Sidelink Discovery Channel

SL-SCH Sidelink Shared Channel

SPDCCH Short PDCCH

SPT Short Processing Time

SPUCCH Short PUCCH

SRS Sounding Reference Symbol

STCH Sidelink Traffic Channel

TAG Timing Advance Group

TB Transport Block

TDD Time Division Duplex

TTI Transmission Time Interval

UE User Equipment

UL Uplink

UMTS Universal Mobile Telecommunication System

U-plane User plane

UTRA Universal Terrestrial Radio Access

UTRAN Universal Terrestrial Radio Access Network

V2X Vehicle-to-Everything

|  |
| --- |
| Next change |

## 8.2 Downlink

The tables describe the possible combinations of physical channels that can be received in parallel in the downlink in the same subframe by one UE. In one subframe, the UE shall be able to receive all TBs according to the indication on PDCCH. Tables 8.2-1, 8.2-1a, 8.2-2 and 8.2-2a are applicable to LTE; Tables 8.2-1b and 8.2-2b are applicable to NB-IoT.

Table 8.2-1: Downlink "Reception Types" except for NB-IoT UEs, BL UEs and UEs in enhanced coverage

|  |  |  |  |
| --- | --- | --- | --- |
| "Reception Type" | Physical Channel(s) | MonitoredRNTI | AssociatedTransport Channel |
| A | PBCH | N/A | BCH |
| B | PDCCH+PDSCH | SI-RNTI | DL-SCH |
| B1 | PDCCH+PDSCH | SI-RNTI (Note 11) | DL-SCH |
| C | PDCCH+PDSCH | P-RNTI | PCH |
| D | PDCCH+PDSCH | RA-RNTI (Note 3) | DL-SCH |
| Temporary C-RNTI (Note 3) (Note 4) | DL-SCH |
| ((PDCCH+SPDCCH)/EPDCCH) +(PDSCH/slot/subslot PDSCH) | C-RNTI and Semi-Persistent Scheduling C-RNTI | DL-SCH  |
| ((PDCCH+SPDCCH)/EPDCCH) +(PDSCH+subslot/slot PDSCH)(Note 14) | C-RNTI and Semi-Persistent Scheduling C-RNTI | DL-SCH  |
| D1 | ((PDCCH+SPDCCH)/EPDCCH) +(PDSCH/subslot/slot PDSCH)(Note 9) | C-RNTI | DL-SCH  |
| ((PDCCH+SPDCCH)/EPDCCH) +(PDSCH+subslot/slot PDSCH)(Note 9, Note 14) | C-RNTI | DL-SCH  |
| D2 | PDCCH+PDSCH | SC-RNTI | DL-SCH |
| G-RNTI | DL-SCH |
| D3 | ((PDCCH+SPDCCH) /EPDCCH) +(PDSCH/subslot/slot PDSCH) | C-RNTI and Semi-Persistent Scheduling C-RNTI | DL-SCH  |
| ((PDCCH+SPDCCH)/EPDCCH) +(PDSCH+subslot/slot PDSCH)(Note 14) | C-RNTI and Semi-Persistent Scheduling C-RNTI | DL-SCH  |
| PDCCH+PDSCH | SC-RNTI | DL-SCH |
| G-RNTI | DL-SCH |
| E | PDCCH/EPDCCH(Note 1) | C-RNTI | N/A |
| F | PDCCH | Temporary C-RNTI (Note 5) | UL-SCH |
| (PDCCH+SPDCCH)/EPDCCH | C-RNTI and Semi-Persistent Scheduling C-RNTI | UL-SCH |
| F1 | (PDCCH+SPDCCH)/EPDCCH(Note 9) | C-RNTI | UL-SCH |
| G | PDCCH | TPC-PUCCH-RNTI | N/A |
| H | PDCCH | TPC-PUSCH-RNTI | N/A |
| I | (PDCCH+SPDCCH)/EPDCCH | Semi-Persistent Scheduling C-RNTI (Note 6) | N/A |
| J | (PDCCH+SPDCCH)/EPDCCH | Semi-Persistent Scheduling C-RNTI (Note 7) | N/A |
| K | PDCCH | M-RNTI (Note 8) | N/A |
| K1 | PDCCH | SC-N-RNTI | N/A |
| K2 | PDCCH | M-RNTI  | N/A |
| L | PMCH | N/A (Note 8) | MCH |
| M | PDCCH | eIMTA-RNTI | N/A |
| N | PDCCH/EPDCCH | SL-RNTI | SL-SCH |
| N1 | PDCCH/EPDCCH | SL-V-RNTI | SL-SCH |
| N2 | PDCCH/EPDCCH | SL Semi-Persistent Scheduling V-RNTI | SL-SCH |
| O | PDCCH | CC-RNTI | N/A |
| P | PDCCH | SRS-TPC-RNTI (Note 10) | N/A |
| Q | PDCCH/EPDCCH | UL Semi-Persistent Scheduling V-RNTI | UL-SCH |
| Q1 | PDCCH/EPDCCH | UL Semi-Persistent Scheduling V-RNTI (Note 12) | N/A |
| R | PDCCH/EPDCCH | SL Semi-Persistent Scheduling V-RNTI (Note 13) | N/A |
| Note 1: PDCCH or EPDCCH is used to convey PDCCH order for Random Access.Note 2: Void.Note 3: RA-RNTI and Temporary C-RNTI are mutually exclusive and only applicable during Random Access procedure.Note 4: Temporary C-RNTI is only applicable when no valid C-RNTI is available.Note 5: Temporary C-RNTI is only applicable during contention-based Random Access procedure.Note 6: Semi-Persistent Scheduling C-RNTI is used for DL Semi-Persistent Scheduling release.Note 7: Semi-Persistent Scheduling C-RNTI is used for UL Semi-Persistent Scheduling release.Note 8: In MBSFN subframes onlyNote 9: DL-SCH reception corresponding to D1, and UL-SCH transmission corresponding to F1, are only applicable to SCells.Note 10: SRS-TPC-RNTI is used to trigger group SRS and TPC for SRS-only SCells. Up to 2 SRS-TPC-RNTI can be concurrently configured.Note 11: For MBMS-dedicated carrier, SI-RNTI may be assigned with two values which may be used in same subframe.Note 12: Used for release of an UL Semi-Persistent Scheduling associated with UL Semi-Persistent Scheduling V-RNTI.Note 13: Used for release of an SL Semi-Persistent Scheduling associated with SL Semi-Persistent Scheduling V-RNTI.Note 14: For a UE indicating the capability of decoding PDSCH and subslot/slot PDSCH assigned with C-RNTI/SPS C-RNTI in the same subframe for a given carrier. |

Table 8.2-1a: Downlink "Reception Types" for BL UEs and UEs in enhanced coverage

|  |  |  |  |
| --- | --- | --- | --- |
| "Reception Type" | Physical Channel(s) | MonitoredRNTI | AssociatedTransport Channel |
| A | PBCH | N/A | BCH |
| B | MPDCCH (Note 1) | C-RNTI | N/A |
| C | MPDCCH | TPC-PUCCH-RNTI | N/A |
| D | MPDCCH | TPC-PUSCH-RNTI | N/A |
| D1 | MPDCCH (Note 7) | SC-RNTI | DL-SCH |
| G-RNTI | DL-SCH |
| E | MPDCCH | Semi-Persistent Scheduling C-RNTI (Note 2) | N/A |
| F | MPDCCH | Semi-Persistent Scheduling C-RNTI (Note 3) | N/A |
| G | MPDCCH (Note 4) | RA-RNTI | DL-SCH |
| Temporary C-RNTI  | UL-SCH |
| Temporary C-RNTI  | DL-SCH |
| P-RNTI | PCH |
| H | PDSCH (Note 5) | SI-RNTI | DL-SCH |
| P-RNTI | PCH  |
| Temporary C-RNTI  | DL-SCH |
| RA-RNTI | DL-SCH |
| H1 | PDSCH (Note 7) | SC-RNTI | DL-SCH |
| G-RNTI | DL-SCH |
| I | MPDCCH | Temporary C-RNTI (Note 6) | UL-SCH |
| C-RNTI and Semi-Persistent Scheduling C-RNTI | UL-SCH |
| J | MPDCCH | C-RNTI and Semi-Persistent Scheduling C-RNTI | DL-SCH |
| K | PDSCH (Note 5) | C-RNTI and Semi-Persistent Scheduling C-RNTI | DL-SCH |
| L | MWUS | N/A | N/A |
| Note 1: MPDCCH is used to convey PDCCH order for Random Access.Note 2: Semi-Persistent Scheduling C-RNTI is used for DL Semi-Persistent Scheduling release.Note 3: Semi-Persistent Scheduling C-RNTI is used for UL Semi-Persistent Scheduling release.Note 4: RA-RNTI, P-RNTI, and Temporary C-RNTI are not required to be simultaneously monitored.Note 5: All RNTIs listed in the reception type are mutually exclusive.Note 6: Temporary C-RNTI is only applicable during contention-based Random Access procedure.Note 7: SC-RNTI and G-RNTI are not required to be simultaneously monitored. |

Table 8.2-1b: Downlink "Reception Types" for NB-IoT UEs

|  |  |  |  |
| --- | --- | --- | --- |
| "Reception Type" | Physical Channel(s) | MonitoredRNTI | AssociatedTransport Channel |
| A | NPBCH | N/A | BCH |
| B | NPDCCH (Note 2) | C-RNTI | N/A |
| C | NPDCCH | P-RNTI | PCH |
| D | NPDCCH | RA-RNTI (Note 1) | DL-SCH |
| Temporary C-RNTI (Note 1) |
| D1 | NPDCCH (Note 3) | SC-RNTI | DL-SCH |
| G-RNTI | DL-SCH |
| E | NPDSCH | N/A | DL-SCH |
| F | NPDCCH | C-RNTI | DL-SCH |
| G | NPDCCH | C-RNTI | UL-SCH |
| H | NWUS | N/A | N/A |
| I | NPDCCH | Semi-Persistent Scheduling C-RNTI (Note 4) | N/A |
| J | NPDCCH | Semi-Persistent Scheduling C-RNTI | UL-SCH |
| K | NPDCCH (Note 5) | PUR-RNTI | N/A |
| L | NPDCCH | PUR-RNTI | DL-SCH |
| M | NPDCCH | PUR-RNTI | UL-SCH |
| Note 1: RA-RNTI and Temporary C-RNTI are mutually exclusive and only applicable during Random Access procedure.Note 2: NPDCCH is used to convey PDCCH order for Random Access.Note 3: SC-RNTI and G-RNTI are not required to be simultaneously monitored.Note 4: Semi-Persistent Scheduling C-RNTI is used for releasing SR with SPS BSR.Note 5: NPDCCH is used to terminate transmission using PUR. |

Table 8.2-2: Downlink "Reception Type" Combinations except for NB-IoT UEs, BL UEs and UEs in enhanced coverage

The "Reception Type" used in this table refers to the "Reception Type" in Table 8.2-1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | PCell | PSCell | SCell | Non-serving cell |
| 1. RRC\_IDLE |
| 1.1 All UEs | A + B + C + D |  |  |  |
| Remarks: The combination for Random Access procedure is only required, related to D. |
| 1.2 UEs supporting MBMS | K + L |  |  |  |
| 1.3 UEs supporting SC-PTM | K1 + D2 |  |  |  |
| 2. RRC\_CONNECTED |
| 2.1 All UEs | A + B + (D or E or G or I) + (F or H or J) + M | A + (D or E or G or I) + (F or H or J) + M | (E or D1) + F1 |  |
| 2.2 UEs supporting FS2 | A + B + (D or E or G or I) + (F or H or J) + F + M + P | A + (D or E or G or I) + (F or H or J) + F + M | (E or D1) + F1 |  |
| Remarks: For TDD UL/DL configuration 6 with special subframe configuration 10 and TDD UL/DL configuration 0, two PDCCHs or EPDCCHs can be received in the same subframe for UL-SCH in two different uplink subframes. |
| 2.2a UEs supporting FS3 |  |  | D1 + F1 + O |  |
| Remarks: For FS3, up to four PDCCHs or EPDCCHs can be received in the same subframe for LAA UL-SCH in different FS3 uplink subframes. |
| 2.3 UEs supporting MBMS | ((E or G or I) + L + K) or (A + B + D) + (F or H or J) + M | ((E or G or I) + L + K) or (A + B + D) + (F or H or J) + M | (E + L + K) or (D1 + B) + F1 | (A + B) or (L + K) |
| Remarks: The combination is the requirement when MBMS reception is on PCell and/or any other cell. *r* is the number of DL CCs on which the UE supports MBMS reception according to the MBMSInterestIndication. The number of L and the number of K ≤ *r*.Remarks: It is not required to simultaneously receive EPDCCH and PMCH on the same cell. |
| 2.3a UEs supporting FeMBMS |  |  | (D1 + B + K2) or (L + K2) + F1 | (A + B1 + K2) or (L + K2) |
| Remarks: The combination is the requirement when MBMS reception is on PCell and/or any other cell. *r* is the number of DL CCs on which the UE supports MBMS reception according to the MBMSInterestIndication. The number of L and the number of K2 ≤ *r*.Remarks: It is not required to simultaneously receive EPDCCH and PMCH on the same cell. |
| 2.4 MBMS UEs supporting FS2 | ((E or G or I) + L + K) or (A + B + D) + 1x(F or H or J) + F + M + P | ((E or G or I) + L + K) or (A + B + D) + 1x(F or H or J) + F + M | (E + L + K) or (D1 + B) + F1 | (A + B) or (L + K) |
| Remarks: For TDD UL/DL configuration 6 with special subframe configuration 10 and TDD UL/DL configuration 0, two PDCCHs or EPDCCHs can be received in the same subframe for UL-SCH in two different uplink subframes.Remarks: The combination is the requirement when MBMS reception is on PCell and/or any other cell. *r* is the number of DL CCs on which the UE supports MBMS reception according to the MBMSInterestIndication. The number of L and the number of K ≤ *r*.Remarks: It is not required to simultaneously receive EPDCCH and PMCH on the same cell. |
| 2.5 UEs supporting ETWS and CMAS | A + B + C + (D or E or G or I) + (F or H or J) + M | A + (D or E or G or I) + (F or H or J) + M | (E or D1) + F1 |  |
| 2.6 ETWS and CMAS UEs supporting FS2 | A + B + C + (D or E or G or I) + (F or H or J) + F + M + P | A + (D or E or G or I) + (F or H or J) + F + M | (E or D1) + F1 |  |
| Remarks: For TDD UL/DL configuration 6 with special subframe configuration 10 and TDD UL/DL configuration 0, two PDCCHs or EPDCCHs can be received in the same subframe for UL-SCH in two different uplink subframes. |
| 2.7 UEs supporting sidelink communication | A + B + (D or E or G or I) + (F or H or J) + M + N |  |  |  |
| 2.7a UEs supporting V2X sidelink communication | A + B + (D or E or G or I) + (F or H or J or Q or Q1) + M + N1 + (N2 or R) |  |  |  |
| 2.7b UEs supporting V2X sidelink communication | A + B + (D or E or G or I) + (F or H or J or Q or Q1) +M |  |  |  |
|  | Remarks: The 2.7 and 2.7a combination is the requirement when the UE is configured in scheduled resource allocation mode, and the 2.7b combination is the requirement when the UE is configured in autonomous resource selection mode. |
| 2.8 UEs supporting SC-PTM | A + B + (D or (K1 + D2) or (K1 + D3) or E or G or I) + (F or H or J) + M | A + B + (D or (K1 + D2) or (K1 + D3) or E or G or I) + (F or H or J) + M | B + (D1 or (K1 + D2) or (K1 + D3) or E) + F1 | A + B + K1+ D2 |
| Remarks: The combination is the requirement when SC-PTM reception is on PCell and/or any other cell. *r* is the number of DL CCs on which the UE supports SC-PTM reception according to the MBMSInterestIndication. The number of K1 and the number of D2 ≤ *r*. |
| 2.9 SC-PTM UEs supporting FS2 | A + B + (D or (K1 + D2) or (K1 + D3) or E or G or I) + (F or H or J) + F + M + P | A + B + (D or (K1 + D2) or (K1 + D3) or E or G or I) + (F or H or J) + F + M | B + (D1 or (K1 + D2) or (K1 + D3) or E) + F1 | A + B + K1+ D2 |
| Remarks: For TDD UL/DL configuration 6 with special subframe configuration 10 and TDD UL/DL configuration 0, two PDCCHs or EPDCCHs can be received in the same subframe for UL-SCH in two different uplink subframes.Remarks: The combination is the requirement when SC-PTM reception is on PCell and/or any other cell. *r* is the number of DL CCs on which the UE supports SC-PTM reception according to the MBMSInterestIndication. The number of K1 and the number of D2 ≤ *r*. |
| NOTE 1: *p* is the number of DL CCs supported by the UE. The number of D1 is ≤ (*p*-1). *q* is the number of UL CCs supported by the UE. For UE not supporting FS2, the number of F1 is ≤ (*q*-1). For UE supporting FS2, the number of F1 is ≤ 2x(*q*-1). *q* = *p* = 1 implies non-CA capable UE. Only 1xE is possible at any subframe over all serving cells. 1xM is included if UE supports eIMTA.NOTE 2: The UE is only required to receive one PDSCH, pertaining to D or D1 or D2 (if the UE supports SC-PTM) or D3 (if the UE supports the parallel reception of unicast and SC-PTM), per DL CC.NOTE 3: If a UE indicating category 0 is scheduled with PDSCH transmissions exceeding its processing capability as specified in TS 36.306 [13], the prioritization between these PDSCH transmissions is up to the UE implementation.NOTE 4: Combination involving EPDCCH is optional and required only for UE supporting EPDCCH.NOTE 5: Combination involving SPDCCH and/or subslot/slot PDSCH is optional and required only for UE supporting SPDCCH and/or subslot/slot PDSCH.NOTE 6: For UEs supporting FS2, for TDD UL/DL configuration 0 not configured with special subframe configuration 10 and TDD UL/DL configuration 6 not configured with special subframe configuration 10, two PDCCHs or SPDCCHs can be received in a slot for UL-SCH with a slot duration in two different uplink slots.NOTE 7: For UEs supporting FS2, for TDD UL/DL configuration 0 with special subframe configuration 10 and TDD UL/DL configuration 6 with special subframe configuration 10, three PDCCHs can be received in a slot for UL-SCH with a slot duration in three different uplink slots or two SPDCCHs can be received in a slot for UL-SCH with a slot duration in two different uplink slots. |

Table 8.2-2a: Downlink "Reception Type" Combinations for BL UEs and UEs in enhanced coverage

The "Reception Type" used in this table refers to the "Reception Type" in Table 8.2-1a.

|  |  |
| --- | --- |
|  | PCell |
| 1. RRC\_IDLE |
| 1.1 All UEs  | A or G or H |
| 1.2 UEs supporting SC-PTM | A or G or H or (D1 + H1) |
| 1.3 UEs supporting MWUS | A or G or H or L |
| 2. RRC\_CONNECTED |
| 2.1 All UEs | A or ((J or C or E or B) + (I or D or F) + K) or G or H |
| Remarks: The combination for Random Access procedure is only required, related to G and H. |
| 2.2 UEs supporting FS2 |  A or ((J or C or E or B) + (I or D or F) + I + K) or G or H |
| Remarks: For TDD UL/DL configuration 0, two MPDCCHs can be received in the same subframe for UL-SCH in two different uplink subframes, which is only applicable for UEs configured with CE mode A with no repetitions.Remarks: The combination for Random Access procedure is only required, related to G and H. |

NOTE: Any subset of the combinations specified in table 8.2-2 and 8.2-2a are also supported.

The "reception type" names in Table 8.2-2b refer to the "reception types" from Table 8.2-1b.

Table 8.2-2b: Downlink "Reception Type" Combinations for NB-IoT UEs

|  |  |
| --- | --- |
|  | PCell |
| 1. RRC\_IDLE |
| 1.1 All UEs | A or C or D or E |
| Remarks: The combination for Random Access procedure is only required, related to D. |
| 1.2 UEs supporting SC-PTM | A or C or D or E or D1 |
| 1.3 UEs supporting NWUS | A or C or D or E or H |
| 1.3 UEs supporting transmission using PUR | A or C or D or E or K or L or M |
| 2. RRC\_CONNECTED |
| 2.1 All UEs | A or B or D or F or G or E |
| 2.2 UEs supporting SR with SPS BSR | A or B or D or F or G or E or I or J |