**3GPP TSG-RAN WG2#101 *DRAFT R2-180xxxx***

**Athens, Greece, 26th Feb. – 2nd Mar. 2018**

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| *CR-Form-v11.2* |
| **CHANGE REQUEST** |
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|  | **38.306** | **CR** | **0003** | **rev** | **3** | **Current version:** | **15.0.0** |  |
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| *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)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network | **x** | Core Network |  |

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| ***Title:***  | Updates on UE capabilities |
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| ***Source to WG:*** | Intel Corporation |
| ***Source to TSG:*** | R2 |
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| ***Work item code:*** | NR\_newRAT-Core |  | ***Date:*** | 2018-02-02 |
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| ***Category:*** | **F** |  | ***Release:*** | Rel-15 |
|  | *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)* |
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| ***Reason for change:*** | New agreements made at RAN2 NR Ad-Hoc: 1. Linking MR-DC BCs to BPCs (R2-1800909)
2. BC structure with UL and DL decoupling (R2-181620)
3. BPC capability coordination in MR-DC (R2-1800740)
4. Clarifications on BPC capabilities (R2-1801532)
5. L2 buffer size calculation (R2-1800946)
6. UE capabilities on dynamic power sharing (R2-1801520)
7. L2/3 capabilities (R2-1801608)
8. RAN1 LS (R2-1801608)
9. UE capability parameters with the table format (R2-1801608)
10. Correction on the field description of singleTransmission (R2-1801653)
11. Removal of *volteOverNR-PDCP* (R2-1800955)
12. Small corrections

New agreements made at RAN2#101: 1. Max data rate calculation in EUTRA side in MR-DC
2. New agreements on L2 buffer size calculation
3. New agreements on L2/3 capabilities
4. Moving tdm-Pattern-r15 from UE-EUTRA-Capability to UE-MRDC-Capability
5. New agreements on SSTD measurement related capabilities
6. New agreements on explicit linking from the RF band combinations to BPCs
7. Other small corrections
8. Add L1/RF/RRM features in accordance with RAN1/4 inputs in R1-1803513 and R4-1803564.
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| ***Summary of change:*** | 1. Add clarification that the UE is allowed to include the fallback BPCs with a higher capability and multiple BPCs for the same band combination.
2. Add clarification how UL and DL decoupling works for SUL.
3. Add clarification of BPC coordination into clause 8 (Capability coordination).
4. Update the field descriptions of physical layer parameters.
5. Update 4.1.4 with the table showing RLC RTT per SCS.
6. Add the field descriptions of *dynamicPowerSharing* and *eutra-BasedTDM*.
7. Update L2/3 capabilities as follow:
* Add the field descriptions of *splitSRB-WithOneUL-Path, directSN-Addition, intraAndInterF-MeasAndReport*, and *eventA-MeasAndReport*.
* Add the field descriptions of *fdd-UE-MRDC-Capability, tdd-UE-MRDC-Capabilty, fdd-UE-NR-Capability* and *tdd-UE-NR-Capability* in 4.2.1
* Update the field description of *multipleTimingAdvances*.
* Fill in FDD-TDD difference column according to the agreements.
1. Update 4.1.2 according to RAN1 LS.
2. Update UE capability parameters with the table format.
3. Update the field description of *singleTransmission*.
4. Remove *volteOverNR-DPCP* field description.
5. Update with the following small corrections:
* Correct reference for channel BW in 4.1.2
* Remove clause 7 (Mandatory features).
* Add some references in 2 and corresponding field descriptions.
* Remove obvious and repeated editor’s notes
1. Add EUTRA max data rate calculation in 4.1.2
2. Add 75ms RTT for EUTRA cell group and a note to consider both MN terminated split bearer and SN terminated split bearers.
3. Further update L2/3 capabilities as follow:
* Remove direstSN-Addition.
* Add splitDRB-withUL-Both-MCG-SCG.
* Add srb3.
* Add a note dataRateDRB-IP may moved to NAS dependent on CT1/SA3 confirmation.
* Add “Yes” in mandatory field for shortSN, am-WithShortSN, um-WIthLongSN, um-WithShortSN, longDRX-Cycle, shortDRX-Cycle, intraAndInterF-MeasAndReport, and eventA-MeasAndReport.
* Add “No” in mandatory field for continueROHC-Context, maxNumberROHC-ContextSessions, supportedROHC-Profiles, uplinkOnlyROHC-Profiles, lcp-Restriction, multipleSR-Configurations, multipleConfiguredGrantConfigurations, independentGapConfig, and sstd-Meas-DC.
* Add clarification on the supported numbers for multipleSR-Configurations (8) and multipleConfiguredGrantConfigurations (16).
* Add clarification in mandatory field for multipleTimingAdvances.
* Add some conditional mandatory features in 6.
1. Add description for tdm-Pattern.
2. Rename sstd-Meas-DC to sftd-Meas-PSCell and add sftd-Meas-NR-Cell.
3. Remove supportedBasebandProcessingCombination-MRDC from physical layer parameters and add basebandProcessingCombination-MRDC to RF Parameters.
4. Following changes are updated:
* Move the description of bandCombinationsUL from 38.331 to 38.306.
* Remove FFS.
* Remove TBD for clear parameter attribute
1. Add L1/RF/RRM features
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| ***Consequences if not approved:*** | Specification is incomplete.  |
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| ***Clauses affected:*** |  |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 38.331 CR 0005 |
| ***affected:*** |  | **x** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** |  |

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| The First Change |

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2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

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

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

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

[4] 3GPP TS 38.101-3: “NR User Equipment (UE) radio transmission and reception Part 3: Range 1 and Range 2 Interworking operation with other radios”.

[5] 3GPP TS 38.133: “NR Requirements for support of radio resource management”.

[6] 3GPP TS 38.211: “NR Physical channels and modulation”.

[7] 3GPP TS 37.340: “Evolved Universal Terrestrial Radio Access (E-UTRA) and NR Multi-connectivity”.

[8] 3GPP TS 38.321: “NR Medium Access Control (MAC) protocol specification”.

[9] 3GPP TS 38.331: “NR Radio Resource Control (RRC) protocol specification”.

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4.1.2 Max data rate without *ue-CategoryDL* and *ue-CategoryUL*

For NR, the approximate data rate for a given number of aggregated carriers in a band or band combination is computed as follows.



wherein

J is the number of aggregated component carriers in a band or band combination

Rmax = 948/1024

For the j-th CC,

 is the maximum number of layers

 is the maximum modulation order

is the scaling factor

The scaling factor can at least take the values 1 and 0.75.

is signalled per band and per band per band combination

 is the numerology (as defined in TS 38.211 [6])

 is the average OFDM symbol duration in a subframe for numerology , i.e. . Note that normal cyclic prefix is assumed.

 is the maximum RB allocation in bandwidth  with numerology , as defined in 5.3 TS 38.101-1 [2] and 5.3 TS 38.101-2 [3], where  is the UE supported maximum bandwidth in the given band or band combination

is the overhead and takes the following values

[0.14], for frequency range FR1 for DL

[0.18], for frequency range FR2 for DL

[0.08], for frequency range FR1 for UL

[0.10], for frequency range FR2 for UL

Note: Only one of the UL or SUL carriers (the one with the higher data rate) is counted for a cell operating SUL

The approximate maximum data rate can be computed as the maximum of the approximate data rates computed using the above formula for each of the supported band or band combinations and baseband processing capabilities.

For EUTRA in case of MR-DC, the approximate data rate for a given number of aggregated carriers in a band or band combination is computed as follows.

Data rate (in Mbps) =

wherein

J is the number of aggregated EUTRA component carriers in MR-DC band combination

is the total maximum number of DL-SCH transport block bits received within a 1ms TTI for j-th CC, as derived from TS36.213 [22] based on the UE supported maximum MIMO layers for the j-th carrier, and based on the modulation order and number of PRBs based on the bandwidth of the j-th carrier.

The approximate maximum data rate can be computed as the maximum of the approximate data rates computed using the above formula for each of the supported band or band combinations.

For MR-DC, the approximate maximum data rate is computed as the sum of the approximate maximum data rates from NR and EUTRA.

Editors’ Note: RAN1 confirmation is needed on scaling factor and EUTRA max data rate calculation.

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4.1.4 Total layer 2 buffer size

The total layer 2 buffer size is defined as the sum of the number of bytes that the UE is capable of storing in the RLC transmission windows and RLC reception and reordering windows for all radio bearers, and for UEs capable of split bearers, also in PDCP reordering windows for all split radio bearers.

The required total layer 2 buffer size for split bearer operation in MR-DC is calculated by *MaxULDataRate \* RLC RTT + MaxDLDataRate\_SN \* RLC RTT + MaxDLDataRate\_MN \* (RLC RTT + Xn delay + Queuing in SN)*. Otherwise it is calculated by *MaxDLDataRate \* RLC RTT + MaxULDataRate \* RLC RTT*. The required total layer 2 buffer size is determined as the maximum total layer 2 buffer size of all the calculated ones for each band combination in the supported MR-DC or NR band combinations.

wherein

Xn delay + Queuing in SN = 25ms

RLC RTT for EUTRA cell group = 75ms

RLC RTT for NR cell group is defined in Table 4.1.4-1

**Table 4.4-1: MAC function location and link direction association.**

| SCS (KHz) | RLC RTT (ms) |
| --- | --- |
| 15KHz | TBD |
| 30KHz | TBD |
| 60KHz | TBD |
| 120KHz | TBD |

Editor’s Note: Both MN terminated split bearer and SN terminated split bearers are considered for L2 buffer size calculation for MR-DC and discussion/decision on the detailed equation is needed.

4.2 UE Capability Parameters

4.2.1 Introduction

If the UE supports both FDD and TDD, set all fields in UE-MRDC-Capability and/or UE-NR-Capability, except fdd-UE-MRDC-Capability, tdd-UE-MRDC-Capability, fdd-UE-NR-Capability, and tdd-UE-NR-Capability, to include the values applicable for both FDD and TDD (i.e. functionality supported by both modes). If (some of) the UE capability fields have a different value for FDD and TDD, the UE includes supported FDD/TDD dedicated additional functionality by the field in fdd-UE-MRDC-Capability/tdd-UE-MRDC-Capability and/or fdd-UE-NR-Capability/tdd-UE-NR-Capability. If the UE supports either FDD or TDD only, set all fields in UE-MRDC-Capability and/or UE-NR-Capability, except fdd-UE-MRDC-Capability, tdd-UE-MRDC-Capability, fdd-UE-NR-Capability and tdd-UE-NR-Capability, to include the values applicable for the FDD/TDD supported by the UE.

4.2.2 General parameters

| Definitions for parameters | Per | M | FDD-TDD diff |
| --- | --- | --- | --- |
| ***splitSRB-WithOneUL-Path***Indicates whether the UE supports UL transmission via either MCG path or SCG path for the split SRB as specified in TS 37.340 [7]. | UE | TBD | Yes |
|  ***splitDRB-withUL-Both-MCG-SCG***Indicates whether the UE supports UL transmission via both MCG path and SCG path for the split DRB as specified in TS 37.340 [7]. | UE | TBD | Yes |
| ***srb3***Indicates whether the UE supports direct SRB between the SN and the UE as specified in TS 37.340 [7]. | UE | TBD | Yes |

4.2.3 SDAP Parameters

Editor’s Note: Targeted for completion in June 2018.

4.2.4 PDCP Parameters

| Definitions for parameters | Per | M | FDD-TDD diff |
| --- | --- | --- | --- |
| ***continueROHC-Context***Defines whether the UE supports ROHC context continuation operation where the UE does not reset the current ROHC context upon handover. | UE | No | No |
| ***dataRateDRB-IP***Defines the upper bound of the aggregated data rate of user plane integrity protected data in either UL or DL DRBs. Value 64kbps corresponds to the aggregated data rate of user plane integrity protected data in either UL or DL cannot exceed 64kbps and so on. It is not supported in this version and is targeted for completion in June 2018.Note: It may be moved to NAS as part of the rest of the UE security capability (CT1/SA3 confirmation is needed)  | UE | N/A | No |
| ***maxNumberROHC-ContextSessions***Defines the maximum number of header compression context sessions supported by the UE, excluding context sessions that leave all headers uncompressed. | UE | No | No |
| ***outOfOrderDelivery***Indicates whether UE supports Out of order delivery of data to upper layers by PDCP. | UE | TBD | No |
| ***shortSN***Indicates whether the UE supports 12 bit length of PDCP sequence number. | UE | Yes | No |
| ***supportedROHC-Profiles***Defines which ROHC profiles from the list below are supported by the UE: - 0x0000 ROHC No compression (RFC 5795)- 0x0001 ROHC RTP/UDP/IP (RFC 3095, RFC 4815)- 0x0002 ROHC UDP/IP (RFC 3095, RFC 4815)- 0x0003 ROHC ESP/IP (RFC 3095, RFC 4815)- 0x0004 ROHC IP (RFC 3843, RFC 4815)- 0x0006 ROHC TCP/IP (RFC 6846)- 0x0101 ROHC RTP/UDP/IP (RFC 5225)- 0x0102 ROHC UDP/IP (RFC 5225)- 0x0103 ROHC ESP/IP (RFC 5225)- 0x0104 ROHC IP (RFC 5225)A UE that supports one or more of the listed ROHC profiles shall support ROHC profile 0x0000 ROHC uncompressed (RFC 5795). | UE | No | No |
| ***uplinkOnlyROHC-Profiles***Indicates which ROHC profile(s) from the list below are supported in uplink-only ROHC operation by the UE. - 0x0006 ROHC TCP (RFC [6846])A UE that supports uplink-only ROHC profile(s) shall support ROHC profile 0x0000 ROHC uncompressed (RFC 5795). | UE | No | No |

4.2.5 RLC parameters

| Definitions for parameters | Per | M | FDD-TDD diff |
| --- | --- | --- | --- |
| ***am-WithShortSN***Indicates whether the UE supports RLC AM with 12 bit length of RLC sequence number. | UE | Yes | No |
| ***um-WIthLongSN***Indicates whether the UE supports RLC UM with 12 bit length of RLC sequence number.  | UE | Yes | No |
| ***um-WithShortSN***Indicates whether the UE supports RLC UM with 6 bit length of RLC sequence number. | UE | Yes | No |

4.2.6 MAC parameters

| Definitions for parameters | Per | M | FDD-TDD diff |
| --- | --- | --- | --- |
| ***lcp-Restriction***Indicates whether UE supports the selection of logical channels for each UL grant based on RRC configured restriction. | UE | No | No |
| ***logicalChannelSR-DelayTimer***Indicates whether the UE supports the logicalChannelSR-DelayTimer as specified in TS 38.321 [8]  | UE | TBD | Yes |
| ***longDRX-Cycle***Indicates whether UE supports long DRX cycle as specified in TS 38.321 [8]. | UE | Yes | Yes |
| ***multipleConfiguredGrantConfigurations***Indicates whether UE supports [16] configured grant configurations per cell group. | UE | No | Yes |
| ***multipleSR-Configurations***Indicates whether the UE supports [8] SR configurations per cell group. | UE | No | Yes |
| ***pucch-SpatialRelInfoMAC-CE***Indicates whether the UE supports indication of PUCCH-spatialrelationinfo by a MAC CE per PUCCH resource. | UE | No | No |
| ***shortDRX-Cycle***Indicates whether UE supports short DRX cycle as specified in TS 38.321 [8]. | UE | Yes | Yes |
| ***skipUplinkTxDynamic***Indicates whether the UE supports skipping of UL transmission for an uplink grant indicated on PDCCH if no data is available for transmission as specified in TS 38.321 [8]. | UE | TBD | Yes |

4.2.7 Physical layer parameters

| **Definitions for parameters** | **Per** | **M** | **FDDTDD****DIFF** | **FR1****FR2****DIFF** |
| --- | --- | --- | --- | --- |
| ***absoluteTPC-Command***Indicates whether the UE supports absolute TPC command mode. | UE | Tbd | No | Yes |
| ***almostContiguousCP-OFDM-UL***Indicates whether the UE supports almost contiguous UL CP-OFDM transmissions. | UE | Tbd | No | Yes |
|  |  |  |  |  |
| ***bwp-SwitchingDelay***Defines whether the UE supports BWP switching delay within type1 or type2 specified in TS38.xxx | UE | Tbd | No | No |
| ***ca-BandwidthClassDL, ca-BandwidthClassUL***This field defines for DL and UL, the class defined by the aggregated transmission bandwidth configuration and maximum number of component carriers supported by a UE, as specified in TS 38.101-1 [2] and TS 38.101-2 [3]. | Band per BPC | Yes | No | Tbd |
| ***calibrationGapPA***Indicates whether the UE supports PA calibration gap to implement PA digital pre-distortion techniques. | UE | Tbd | No | NoFR2 |
| ***cbg-FlushIndication-DL***Indicates whether the UE supports CBG-based (re)transmission for DL using CBG flushing out information (CBGFI) as specified in TS 38.214. | UE | Tbd | No | No |
| ***cbg-TransIndication***Indicates whether the UE supports CBG-based (re)transmission for DL and UL using CBG transmission information (CBGTI) as specified in TS 38.214. | UE | Tbd | No | No |
| ***configuredUL-GrantType1***Indicates whether the UE supports Type 1 PUSCH transmissions with configured grant as specified in TS 38.214 with UL-TWG-repK value of one. | UE | Tbd | No | No |
| ***configuredUL-GrantType2***Indicates whether the UE supports Type 2 PUSCH transmissions with configured grant as specified in TS 38.214 with UL-TWG-repK value of one. | UE | Tbd | No | No |
| ***crossCarrierScheduling***Indicates whether the UE supports cross carrier scheduling operation for carrier aggregation with carrier indicator field (CIF).  | CC per BPC | Tbd | No | No |
| ***csi-ReportWithCRI***Indicates whether UE supports CSI reporting with CRI as defined in Section 5.2.1.4 of TS 38.214 | UE | Tbd | No | Yes |
| ***csi-ReportWithoutCQI***Indicates whether UE supports CSI reporting with report quantity set to ‘CRI/RI/i1’ as defined in Section 5.2.1.4 of TS 38.214. | UE | Tbd | No | Yes |
| ***csi-ReportWithoutPMI***Indicates whether UE supports CSI reporting with report quantity set to ‘CRI/RI/CQI’ as defined in Section 5.2.1.4 of TS 38.214. | UE | Tbd | No | Yes |
| ***csi-RS-CFRA-ForHO***Indicates whether the UE can perform handover using a contention free random access on PRACH resources that are associated with CSI-RS resources of the target cell. | UE | Tbd | No | No |
| ***csi-RS-MeasSCellWithoutSSB***Defines whether the UE can perform CSI-RSRP and CSI-RSRQ measurement as specified in TS38.215 [ref], where CSI-RS resource is configured for a cell that does not transmit SS/PBCH block. A UE that supports this feature shall also support scellWithoutSSB | CC per BPC | Tbd | No | No |
| ***diffNumerologyAcrossPUCCH-Group***Indicates whether different numerology across PUCCH groups in CA is supported by the UE. | CC per BPC | Tbd | No | No |
| ***diffNumerologyWithinPUCCH-Group***Indicates whether UE supports different numerology across carriers within a PUCCH group and a same numerology between DL and UL per carrier for data/control channel at a given time. | CC per BPC | Tbd | No | No |
| ***downlinkSPS***Indicates whether the UE supports PDSCH reception based on semi-persistent scheduling. | UE | Tbd | No | No |
| ***dynamicBetaOffsetInd-HARQ-ACK-CSI***Indicates whether the UE supports indicating beta-offset (UCI repetition factor onto PUSCH) for HARQ-ACK and/or SR via DCI among the RRC configured beta-offsets. | UE | Tbd | No | No |
| ***dynamicHARQ-ACK-CodeB-CBG-Retx-DL***Indicates whether the UE supports HARQ-ACK codebook size for CBG-based (re)transmission based on the DAI-based solution as specified in TS 38.213. | UE | Tbd | No | No |
| ***dynamicHARQ-ACK-Codebook***Indicates whether the UE supports HARQ-ACK codebook dynamically constructed by DCI(s). | UE | Yes | No | No |
| ***dynamicPowerSharing***Indicates whether the UE supports dynamic EN-DC power sharing or not. If the UE supports this capability it will dynamically share the power between NR and LTE if P\_LTE + P\_NR > Pcmax.  | UE | Tbd | No | Tbd |
| ***dynamicPRB-BundlingDL***Indicates whether UE supports DCI-based indication of the PRG size for PDSCH reception. | UE | No | No | No |
| ***dynamicSFI***Indicates whether the UE supports monitoring for DCI format 2\_0 and determination of slot formats via DCI format 2\_0. | UE | Tbd | No | No |
| ***dynamicSwitchRA-Type0-1-PDSCH***Indicates whether the UE supports dynamic switching between resource allocation Types 0 and 1 for PDSCH as specified in TS 38.212. | UE | Tbd | No | No |
| ***dynamicSwitchRA-Type0-1-PUSCH***Indicates whether the UE supports dynamic switching between resource allocation Types 0 and 1 for PUSCH as specified in TS 38.212. | UE | Tbd | No | No |
| ***dynamicSwitchSUL***Indicates whether the UE supports supplemental uplink with dynamic switch (DCI based selection of PUSCH carrier) | CC per BPC | Tbd | No | No |
| ***freqHoppingPUCCH-F0-2***Indicates whether the UE supports transmission of a PUCCH format 0 or 2 without frequency hopping. | UE | Tbd | No | Yes |
| ***freqHoppingPUCCH-F1-3-4***Indicates whether the UE supports transmission of a PUCCH format 1, 3 or 4 without frequency hopping. | UE | Tbd | No | Yes |
| ***interleavingVRB-ToPRB-PDSCH***Indicates whether the UE supports receiving PDSCH with interleaved VRB-to-PRB mapping as specified in TS 38.211. | UE | Tbd | No | No |
| ***interleavingVRB-ToPRB-PUSCH***Indicates whether the UE supports transmitting PUSCH with interleaved VRB-to-PRB mapping as specified in TS 38.211. A UE that supports this feature shall also support supports non-continuous resource block transmission in uplink using CP-OFDM waveform for each component carrier. | UE | Tbd | No | No |
| ***interSlotFreqHopping-PUSCH***Indicates whether the UE supports inter-slot frequency hopping for PUSCH transmissions. | UE | Tbd | No | No |
| ***intraSlotFreqHopping-PUSCH***Indicates whether the UE supports intra-slot frequency hopping for PUSCH transmission, except for PUSCH scheduled by PDCCH in the Type1-PDCCH common search space before RRC connection establishment.  | UE | Yes | No | Yes |
| ***lowLatencyCSI-Feedback***Indicates whether UE supports supporting low latency class as defined in Section [TBD] in TS 38.214. | CC per BPC | No | No | No |
| ***maxNumberMIMO-LayersPDSCH***Defines the maximum number of spatial multiplexing layer(s) supported by the UE for DL reception. | CC per BPC | Tbd | No | No |
| ***maxNumberMIMO-LayersCB-PUSCH***Defines supported maximum number of MIMO layers at the UE for PUSCH transmission with codebook precoding. UE indicating support of this feature shall also indicate support of PUSCH codebook coherency subset. | CC per BPC | Tbd | No | No |
| ***maxNumberMIMO-LayersNonCB-PUSCH***Defines supported maximum number of MIMO layers at the UE for PUSCH transmission using non-codebook precoding. | CC per BPC | Tbd | No | No |
| ***multipleCORESET***Indicates whether the UE supports configuration of more than one PDCCH CORESET per BWP in addition to the CORESET with CORESET-ID 0 in the BWP. | UE | Td | No | No |
|  |  |  |  |  |
| ***mux-SR-HARQ-ACK-CSI-PUCCH***Indicates whether the UE supports multiplexing SR, HARQ-ACK and CSI on a PUCCH or piggybacking on a PUSCH once per slot.  | UE | Tbd | No | Yes |
| ***nzp-CSI-RS-IntefMgmt***Indicates whether the UE supports interference measurements using NZP CSI-RS. | UE | No | No | No |
| ***oneFL-DMRS-ThreeAdditionalDMRS***Defines whether the UE supports DM-RS pattern for DL reception and/or UL transmission with 1 symbol front-loaded DM-RS with three additional DM-RS symbols. | UE | Tbd | No | Yes |
| ***oneFL-DMRS-TwoAdditionalDMRS***Defines support of DM-RS pattern for DL reception and/or UL transmission with 1 symbol front-loaded DM-RS with 2 additional DM-RS symbols and more than 1 antenna ports. | UE | Yes | No | Yes |
| ***onePortsPTRS***Defines whether UE supports PT-RS with 1 antenna port in DL reception and/or UL transmission for FR1. For FR2, it is mandatory with UE capability signalling.  | UE | Yes/No | No | Yes |
| ***onePUCCH-LongAndShortFormat***Indicates whether the UE supports transmission of one long PUCCH format and one short PUCCH format in TDM in the same slot. | UE | Tbd | No | Yes |
| ***oneSymbolGP-TDD***Indicates whether the UE supports slot formats with 1-symbol GP(s) for 120KHz SCS in unpaired spectrum in FR2 or slot formats with 1-symbol GP(s) for 60KHz SCS in unpaired spectrum in FR1. | UE | Tbd | NoTDD | Yes |
| ***pdcch-BlindDetectionCA***Indicates PDCCH blind decoding capabilities supported by the UE for CA with more than 4 CCs as specified in TS 38.213. The field value is from 4 to 16.  | UE | Tbd | No | Yes |
| ***pdcchMonitoringAnyOccasions***Defines the supported PDCCH search space monitoring occasions. withoutDCI-gap indicates whether the UE supports PDCCH search space monitoring occasions in any symbol of the slot for Type 1-PDCCH common search space configured by dedicated RRC signaling, for a Type 3-PDCCH common search space, or for a UE-specific search space with the capability of supporting at least 44, 36, 22, and 20 blind decodes in a slot for 15 kHz, 30 kHz, 60kHz, and 120 kHz subcarrier spacing values respectively. withDCI-gap indicates whether the UE supports PDCCH search space monitoring occasions in any symbol of the slot with minimum time separation between two consecutive transmissions of PDCCH scrambled with C-RNTI or CS-RNTI for Type 1-PDCCH common search space configured by dedicated RRC signaling, for a Type 3-PDCCH common search space, or for a UE-specific search space, with the capability of supporting at least 44, 36, 22, and 20 blind decodes in a slot for 15 kHz, 30 kHz, 60kHz, and 120 kHz subcarrier spacing values respectively. | CC per BPC | Tbd | No | No |
| ***pdcchMonitoringSingleOccasion***Indicates whether the UE supports receiving PDCCH scrambled with C-RNTI or CS-RNTI in a search space configured to be monitored within a single span of any three contiguous OFDM symbols in a slot with the capability of supporting at least 44 blind decodes in a slot for 15 kHz subcarrier spacing. | UE | Tbd | No | NoFR1 |
| ***pdsch-256QAM-FR1***Indicates whether the UE supports 256QAM for PDSCH for FR1.  | UE | Yes | No | Yes |
| ***pdsch-DifferentTB-PerSlot***Defines whether the UE supports reception of up to two PDSCHs for different transport blocks with PDSCH scrambled using C-RNTI, TC-RNTI, or CS-RNTI within the same slot or whether the UE supports reception of up to seven PDSCHs for different transport blocks with PDSCH scrambled using C-RNTI or CS-RNTI within the same slot. | CC per BPC | Tbd | No | No |
| ***pdsch-MappingTypeA***Indicates whether the UE supports receiving PDSCH using PDSCH mapping type A with less than seven symbols. | UE | [Yes] | No | No |
| ***pdsch-MappingTypeB***Indicates whether the UE supports receiving PDSCH using PDSCH mapping type B. | UE | Yes | No | No |
| ***pdsch-RepetitionMultiSlots***Indicates whether the UE supports receiving PDSCH scheduled by DCI format 1\_0 or 1\_1 when configured with higher layer parameter aggregationFactorDL > 1. | UE | Tbd | No | Tbd |
|  |  |  |  |  |
| ***pre-EmptIndication-DL***Indicates whether the UE supports interrupted transmission indication for PDSCH reception based on reception of DCI format 2\_1 as defined in TS 38.213. | UE | Tbd | No | No |
| ***precoderGranularityCORESET***Indicates whether the UE supports receiving PDCCH in CORESETs configured with CORESET-precoder-granularity equal to the size of the CORESET in the frequency domain as specified in TS 38.211. | UE | Tbd | No | No |
| ***pucch-F2-WithFH***Indicates whether the UE supports transmission of a PUCCH format 2 (2 OFDM symbols in total) with frequency hopping in a slot. | UE | Yes | No | Yes |
| ***pucch-F3-4-HalfPi-BPSK***Indicates whether the UE supports pi/2-BPSK for PUCCH format 3/4. For FR1, it is optional. | UE | No | No | Yes |
| ***pucch-F3-WithFH***Indicates whether the UE supports transmission of a PUCCH format 3 (4~14 OFDM symbols in total) with frequency hopping in a slot. | UE | Yes | No | Yes |
| ***pucch-F4-WithFH***Indicates whether the UE supports transmission of a PUCCH format 4 (4~14 OFDM symbols in total) with frequency hopping in a slot. | UE | Yes | No | Yes |
| ***pusch-LBRM***Indicates whether the UE supports limited buffer rate matching in UL as specified in TS 38.212. | UE | Tbd | No | Yes |
| ***pucch-Repetition-F1-3-4***Indicates whether the UE supports transmission of a PUCCH format 1 or 3 or 4 over multiple slots with the repetition factor 1, 2, 4 or 8. | UE | Yes | No | No |
| ***pusch-DifferentTB-PerSlot***Indicates whether the UE supports transmission of up to two PUSCHs or up to seven PUSCHs for different transport blocks within the same slot. | CC per BPC | Tbd | No | No |
| ***pusch-HalfPi-BPSK***Indicates whether the UE supports pi/2-BPSK for PUSCH. For FR1, it is optional.  | UE | No | No | Yes |
| ***pusch-RepetitionMultiSlots***Indicates whether the UE supports transmitting PUSCH scheduled by DCI format 0\_0 or 0\_1 when configured with higher layer parameter aggregationFactorIUL > 1. | UE | Tbd | No | No |
| ***ra-Type0-PUSCH***Indicates whether the UE supports resource allocation Type 0 for PUSCH as specified in TS 38.214. | UE | Tbd | No | No |
| ***rateMatchingLTE-CRS***Indicates whether the UE supports receiving PDSCH with resource mapping that excludes the REs determined by the higher layer configuration LTE-carrier configuring common RS, as specified in TS 38.214. | UE | Tbd | No | No |
| ***rateMatchingResrcSetDynamic***Indicates whether the UE supports receiving PDSCH with resource mapping that excludes the REs corresponding to resource sets configured with RB-symbol level granularity based on dynamic indication in the scheduling DCI as specified in TS 38.214. | UE | Tbd | No | No |
| ***rateMatchingResrcSetSemi-Static***Indicates whether the UE supports receiving PDSCH with resource mapping that excludes the REs corresponding to resource sets configured with RB-symbol level granularity following the semi-static configuration as specified in TS 38.214. | UE | Tbd | No | No |
| ***scalingFactor0dot75***Indicates the scaling factor 0.75 is applied to the band in the max data rate calculation as defined in 4.1.2. If absent, the scaling factor 1 is applied to the band in the max data rate calculation. | CC per BPC | Tbd | Tbd | Tbd |
| ***scellWithoutSSB***Defines whether the UE supports configuration of SCell that does not transmit SS/PBCH block. | CC per BPC | Tbd | No | No |
| ***scs-60kHz***Indicates whether the UE supports 60kHz subcarrier spacing for data channel in FR1. | UE | Tbd | No | NoFR1 |
| ***searchSpaceSharingCA-DL***Defines whether the UE supports DL PDCCH search space sharing for carrier aggregation operation. | CC per BPC | Tbd | No | No |
| ***searchSpaceSharingCA-UL***Defines whether the UE supports UL PDCCH search space sharing for carrier aggregation operation. | CC per BPC | Tbd | No | No |
| ***semiOpenLoopCSI***Indicates whether UE supports CSI reporting with report quantity set to ‘CRI/RI/i1’ as defined in Section 5.2.1.4 of TS 38.214. | UE | Tbd | No | Yes |
| ***semiStaticHARQ-ACK-Codebook***Indicates whether the UE supports HARQ-ACK codebook constructed by semi-static configuration | UE | Yes | No | No |
| ***simultaneousTxSUL-NonSUL***Indicates whether the UE supports simultaneous transmission of SRS on an SUL/non-SUL carrier and PUSCH/PUCCH/SRS/PRACH on the other UL carrier in the same cell. | CC per BPC | Tbd | No | No |
| ***spatialBundlingHARQ-ACK***Indicates whether the UE supports spatial bundling of HARQ-ACK bits carried on PUCCH or PUSCH per PUCCH group. With spatial bundling, two HARQ-ACK bits for a DL MIMO data is bundled into a single bit by logical “AND” operation. | UE | Tbd | No | No |
|  |  |  |  |  |
| ***sp-CSI-ReportPUCCH***Indicates whether UE supports semi-persistent CSI reporting using PUCCH formats 2, 3 and 4. | UE | No | No | No |
|  |  |  |  |  |
| ***sp-CSI-ReportPUSCH***Indicates whether UE supports semi-persistent CSI reporting using PUSCH. | UE | No | No | No |
| ***srs-AssocCSI-RS***Indicates whether UE supports calculation of the precoder for SRS transmission based on channel measurements using associated NZP CSI-RS resource as described in Section 6.1.1.2 of TS 38.214. UE supporting this feature shall also indicate support of non-codebook based PUSCH transmission | CC per BPC | No | No | No |
| ***srs-TxSwitch***Defines whether UE supports SRS antenna port switching as defined in Section 6.2.1.2 of TS 38.214. | CC per BPC | Tbd | No | No |
| ***supportedBandwidthDL***Defines maximum DL bandwidth supported per CC.  | CC per BPC | Tbd | No | Tbd |
| ***supportedBandwidthUL***Defines maximum UL bandwidth supported per CC. | CC per BPC | Tbd | No | Tbd |
| ***supportedBasebandProcessingCombination***Defines the supported CA baseband processing combinations by the UE. Only the baseband processing combinations associated to supportedBandCombination are included. For a given band combination, multiple baseband processing combinations and fallback baseband processing combination with a higher capability can be included.  | UE | Yes | No | Tbd |
|  |  |  |  |  |
| ***supportedDMRS-TypeDL***Defines supported DM-RS configuration types at the UE for DL reception. | UE | Tbd | No | Yes |
| ***supportedDMRS-TypeUL***Defines supported DM-RS configuration types at the UE for UL transmission. At least support of type1 is mandatory.  | UE | Yes/No? | No | Yes |
| ***supportedModulationOrderDL***Defines the supported modulation scheme for DL by the UE. | CC per BPC | Tbd | No | Tbd |
| ***supportedModulationOrderUL***Defines the supported modulation scheme for UL by the UE. | CC per BPC | Tbd | No | Tbd |
| ***supportedNumberTAG***Defines the number of timing advance groups are supported by the UE | CC per BPC | Tbd | No | No |
| ***supportedSRS-Resources***Defines support of SRS resources. The capability signalling comprising indication of: * Supported maximum number of aperiodic SRS resources that can be configured for the UE per each BWP
* Supported maximum number of aperiodic SRS resources per slot in the BWP
* Supported maximum number of periodic SRS resources per BWP
* Supported maximum number of periodic SRS resources per slot in the BWP
* Supported maximum number of semi-persistent SRS resources that can be configured for the UE per each BWP
* Supported maximum number of semi-persistent SRS resources per slot in the BWP
* Supported maximum number of SRS antenna port per each SRS resource
 | CC per BPC | Tbd | No | No |
| ***supportedSubCarrierSpacingDL***Defines the supported sub-carrier spacing for DL by the UE. Note the UE shall support all mandated sub-carrier spacing for FR1/FR2.  | CC per BPC | No | No | No |
| ***supportedSubCarrierSpacingUL***Defines the supported sub-carrier spacing for UL by the UE. Note the UE shall support all mandated sub-carrier spacing for FR1/FR2. | CC per BPC | No | No | No |
| ***tdm-Pattern***Indicates whether the UE supports the *tdm-Pattern for single UL transmission* associated functionality. Support is conditionally mandatory for UEs that do not support dynamic power sharing and for UEs that indicate single UL for any BC, and optional otherwise. | UE | Yes/No | Yes | Tbd |
| ***timeDurationForQCL***Defines minimum number of OFDM symbols required by the UE to perform PDCCH reception and applying spatial QCL information received in DCI for PDSCH processing as described in TS 38.214 Section 5.1.5. UE shall indicate one value of the minimum number of OFDM symbols per each subcarrier spacing of 60kHz and 120kHz. | CC per BPC | Tbd | No | NoFR2 |
| ***tpc-PUCCH-RNTI***Indicates whether the UE supports group DCI message based on TPC-PUCCH-RNTI for TPC commands for PUCCH. | UE | Tbd | No | Yes |
| ***tpc-PUSCH-RNTI***Indicates whether the UE supports group DCI message based on TPC-PUSCH-RNTI for TPC commands for PUSCH. | UE | Tbd | No | Yes |
| ***tpc-SRS-RNTI***Indicates whether the UE supports group DCI message based on TPC-SRS-RNTI for TPC commands for SRS. | UE | Tbd | No | Yes |
| ***twoDifferentTPC-Loop-PUCCH***Indicates whether the UE supports two different TPC loops for PUCCH closed loop power control. | UE | Tbd | Yes | Yes |
| ***twoDifferentTPC-Loop-PUSCH***Indicates whether the UE supports two different TPC loops for PUSCH closed loop power control. | UE | Tbd | Yes | Yes |
| ***twoFL-DMRS***Defines whether the UE supports DM-RS pattern for DL reception and/or UL transmission with 2 symbols front-loaded DM-RS without additional DM-RS symbols. | UE | Tbd | No | Yes |
| ***twoFL-DMRS-TwoAdditionalDMRS***Defines whether the UE supports DM-RS pattern for DL reception and/or UL transmission with 2 symbols front-loaded DM-RS with one additional 2 symbols DM-RS. | UE | Tbd | No | Yes |
| ***twoPUCCH-AnyOthersInSlot***Indicates whether the UE supports transmission of two PUCCH formats in TDM in the same slot, which are not covered by 4-22 and 4-2. | UE | Tbd | No | Yes |
| ***twoPUCCH-F0-2-ConsecSymbols***Indicates whether the UE supports transmission of two PUCCHs of format 0 or 2 in consecutive symbols in a slot. | UE | Tbd | Yes | Yes |
| ***twoPUCCH-Group***Indicates whether two PUCCH group in CA with a same numerology across CCs for data and control channel [at a given time] is supported by the UE. | CC per BPC | Tbd | No | No |
| ***type1-3-CSS***Defines whether the UE is able to receive PDCCH in a Type1-PDCCH common search space configured by dedicated RRC signaling, or in a Type3-PDCCH common search space or in a UE-specific search space, with an associated CORESET duration of 3 symbols in FR2. | CC per BPC | Yes | No | No |
| ***type1-PUSCH-RepetitionMultiSlots***Indicates whether the UE supports Type 1 PUSCH transmissions with configured grant as specified in TS 38.214 with UL-TWG-repK value equal to 2, 4, or 8 with a single repetition of the transport block within each slot, and redundancy version pattern as indicated by UL-TWG-RV-rep. A UE supporting this feature shall also support Type 1 PUSCH transmissions with configured grant as specified in TS 38.214 with UL-TWG-repK value of one. | UE | Tbd | No | No |
| ***type1-PUSCH-RepetitionOneSlot***Indicates whether the UE supports Type 1 PUSCH transmissions with configured grant as specified in TS 38.214 with UL-TWG-repK value equal to 2, 4, or 8 with multiple repetitions of the transport block within a slot, and redundancy version pattern as indicated by UL-TWG-RV-rep. A UE supporting this feature shall also support Type 1 PUSCH transmissions with configured grant as specified in TS 38.214 with UL-TWG-repK value of one. | UE | Tbd | No | No |
| ***type2-PUSCH-RepetitionMultiSlots***Indicates whether the UE supports Type 1 PUSCH transmissions with configured grant as specified in TS 38.214 with UL-TWG-repK value equal to 2, 4, or 8 with a single repetition of the transport block within each slot, and redundancy version pattern as indicated by UL-TWG-RV-rep. A UE supporting this feature shall also support Type 2 PUSCH transmissions with configured grant as specified in TS 38.214 with UL-TWG-repK value of one. | UE | Tbd | No | No |
| ***type2-PUSCH-RepetitionOneSlot***Indicates whether the UE supports Type 1 PUSCH transmissions with configured grant as specified in TS 38.214 with UL-TWG-repK value equal to 2, 4, or 8 with multiple repetitions of the transport block within a slot, and redundancy version pattern as indicated by UL-TWG-RV-rep. A UE supporting this feature shall also support Type 2 PUSCH transmissions with configured grant as specified in TS 38.214 with UL-TWG-repK value of one. | UE | Tbd | No | No |
| ***type2-SP-CSI-Feedback-LongPUCCH***Indicates whether UE supports Type II CSI semi-persistent CSI reporting over PUCCH Formats 3 and 4 as defined in Section 5.2.4 of TS 38.214. | UE | No | No | No |
| ***uci-CodeBlockSegmentation***Indicates whether the UE supports segmenting UCI into multiple code blocks depending on the payload size. | UE | Yes | No | Yes |
| ***ue-SpecificUL-DL-Assignment***Indicates whether the UE supports dynamic determination of UL and DL link direction and slot format based on Layer 1 scheduling DCI and higher layer configured parameter UL-DL-configuration-dedicated as specified in TS 38.213. | CC per BPC | Tbd | No | No |

4.2.8 RF parameters

| **Definitions for parameters** | **Per** | **M** | **FDDTDD****DIFF** | **FR1****FR2****DIFF** |
| --- | --- | --- | --- | --- |
| ***aperiodicBeamReport***Indicates whether the UE supports aperiodic 'CRI/RSRP' or 'SSBRI/RSRP' reporting on PUSCH. For FR2, it is mandatory. | Band | Yes | No | Yes |
| ***asyncIntraBandENDC***Indicates whether the UE supports asynchronous FDD-FDD intra-band EUTRA-NR EN-DC with MRTD and MTTD as specified in [x]. If it is not supported for FDD-FDD intra-band EUTRA-NR EN-DC, the UE supports only synchronous FDD-FDD intra-band EUTRA-NR EN-DC.  | BC | Tbd | Tbd | Tbd |
| ***bandCombinationsUL***BIT STRING with pointers to entries in *BandCombinationParametersUL-List*. Only the UL combinations of the same number of entries as in *BandAndDL-ParametersList* can be pointed to.  | Tbd | Yes | No | Tbd |
| ***basebandProcesingCombinationMRDC*** Defines the supported MN and SN baseband processing combinations per supported CA and/or MR-DC band combination by the UE. The *basebandProcessingCombinationIndexMN* defines the supported baseband processing combinations in MN side and *basebandProcessingCombinationLinkedIndexSN* defines the supported baseband processing combinations in SN side, which are associated with each supported MN baseband processing combination.  | Tbd | Yes | No | Tbd |
| ***beamCorrespondence***Indicates whether UE supports beam correspondence as defined in <TBD RAN4 >. For FR2, it is mandatory.  | Band | Yes | No | No |
| ***beamManagementSSB-CSI-RS***Defines support of SS/PBCH and CSI-RS based RSRP measurements. The capability comprises signalling of - Maximum total number of one port NZP CSI-RS resources and SS/PBCH blocks that are supported by the UE for 'CRI/RSRP' and 'SSBRI/RSRP' reporting within a slot and across all serving cells. - Maximum total number of two ports NZP CSI-RS resources and SS/PBCH blocks that are supported by the UE for 'CRI/RSRP' or 'SSBRI/RSRP' reporting within a slot and across all serving cells.- Supported density of one RE per PRB for one port NZP CSI-RS resource for RSRP reporting. | Band | Tbd | No | Yes |
| ***bwp-DiffNumerology***Indicates whether the UE supports BWP adaptation up to 4 BWPs with the different numerologies. | Band | No | No | No |
| ***bwp-SameNumerology***Defines type A/B BWP adaptation (up to 2/4 BWPs) with the same numerology.  | Band | Tbd | No | No |
| ***ca-BandwidthClassDL***Defines for NR DL, the class defined by the aggregated transmission bandwidth configuration and maximum number of component carriers supported by a UE, as specified in TS 38.101-1 [2] and TS 38.101-2 [3] | Band per BC | Yes | No | Tbd |
| ***ca-BandwidthClassUL***Defines for NR UL, the class defined by the aggregated transmission bandwidth configuration and maximum number of component carriers supported by a UE, as specified in TS 38.101-1 [2] and TS 38.101-2 [3] | Band per BC | Yes | No | Tbd |
| ***crossCarrierScheduling***Indicates whether the UE supports cross carrier scheduling operation for carrier aggregation with carrier indicator field (CIF).  | Band | Tbd | No | No |
| ***csi-RS-MeasSCellWithoutSSB***Indicates whether the UE supports CSI-RSRP and CSI-RSRQ measurement as specified in TS38.215 [ref], where CSI-RS resource is configured for a cell that does not transmit SS/PBCH block. A UE that supports this feature shall also support <Support of SCell without SS/PBCH block>. | Band | Tbd | No | No |
| ***diffNumerologyAcrossPUCCH-Group***Indicates whether different numerology across PUCCH groups in CA is supported by the UE. | Band | Tbd | No | No |
| ***diffNumerologyWithinPUCCH-Group***Indicates whether UE supports different numerology across carriers within a PUCCH group and a same numerology between DL and UL per carrier for data/control channel at a given time. | Band | Tbd | No | No |
| ***extendedCP***Indicates whether the UE supports 60 kHz subcarrier spacing with extended CP length for reception of PDCCH, and PDSCH, and transmission of PUCCH, PUSCH, and SRS.  | Band | Yes | No | No |
| ***groupBeamReporting***Indicates whether UE supports RSRP reporting for the group of two reference signals. | Band | No | No | No |
| ***intraBandFreqSeparationDL***Indicates whether the UE supports frequency separation classes to handle the total frequency span for DL for intra-band non-contiguous CA. | Band per BPC | Tbd | No | NoFR2 |
| ***intraBandFreqSeparationUL***Indicates whether the UE supports frequency separation classes to handle the total frequency span for UL for intra-band non-contiguous CA. | Band per BPC | Tbd | No | NoFR2 |
| ***lowLatencyCSI-Feedback***Indicates whether UE is capable of supporting low latency class as defined in Section [TBD] in TS 38.214. | Band | No | No | No |
| ***maxChannelBW-PerCC***Indicates maximum channel bandwidth supported in each band for DL and UL separately and for each SCS that UE supports within a single CC, which is defined in Table 5.3.5-1 in TS38.101-1 for FR1 and Table 5.3.5-1 in TS38.101-2 for FR2. | Band | Tbd | No | No |
| ***maxNumberActiveTCI-PerCC***Defines maximum number of TCI states that can be configured for the UE using RRC signalling. This value shall not be lower than the maximum number of TCI states supported by the UE for MAC Control Element activation. | Band | Tbd | No | No |
| ***maxNumberConfiguredTCIstates***Defines maximum number of Transmission Configuration Indication (TCI) states for PDSCH reception that can be activated for the UE using MAC Control Element from the set of RRC configured TCI states as defined in TS 38.214 Section 5.1.5. | Band | Tbd | No | No |
| ***maxNumberSimultaneousSRS-PerCC***Defines the number of SRS resources that can be transmitted by the UE in one OFDM symbol per each CC. | Band | Tbd | No | No |
| ***maxNumberCSI-RS-BFR***Indicates maximal number of CSI-RS resources across all CCs for UE to monitor PDCCH quality | Band | Tbd | No | No |
| ***maxNumberCSI-RS-SSB-BFR***Defines maximal number of different CSI-RS [and/or SSB] resources across all CCs for new beam identifications. | Band | Tbd | No | No |
| ***maxNumberMIMO-LayersPDSCH***Indicates the maximum number of spatial multiplexing layer(s) supported by the UE for DL reception. | Band or CC in band | Tbd | No | No |
| ***maxNumberMIMO-LayersCB-PUSCH***Indicates supported maximum number of MIMO layers at the UE for PUSCH transmission with codebook precoding. UE indicating support of this feature shall also indicate support of PUSCH codebook coherency subset. | Band or CC in band | Tbd | No | No |
| ***maxNumberMIMO-LayersNonCB-PUSCH***Indicates supported maximum number of MIMO layers at the UE for PUSCH transmission using non-codebook precoding. | Band or CC in band | Tbd | No | No |
| ***maxNumberNonGroupBeamReporting***Defines support of non-group based RSRP reporting using N\_max reference signals.  | Band | Tbd | No | No |
| ***maxNumberRxBeam***Defines whether UE supports receive beamforming switching using NZP CSI-RS resource. UE shall indicate a single value for the preferred number of NZP CSI-RS resource repetitions per CSI-RS resource set.  | Band | Tbd | No | No |
| ***maxNumberRxTxBeamSwitchDL***Defines the number of Tx and Rx beam changes UE can perform within a slot across all configured serving cells. UE shall report one value per each subcarrier spacing supported by the UE. | Band | Tbd | No | No |
| ***maxNumberSSB-BFR***Defines maximal number of different SSBs across all CCs for UE to monitor PDCCH quality  | Band | Tbd | No | No |
| ***modifiedMPR-Behaviour***Indicates whether the UE supports modified A-MPR due to some reasons e.g. regulatory requirements change, RB restriction is replaced to A-MPR for better frequency usage efficiency. | Band | Tbd | Tbd | Tbd |
| ***multipleTCI***Indicates whether the UE supports more than one configuration of *TCI-StatesPDCCH* for a PDCCH CORESET configured by dedicated RRC signaling. | Band | Tbd | No | No |
| ***multipleTimingAdvances***Indicates whether multiple timing advances are supported by the UE. For NR CA band combination, if the band combination comprised of more than one band entry (i.e., inter-band or intra-band non-contiguous band combination), the field indicates that different timing advances on different band entries are supported. For EN-DC band combination, this field is not presented and it is mandatory for the UE supporting EN-DC band combination. In this release, up to two timing advances are supported for EN-DC band combination or NR CA band combination. Note\*: For NR CA, it is mandatory with IOT bit for inter-band NR CA, otherwise optional. For EN-DC, it is mandatory without IOT bit.  | BC | Yes/No | No | No |
| ***periodicBeamReport***Indicates whether UE supports periodic 'CRI/RSRP' or 'SSBRI/RSRP' reporting using PUCCH formats 2,3 and 4 in one slot. For FR2, it is mandatory. | Band | Yes | No | No |
| ***pdcchMonitoringAnyOccasions***Defines the supported PDCCH search space monitoring occasions. withoutDCI-gap indicates whether the UE supports PDCCH search space monitoring occasions in any symbol of the slot for Type 1-PDCCH common search space configured by dedicated RRC signaling, for a Type 3-PDCCH common search space, or for a UE-specific search space with the capability of supporting at least 44, 36, 22, and 20 blind decodes in a slot for 15 kHz, 30 kHz, 60kHz, and 120 kHz subcarrier spacing values respectively. withDCI-gap indicates whether the UE supports PDCCH search space monitoring occasions in any symbol of the slot with minimum time separation between two consecutive transmissions of PDCCH scrambled with C-RNTI or CS-RNTI for Type 1-PDCCH common search space configured by dedicated RRC signaling, for a Type 3-PDCCH common search space, or for a UE-specific search space, with the capability of supporting at least 44, 36, 22, and 20 blind decodes in a slot for 15 kHz, 30 kHz, 60kHz, and 120 kHz subcarrier spacing values respectively. | Band | Tbd | No | No |
| ***pdsch-256QAM-FR2***Indicates whether the UE supports 256QAM for PDSCH for FR2. | Band | Tbd | No | Yes |
| ***pdsch-DifferentTB-PerSlot***Defines whether the UE supports reception of up to two PDSCHs for different transport blocks with PDSCH scrambled using C-RNTI, TC-RNTI, or CS-RNTI within the same slot or whether the UE supports reception of up to seven PDSCHs for different transport blocks with PDSCH scrambled using C-RNTI or CS-RNTI within the same slot. | Band | Tbd | No | No |
| ***phaseCoherenceUL***Indicates whether the UE can maintain phase coherence during a single transmission of a single channel, i.e. PUSCH, PUCCH, or SRS, with one or more OFDM symbol time gap when none of the following conditions are satisfied:- transmit power has changed across the gap- UE is required to receive DL signals within the gap,- other transmissions from the UE occur within the gap,- resource block allocation changes across the gap, and- resource block hopping is enabled. | Band | Tbd | No | No |
| ***pusch-256QAM***Indicates whether the UE supports 256QAM for PUSCH. For FR1, it is optional.  | Band | No | No | Yes |
| ***pusch-DifferentTB-PerSlot***Defines whether the UE supports transmission of up to two PUSCHs or up to seven PUSCHs for different transport blocks within the same slot. | Band | Tbd | No | No |
| ***pusch-TransCoherence***Defines support of the uplink codebook subset by the UE for UL precoding for PUSCH transmission as described in Section 6.1.1.1 of TS 38.214. UE indicated support of partial coherent codebook subset shall also support non-coherent codebook subset. UE indicated support of full coherent codebook subset shall also support partial and non-coherent codebook subset. | Band | Tbd | No | No |
|  |  |  |  |  |
| ***scellWithoutSSB***Indicates whether the UE can support configuration of SCell that does not transmit SS/PBCH block. | Band | Tbd | No | No |
| ***searchSpaceSharingCA-DL***Defines whether the UE supports DL PDCCH search space sharing for carrier aggregation operation. | Band | Tbd | No | No |
| ***searchSpaceSharingCA-UL***Indicates whether the UE supports UL PDCCH search space sharing for carrier aggregation operation. | Band | Tbd | No | No |
| ***simultaneousRxTxInterBandCA***Indicates whether the UE supports simultaneous transmission and reception in TDD-TDD and TDD-FDD inter-band NR CA.  | BC | Tbd | No | No |
| ***simultaneousRxTxInterBandENDC***Indicates whether the UE supports simultaneous transmission and reception in TDD-TDD and TDD-FDD inter-band EN-DC. | BC | Tbd | No | No |
| ***simultaneousTxSUL-NonSUL***Indicates whether the UE supports simultaneous transmission of SRS on an SUL/non-SUL carrier and PUSCH/PUCCH/SRS/PRACH on the other UL carrier in the same cell | Band | Tbd | No | No |
| ***singleUL-Transmission***Indicates that the UE does not support simultaneous UL transmissions as defined in TS 38.101-3 [4]. The UE may only set this bit for certain band combinations defined in TS 38.101-3 [4]. If set for a particular band combination, the bit applies to all fallback band combinations of this band combination that are defined in TS 38.101-3 [4] as being allowed to set the bit and does not apply to any other fallback band combinations defined in TS 38.101-3 [4]. | BC | Tbd | No | No |
| ***sp-BeamReportPUCCH***Indicates support of semi-persistent 'CRI/RSRP' or 'SSBRI/RSRP' reporting using PUCCH formats 2, 3 and 4 in one slot. | Band | No | No | Yes |
| ***sp-BeamReportPUSCH***Indicates support of semi-persistent 'CRI/RSRP' or 'SSBRI/RSRP' reporting on PUSCH. | Band | No | No | Yes |
| ***srs-AssocCSI-RS***Indicates whether UE can support calculation of the precoder for SRS transmission based on channel measurements using associated NZP CSI-RS resource as described in Section 6.1.1.2 of TS 38.214. UE supporting this feature shall also indicate support of non-codebook based PUSCH transmission. | Band | No | No | No |
| ***srs-TxSwitch***Defines whether UE supports SRS antenna port switching as defined in Section 6.2.1.2 of TS 38.214. | Band | Tbd | No | No |
| ***supportedBandCombination***Defines the supported CA and/or MR-DC band combinations by the UE. For each band in a band combination the UE provides the supported CA bandwidth classes for DL and/or UL. For SUL, frequency band indicator is included in *BandDL-Info* and *bandParametersDL* is absent.  | UE | Yes | No | Tbd |
| ***supportedBandListNR***Includes the supported NR bands as defined in TS 38.101-1 [2] and TS 38.101-2 [3]. | UE | Yes | No | Tbd |
| ***supportedBandwidthCombinationSet***Defines the supported bandwidth combination for the band combination set as defined in the 38.101-1 [X] and 38.101-2 [Y]. Field encoded as a bit map, where bit N is set to "1" if UE support Bandwidth Combination Set N for this band combination as defined in the 38.101-1 [X] and 38.101-2 [Y]. The leading / leftmost bit (bit 0) corresponds to the Bandwidth Combination Set 0, the next bit corresponds to the Bandwidth Combination Set 1 and so on.  | BC | Tbd | No | Tbd |
| ***supportedNumberTAG***Defines the number of timing advance groups are supported by the UE | Band | Tbd | No | No |
| ***supportedSRS-Resources***Defines support of SRS resources. The capability signalling comprising indication of: * Supported maximum number of aperiodic SRS resources that can be configured for the UE per each BWP
* Supported maximum number of aperiodic SRS resources per slot in the BWP
* Supported maximum number of periodic SRS resources per BWP
* Supported maximum number of periodic SRS resources per slot in the BWP
* Supported maximum number of semi-persistent SRS resources that can be configured for the UE per each BWP
* Supported maximum number of semi-persistent SRS resources per slot in the BWP

Supported maximum number of SRS antenna port per each SRS resource | Band | Tbd | No | No |
| ***tdm-Pattern***This field indicates whether the UE supports the *tdm-Pattern for single UL transmissionSUO case1* associated functionality. Support is conditionally mandatory for UEs that do not support dynamic power sharing and or for UEs that indicate single UL for any BC, and optional otherwise. | UE | Yes/No | Yes | Yes |
| ***timeDurationForQCL***Defines minimum number of OFDM symbols required by the UE to perform PDCCH reception and applying spatial QCL information received in DCI for PDSCH processing as described in TS 38.214 Section 5.1.5. UE shall indicate one value of the minimum number of OFDM symbols per each subcarrier spacing of 60kHz and 120kHz. | Band | Tbd | No | NoFR2 |
| ***twoPortsPTRS***Defines whether UE supports PT-RS with 2 antenna ports for DL reception and/or UL transmission. | Band | No | No | No |
| ***twoPUCCH-Group***Indicates whether two PUCCH group in CA with a same numerology across CCs for data and control channel [at a given time] is supported by the UE. | Band | Tbd | No | No |
| ***type1-3-CSS***Indicates whether the UE supports receiving PDCCH in a Type1-PDCCH common search space configured by dedicated RRC signaling, or in a Type3-PDCCH common search space or in a UE-specific search space, with an associated CORESET duration of 3 symbols in FR2. | Band | Yes | No | No |
| ***ue-SpecificUL-DL-Assignment***Indicates whether the UE supports dynamic determination of UL and DL link direction and slot format based on Layer 1 scheduling DCI and higher layer configured parameter UL-DL-configuration-dedicated as specified in TS 38.213. | Band | Tbd | No | No |
| ***ul-SharingEUTRA-NR***Indicates whether the UE supports EN-DC with EUTRA-NR coexistence in UL sharing from UE perspective.  | BC | No | No | NoFR1 |
| ***ul-SwitchingTimeEUTRA-NR***Indicates support of switching type between LTE UL and NR UL for EN-DC with LTE-NR coexistence in UL sharing from UE perspective. Type1 indicates UE supports switching within less than 0 us and type2 indicates UE supports switching within less than 20us.  | BC | Tbd | No | NoFR1 |
| **uplinkBeamManagement**Defines support of beam management for UL. The capability include indication of the- Maximum number of SRS resources per SRS resource set supported by the UE. - Maximum number of SRS resource sets supported by the UE. | Band | Tbd | No | No |

4.2.9 Measurement parameters

| Definitions for parameters | Per | M | FDD-TDD diff |
| --- | --- | --- | --- |
| ***csi-RS-RLM***Indicates whether the UE can perform radio link monitoring procedure based on measurement of CSI-RS as specified in TS38.213 [ref] and 38.133 [ref]. This parameter needs FR1 and FR2 differentiation. | UE | Tbd | No |
| ***csi-RSRP-AndRSRQ-MeasWithSSB***Indicates whether the UE can perform CSI-RSRP and CSI-RSRQ measurement as specified in TS38.215 [ref], where CSI-RS resource is configured with an associated SS/PBCH. This parameter needs FR1 and FR2 differentiation. | UE | Tbd | No |
| ***csi-RSRP-AndRSRQ-MeasWithoutSSB***Indicates whether the UE can perform CSI-RSRP and CSI-RSRQ measurement as specified in TS38.215 [ref], where CSI-RS resource is configured for a cell that transmits SS/PBCH block and without an associated SS/PBCH block. This parameter needs FR1 and FR2 differentiation. | UE | Tbd | No |
| ***csi-SINR-Meas***Indicates whether the UE can perform CSI-SINR measurements based on configured CSI-RS resources as specified in TS38.215. This parameter needs FR1 and FR2 differentiation. | UE | Tbd | No |
| ***eventA-MeasAndReport***Indicates whether the UE supports NR measurements and events A triggered reporting as specified in TS 38.331 [9] | UE | Yes | Yes |
| ***independentGapConfig***This field indicates whether the UE supports two independent measurement gap configurations for FR1 and FR2 specified in TS 38.133 [5]. | UE | No | Yes |
| ***intraAndInterF-MeasAndReport***Indicates whether the UE supports NR intra-frequency and inter-frequency measurements and at least periodical reporting.  | UE | Yes | Yes |
| ***simultaneousRxDataSSB-DiffNumerology*** Indicates whether the UE supports concurrent intra-frequency measurement on serving cell or neighbouring cell and PDCCH or PDSCH reception from the serving cell with a different numerology.  | UE | TBD | Yes |
| ***rs-SINR-MeasEUTRA***Indicates whether the UE can perform E-UTRA RS-SINR measurements as specified in TS38.215 [ref]. | UE | Tbd | No |
| ***sftd-MeasPSCell***Indicates whether the UE supports SFTD measurements between the Pcell and a configured PSCell. | UE | No | Yes |
| ***sftd-MeasNR-Cell***Indicates whether the SFTD measurement between the Pcell and the NR cells is supported by the UE which is capable of EN-DC when EN-DC is not configured. | UE | No | Yes |
| ***ss-SINR-Meas***Indicates whether the UE can perform SS-SINR measurement as specified in TS38.215 [ref]. This parameter needs FR1 and FR2 differentiation.  | UE | Tbd | No |
|  |  |  |  |
|  |  |  |  |

4.2.10 Inter-RAT parameters

4.2.10.1 *eutraFDD*

This parameter defines whether the UE supports EUTRA FDD.

4.2.10.2 *eutraTDD*

This parameter defines whether the UE supports EUTRA TDD.

|  |
| --- |
| The Next Change |

# 6 Conditionally mandatory features

| Features | Condition |
| --- | --- |
| Skipping UL configured grant if no data to transmit. | Configured grant type ½ is supported. |
| *multipleTimingAdvances* | EN-DC is supported. |
| *tdm-pattern* | *dynamicPowerSharing* is not supported or single UL for any band combination is indicated.  |

|  |
| --- |
| The Last Change |

7 Capability coordination in MR-DC operation

In MR-DC operation, only two nodes (one EUTRA eNB and one NR gNB) need to be considered in the EUTRA/NR capability coordination. For capabilities for which coordination is needed, it is up to the MN to make the decision on how to resolve the dependency between MN and SN configurations. The MN provides the resulting UE capabilities usable for SCG configuration to the SN. The SN is allowed to initiate the re-negotiation of capability. For capabilities for which no coordination is needed, the SN specific capabilities are just forwarded by the MN to the SN. For baseband processing combination, MN determines its own baseband processing combination to be used in MN side based on *supportedBandCombination* in MRDC container and *supportedBasebandProcessingCombination-MRDC* then determines the allowed baseband processing combination list in SN side and indicates them to SN via *SCG-ConfigInfo*. SN may request to MN different baseband processing combination to be used in SN side via *SCG-Config*.

Editor’s Note: Whether to include the list of capabilities which need the coordination or to refer the other specification needs to be discussed.