**3GPP TSG-RAN WG2 Meeting #117 electronic R2-22**

**Online, February 21 – March 3, 2022**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **38.331** | **CR** | **draft** | **rev** | **-** | **Current version:** | **16.7.0** |  |
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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:***  | Introduction of capability for RRM enhancements for Rel-17 NR FR1 HST |
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| ***Source to WG:*** | CMCC, Ericsson, Huawei, Nokia, Qualcomm |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | NR\_HST\_FR1\_enh |  | ***Date:*** | 2022-02-21 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-17 |
|  | *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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | R17 HST capabilities are captured in RAN4 feature list in R4-2202400. As per the Rel-17 work item RRM enhancements for Rel-17 NR FR1 HST the network should be able to enable/disable RRM measurement enhancements for FR1 high-speed train scenarios. RAN4 has agreed the following:*Rev 0 (Add features according to RAN4 LSin R4-2120286 at RAN2#116bis-e)*For CA enhancement:* the network needs to be able to inform UE whether to apply the enhanced RRM requirements for CA specified in TS38.133
* a per-UE capability is needed which indicates whether the UE is capable of supporting the enhanced RRM requirements for CA in Rel-17

For inter-frequency measurement enhancement:* for idle mode, network signalling should be added to inform the UE whether the enhanced inter-frequency HST measurement requirements are applied per each inter-frequency carrier
* a per-UE capability is needed which indicates whether the UE is capable of supporting the enhanced RRM requirements for inter-frequency measurement for connected mode

Note: The support of HST **idle** mode inter-frequency measurement enhancements is an optional UE feature without capability signalling hence does not impact RRC.*Rev 1 (Add features according to RAN4 LSin R4-2202591 and R4-2202984 at RAN2#117-e)*For demodulation enhancement: * the network needs to be able to inform UE whether to apply the enhanced PDSCH requirements for CA specified in TS38.101-4.
* introduce a new UE capability For the enhanced demodulation requirements for CA in HST SFN.

For inter-frequency measurement enhancement:* a cell specific network signalling is needed to inform UE whether to apply the enhanced RRM requirements for inter-frequency measurement specified in TS38.133
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| ***Summary of change:*** | *Rev 0 (Add features according to RAN4 LSin R4-2120286 at RAN2#116bis-e)*For CA enhancement:* network can configure the UE to apply the enhanced RRM requirements for CA SCell. This configuration has been added to the ServingCellConfigCommon IE.
* a per-UE capability indication has been added that indicates whether the UE is capable of supporting the enhanced RRM requirements for CA. This capability indication has been named *measurementEnhancementCA-r17* and has been added to the new IE *HighSpeedParameters-r17*.

For inter-frequency measurement enhancement:* for idle mode, network signalling has been added to SIB4 to indicate per inter-frequency carrier whether UEs supporting high speed inter-frequency measurements in IDLE/INACTIVE shall apply high speed inter-frequency measurements.
* a per-UE capability indication has been added that indicates whether the UE is capable of supporting the enhanced RRM requirements for inter-frequency measurements. This capability indication has been named *measurementEnhancementInterFreq-r17* and has been added to the new IE *HighSpeedParameters-r17*.

*Rev 1 (Add features according to RAN4 LSin R4-2202591 and R4-2202984 at RAN2#117-e)*For demodulation enhancement: * introduce a signalling to inform UE whether to apply the enhanced PDSCH requirements for SCell for CA specified in TS38.101-4.
* for the enhanced demodulation requirements for CA in HST, introduce a new UE capability for HST SFN CA.

For inter-frequency measurement enhancement:* introduce a cell specific network signalling to inform UE whether to apply the enhanced RRM requirements for inter-frequency measurement specified in TS38.133
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| ***Consequences if not approved:*** | RRM enhancements for Rel-17 NR FR1 HST is not supported by RRC. |
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| ***Clauses affected:*** | 6.3.1, 6.3.2, 6.3.3,  |
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|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 38.306 CR 0683 |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** | This CR should be lifted to the latest version of the specification before approval.This CR can be early implemented by Rel-16 UEs. |
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| ***This CR's revision history:*** |  |

*FIRST CHANGE*

### 6.3.3 UE capability information elements

**/\*Partially omitted\*/**

#### – HighSpeedParameters

The IE *HighSpeedParameters* is used to convey capabilities related to high speed scenarios.

*HighSpeedParameters* information element

-- ASN1START

-- TAG-HIGHSPEEDPARAMETERS-START

HighSpeedParameters-r16 ::= SEQUENCE {

 measurementEnhancement-r16 ENUMERATED {supported} OPTIONAL,

 demodulationEnhancement-r16 ENUMERATED {supported} OPTIONAL

}

HighSpeedParameters-v1650 ::= CHOICE {

 intraNR-MeasurementEnhancement-r16 ENUMERATED {supported},

 interRAT-MeasurementEnhancement-r16 ENUMERATED {supported}

}

HighSpeedParameters-v17xy ::= SEQUENCE {

 measurementEnhancementCA-r17 ENUMERATED {supported},

 measurementEnhancementInterFreq-r17 ENUMERATED {supported},

 demodulationEnhancementCA-r17 ENUMERATED {supported}

}

-- TAG-HIGHSPEEDPARAMETERS-STOP

-- ASN1STOP

**/\*Partially omitted\*/**

#### – UE-NR-Capability

The IE *UE-NR-Capability* is used to convey the NR UE Radio Access Capability Parameters, see TS 38.306 [26].

*UE-NR-Capability* information element

-- ASN1START

-- TAG-UE-NR-CAPABILITY-START

UE-NR-Capability ::= SEQUENCE {

 accessStratumRelease AccessStratumRelease,

 pdcp-Parameters PDCP-Parameters,

 rlc-Parameters RLC-Parameters OPTIONAL,

 mac-Parameters MAC-Parameters OPTIONAL,

 phy-Parameters Phy-Parameters,

 rf-Parameters RF-Parameters,

 measAndMobParameters MeasAndMobParameters OPTIONAL,

 fdd-Add-UE-NR-Capabilities UE-NR-CapabilityAddXDD-Mode OPTIONAL,

 tdd-Add-UE-NR-Capabilities UE-NR-CapabilityAddXDD-Mode OPTIONAL,

 fr1-Add-UE-NR-Capabilities UE-NR-CapabilityAddFRX-Mode OPTIONAL,

 fr2-Add-UE-NR-Capabilities UE-NR-CapabilityAddFRX-Mode OPTIONAL,

 featureSets FeatureSets OPTIONAL,

 featureSetCombinations SEQUENCE (SIZE (1..maxFeatureSetCombinations)) OF FeatureSetCombination OPTIONAL,

 lateNonCriticalExtension OCTET STRING (CONTAINING UE-NR-Capability-v15c0) OPTIONAL,

 nonCriticalExtension UE-NR-Capability-v1530 OPTIONAL

}

-- Regular non-critical extensions:

UE-NR-Capability-v1530 ::= SEQUENCE {

 fdd-Add-UE-NR-Capabilities-v1530 UE-NR-CapabilityAddXDD-Mode-v1530 OPTIONAL,

 tdd-Add-UE-NR-Capabilities-v1530 UE-NR-CapabilityAddXDD-Mode-v1530 OPTIONAL,

 dummy ENUMERATED {supported} OPTIONAL,

 interRAT-Parameters InterRAT-Parameters OPTIONAL,

 inactiveState ENUMERATED {supported} OPTIONAL,

 delayBudgetReporting ENUMERATED {supported} OPTIONAL,

 nonCriticalExtension UE-NR-Capability-v1540 OPTIONAL

}

UE-NR-Capability-v1540 ::= SEQUENCE {

 sdap-Parameters SDAP-Parameters OPTIONAL,

 overheatingInd ENUMERATED {supported} OPTIONAL,

 ims-Parameters IMS-Parameters OPTIONAL,

 fr1-Add-UE-NR-Capabilities-v1540 UE-NR-CapabilityAddFRX-Mode-v1540 OPTIONAL,

 fr2-Add-UE-NR-Capabilities-v1540 UE-NR-CapabilityAddFRX-Mode-v1540 OPTIONAL,

 fr1-fr2-Add-UE-NR-Capabilities UE-NR-CapabilityAddFRX-Mode OPTIONAL,

 nonCriticalExtension UE-NR-Capability-v1550 OPTIONAL

}

UE-NR-Capability-v1550 ::= SEQUENCE {

 reducedCP-Latency ENUMERATED {supported} OPTIONAL,

 nonCriticalExtension UE-NR-Capability-v1560 OPTIONAL

}

UE-NR-Capability-v1560 ::= SEQUENCE {

 nrdc-Parameters NRDC-Parameters OPTIONAL,

 receivedFilters OCTET STRING (CONTAINING UECapabilityEnquiry-v1560-IEs) OPTIONAL,

 nonCriticalExtension UE-NR-Capability-v1570 OPTIONAL

}

UE-NR-Capability-v1570 ::= SEQUENCE {

 nrdc-Parameters-v1570 NRDC-Parameters-v1570 OPTIONAL,

 nonCriticalExtension UE-NR-Capability-v1610 OPTIONAL

}

-- Late non-critical extensions:

UE-NR-Capability-v15c0 ::= SEQUENCE {

 nrdc-Parameters-v15c0 NRDC-Parameters-v15c0 OPTIONAL,

 partialFR2-FallbackRX-Req ENUMERATED {true} OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- Regular non-critical extensions:

UE-NR-Capability-v1610 ::= SEQUENCE {

 inDeviceCoexInd-r16 ENUMERATED {supported} OPTIONAL,

 dl-DedicatedMessageSegmentation-r16 ENUMERATED {supported} OPTIONAL,

 nrdc-Parameters-v1610 NRDC-Parameters-v1610 OPTIONAL,

 powSav-Parameters-r16 PowSav-Parameters-r16 OPTIONAL,

 fr1-Add-UE-NR-Capabilities-v1610 UE-NR-CapabilityAddFRX-Mode-v1610 OPTIONAL,

 fr2-Add-UE-NR-Capabilities-v1610 UE-NR-CapabilityAddFRX-Mode-v1610 OPTIONAL,

 bh-RLF-Indication-r16 ENUMERATED {supported} OPTIONAL,

 directSN-AdditionFirstRRC-IAB-r16 ENUMERATED {supported} OPTIONAL,

 bap-Parameters-r16 BAP-Parameters-r16 OPTIONAL,

 referenceTimeProvision-r16 ENUMERATED {supported} OPTIONAL,

 sidelinkParameters-r16 SidelinkParameters-r16 OPTIONAL,

 highSpeedParameters-r16 HighSpeedParameters-r16 OPTIONAL,

 mac-Parameters-v1610 MAC-Parameters-v1610 OPTIONAL,

 mcgRLF-RecoveryViaSCG-r16 ENUMERATED {supported} OPTIONAL,

 resumeWithStoredMCG-SCells-r16 ENUMERATED {supported} OPTIONAL,

 resumeWithStoredSCG-r16 ENUMERATED {supported} OPTIONAL,

 resumeWithSCG-Config-r16 ENUMERATED {supported} OPTIONAL,

 ue-BasedPerfMeas-Parameters-r16 UE-BasedPerfMeas-Parameters-r16 OPTIONAL,

 son-Parameters-r16 SON-Parameters-r16 OPTIONAL,

 onDemandSIB-Connected-r16 ENUMERATED {supported} OPTIONAL,

 nonCriticalExtension UE-NR-Capability-v1640 OPTIONAL

}

UE-NR-Capability-v1640 ::= SEQUENCE {

 redirectAtResumeByNAS-r16 ENUMERATED {supported} OPTIONAL,

 phy-ParametersSharedSpectrumChAccess-r16 Phy-ParametersSharedSpectrumChAccess-r16 OPTIONAL,

 nonCriticalExtension UE-NR-Capability-v1650 OPTIONAL

}

UE-NR-Capability-v1650 ::= SEQUENCE {

 mpsPriorityIndication-r16 ENUMERATED {supported} OPTIONAL,

 highSpeedParameters-v1650 HighSpeedParameters-v1650 OPTIONAL,

 nonCriticalExtension UE-NR-Capability-v17xy OPTIONAL

}

UE-NR-Capability-v17xy ::= SEQUENCE {

highSpeedParameters-v17xy HighSpeedParameters-v17xy OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

UE-NR-CapabilityAddXDD-Mode ::= SEQUENCE {

 phy-ParametersXDD-Diff Phy-ParametersXDD-Diff OPTIONAL,

 mac-ParametersXDD-Diff MAC-ParametersXDD-Diff OPTIONAL,

 measAndMobParametersXDD-Diff MeasAndMobParametersXDD-Diff OPTIONAL

}

UE-NR-CapabilityAddXDD-Mode-v1530 ::= SEQUENCE {

 eutra-ParametersXDD-Diff EUTRA-ParametersXDD-Diff

}

UE-NR-CapabilityAddFRX-Mode ::= SEQUENCE {

 phy-ParametersFRX-Diff Phy-ParametersFRX-Diff OPTIONAL,

 measAndMobParametersFRX-Diff MeasAndMobParametersFRX-Diff OPTIONAL

}

UE-NR-CapabilityAddFRX-Mode-v1540 ::= SEQUENCE {

 ims-ParametersFRX-Diff IMS-ParametersFRX-Diff OPTIONAL

}

UE-NR-CapabilityAddFRX-Mode-v1610 ::= SEQUENCE {

 powSav-ParametersFRX-Diff-r16 PowSav-ParametersFRX-Diff-r16 OPTIONAL,

 mac-ParametersFRX-Diff-r16 MAC-ParametersFRX-Diff-r16 OPTIONAL

}

BAP-Parameters-r16 ::= SEQUENCE {

 flowControlBH-RLC-ChannelBased-r16 ENUMERATED {supported} OPTIONAL,

 flowControlRouting-ID-Based-r16 ENUMERATED {supported} OPTIONAL

}

-- TAG-UE-NR-CAPABILITY-STOP

-- ASN1STOP

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| *UE-NR-Capability* field descriptions |
| ***featureSetCombinations***A list of *FeatureSetCombination:s* for *supportedBandCombinationList* in *UE-NR-Capability*. The *FeatureSetDownlink:s* and *FeatureSetUplink:s* referred to from these *FeatureSetCombination:s* are defined in the *featureSets* list in *UE-NR-Capability*. |

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| *UE-NR-Capability-v1540 field descriptions* |
| ***fr1-fr2-Add-UE-NR-Capabilities***This instance of *UE-NR-CapabilityAddFRX-Mode* does not include any other fields than *csi-RS-IM-ReceptionForFeedback*/ *csi-RS-ProcFrameworkForSRS*/ *csi-ReportFramework*. |

*CHANGE END*