**3GPP TSG RAN meeting #94e RP-21xxxx**

**Electronic Meeting, December 6 - 17, 2021**

**Source: Ericsson (Moderator)**

**Title: New WID on enhanced support of reduced capability NR devices**

**Document for: Approval**

**Agenda Item: 8A.1**

3GPP™ Work Item Description

Information on Work Items can be found at <http://www.3gpp.org/Work-Items>
See also the [3GPP Working Procedures](http://www.3gpp.org/specifications-groups/working-procedures), article 39 and the TSG Working Methods in [3GPP TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm)

# Title: Enhanced support of reduced capability NR devices

## Acronym: NR\_eredcap

## Unique identifier: xxxxxx

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| --- | --- |
| **This WID includes a Core part** | **X** |
| **This WID includes a Performance part** | **X** |

Potential target Release: Rel-18

## 1 Impacts

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| --- | --- | --- | --- | --- | --- |
| **Affects:** | UICC apps | ME | AN | CN | Others (specify) |
| **Yes** |  | X | X |  |  |
| **No** | X |  |  |  | X |
| **Don't know** |  |  |  | X |  |

## 2 Classification of the Work Item and linked work items

### 2.1 Primary classification

This work item is a

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| --- | --- |
| X | Feature |
|  | Building Block |
|  | *Work Task* |
|  | Study Item |

### 2.2 Parent Work Item

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| Parent Work / Study Items  |
| Acronym | Working Group | Unique ID | Title (as in 3GPP Work Plan) |
|  |  |  |  |

### 2.3 Other related Work Items and dependencies

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| --- |
| Other related Work Items (if any) |
| Unique ID | Title | Nature of relationship |
| 860035 | Study on support of reduced capability NR devices |  |
| 860036 | Study on NR coverage enhancements |  |
| 860047 | UE power saving enhancements for NR |  |
| 900061 | NR coverage enhancements |  |
| 900062 | Support of reduced capability NR devices |  |

## 3 Justification

5G aims to accelerate industrial transformation and digitalization, which improve flexibility, enhance productivity and efficiency, reduce maintenance cost, and improve operational safety. Industrial sensors play an important role for realizing such a vision. Not only widely used in industrial automation and digitalization use cases, industrial sensors are also widely used in the general environmental monitoring use cases such as monitoring of critical infrastructure (e.g., buildings, bridges, water dams, etc.) or monitoring for natural disasters (e.g., wild fire, flood, tsunami, earthquake, etc.).

Another emerging new class of new 5G use cases is the smart city vertical, which covers data collection and processing to more efficiently monitor and control city resources, and to provide services to city residents. Especially, the deployment of surveillance cameras is an essential part of the smart city but also of factories and industries.

Furthermore, there have been increasing interests in wearables use cases such as smart watches, eHealth related devices, and medical monitoring devices. These use cases call for different design considerations and have different requirements in terms of form factor, UE complexity and energy efficiency, compared to eMBB devices.

The support of industrial sensors, video surveillance, and wearables were the motivations behind Rel-17 RedCap. Through the Rel-17 NR RedCap work item, 3GPP has established a framework for enabling reduced capability NR devices suitable for a range of use cases, including the industrial sensors, video surveillance, and wearables use cases mentioned above, with requirements on low UE complexity and sometimes also on low UE power consumption.

Now when the foundation has been laid in Rel-17, enhancements can be considered to enable as efficient support as possible for the mentioned use cases and also to expand RedCap into a new range of use cases.

Many industrial sensors use cases require a deployment of a massive number of sensors. Replacing the battery of each of these sensors might be prohibitively difficult or undesirable. In certain use cases, it might be difficult to access or even exactly locate the sensors after they have been deployed. Thus, for these use cases, a key enabler is to allow the sensors to sustain operation without needing battery replacement.

To further expand the market for RedCap use cases with relatively low cost, low energy consumption, and low data rate requirements, e.g., industrial wireless sensor network use cases, some further cost and complexity reduction enhancements should be considered. The enhancements aim at supporting lower UE complexity/cost and energy consumption compared to Rel-17. Rel-18 RedCap should provide NR support for low-tier devices between existing LPWA UEs and the capabilities of Rel-17 RedCap UEs but it should not overlap with existing LPWA solutions.

These enhancements should be introduced while maintaining the integrity of the RedCap ecosystem and maximizing the benefit of economies of scale. The WI aims to specify enhancements applicable to the RedCap UE type and framework defined in Rel-17.

## 4 Objective

### 4.1 Objective of Core part WI

To further expand the RedCap use cases, the following enhancements can be considered:

**Power saving/energy efficiency enhancements**

* Enhanced DRX in RRC\_INACTIVE (>10.24s) [RAN2, RAN3, RAN4]
	+ *Note that this objective requires SA2, CT1 involvement*

**Complexity/cost reduction**

* Further reduced UE cost / complexity
	+ *TBD: based on SI outcome*
* Support for lower UE power class [RAN4] (*lower priority*)
	+ Focus on non-coverage-limited scenarios, e.g., indoor industrial

Notes:

* The work defined as part of this WI is not to overlap with LPWA use cases.
* Coexistence with non-RedCap UEs and Rel-17 RedCap UEs should be ensured.
* This WI focuses on SA mode and single connectivity with operation in a single band at a time.
* This WI considers all frequency ranges and all applicable duplex modes unless otherwise specified.

### 4.2 Objective of Performance part WI

Specify necessary performance requirements, measurement accuracy requirements and test cases related to the above-mentioned enhancements and core requirements [RAN4].

### 4.3 RAN time budget request

**This WI is supposed to start after the corresponding SI, i.e., at RAN#97 (Sep ’22)**

## 5 Expected Output and Time scale

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| **New specifications** *{One line per specification. Create/delete lines as needed}* |
| Proposed Spec no. or series | Type (see note 1)  | Title | For info at TSG#  | For approval at TSG# | Remarks |
|  |  |  |  |  |  |

|  |
| --- |
| **Impacted existing TS/TR** *{One line per specification. Create/delete lines as needed}* |
| TS/TR No. | Description of change  | Target completion plenary# | Remarks |
| 38.202  | NR; Services provided by the physical layer | RAN#X | Core part |
| 38.211 | NR; Physical channels and modulation | RAN#X | Core part |
| 38.212 | NR; Multiplexing and channel coding | RAN#X | Core part |
| 38.213 | NR; Physical layer procedures for control | RAN#X | Core part |
| 38.214 | NR; Physical layer procedures for data | RAN#X | Core part |
| 38.300  | NR; NR and NG-RAN Overall description; Stage-2  | RAN#X+1 | Core part |
| 38.304  | NR; User Equipment (UE) procedures in idle mode and in RRC Inactive state | RAN#X+1 | Core part |
| 38.306 | NR; User Equipment (UE) radio access capabilities | RAN#X+1 | Core part |
| 38.321 | NR; Medium Access Control (MAC) protocol specification | RAN#X+1 | Core part |
| 38.331 | NR; Radio Resource Control (RRC) protocol specification | RAN#X+1 | Core part |
| 38.101-1  | NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone  | RAN#X+1 | Core part |
| 38.101-2  | NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone | RAN#X+1 | Core part |
| 38.133  | NR; Requirements for support of radio resource management | RAN#X+1 | Core part |
| 36.133  | Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management | RAN#X+1 | Core part |
| 38.101-4 | NR; User Equipment (UE) radio transmission and reception; Part 4: Performance requirements | RAN#X+3 | Perf. part |
| 38.104 | NR; Base Station (BS) radio transmission and reception | RAN#X+3 | Perf. part |
| 38.133  | NR; Requirements for support of radio resource management | RAN#X+3 | Perf. part |
| 36.133  | Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management | RAN#X+3 | Perf. part |
| 38.141-1  | NR; Base Station (BS) conformance testing Part 1: Conducted conformance testing  | RAN#X+3 | Perf. part |
| 38.141-2  | NR; Base Station (BS) conformance testing Part 2: Radiated conformance testing | RAN#X+3 | Perf. part |
|  |  |  |  |

## 6 Work item Rapporteur(s)

TBD

## 7 Work item leadership

Primary: RAN WG1

Secondary: RAN WG2, RAN WG4, RAN WG3

## 8 Aspects that involve other WGs

The WI objective on enhanced DRX in RRC\_INACTIVE requires SA2 and CT1 involvement.

## 9 Supporting Individual Members

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| Supporting IM name |
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