# 3GPP TR 36.8xx V0.0.0 (2011-09)

**3rd Generation Partnership Project;**
**Technical Specification Group Radio Access Network;**
**LTE RAN Enhancements for Diverse Data Applications**

**(Release 11)**

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# Contents

# Foreword

This Technical Report has been produced by the 3<sup>rd</sup> Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x   the first digit:

1   presented to TSG for information;

2   presented to TSG for approval;

3   or greater indicates TSG approved document under change control.

y   the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z   the third digit is incremented when editorial only changes have been incorporated in the document.

# Introduction

The work item "LTE RAN Enhancements for Diverse Data Applications" was approved at RAN #51 [1] and incorporates an initial evaluation phase prior to the stage 2 and stage 3 work.

This report captures the output of the initial evaluation phase.

# 1 Scope

The present document constitutes the output of the initial evaluation phase for the work item "LTE RAN Enhancements for Diverse Data Applications" (LTE_eDDA). The document captures agreements and descriptions related to the evaluation methodology used, descriptions of enhancement proposals and their evaluation results, and conclusions and recommendations for further work within the scope of the LTE_eDDA work item.

# 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".

[x]      <doctype> <#>[ ([up to and including]{yyyy[-mm]|V<a[.b[.c]]>}[onwards])]: "<Title>".

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [x] 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 [x].

**<example>:** <text used to clarify abstract rules by applying them literally >.

## 3.2 Symbols

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

<symbol>        <Explanation>

## 3.3 Abbreviations

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

<ACRONYM>   <Explanation>

# 4 Evaluation Methodology

Enhancement proposals considered as part of the LTE_eDDA work item are likely to exhibit some diversity in their focus on different application/traffic situations, and to tackle different areas of the system and its optimisation.

In order to provide the necessary degree of commonality and comparability between company results when evaluating these proposals, an evaluation framework has been established encompassing:

-   Evaluation guidelines(detailed in sub-clause 4.1)

-   The types of traffic to be evaluated (detailed in sub-clause 4.2)

# 4.1 Evaluation Guidelines

## 4.1.1 Traffic Sources

The following alternatives have been identified to generate source traffic for the purposes of evaluation:

| | |
|---|---|
| Traffic Trace: | Data traffic or packets captured from live systems or apparatus running one or more applications of interest |
| Synthetic Models: | Abstract modelling of application-level and/or user behaviours in order to faithfully represent or emulate data traffic that would typically be observed from a live running application |
| Statistical Models: | Generation of data traffic or packets according to random processes governed by parameters that are themselves derived from statistics observed from one or more live running applications |

-   Companies may use either trace-based or synthetic/statistical model-based approaches to generate source traffic

-   For trace based approaches:

    o   Reasonable disclosure of the trace capture environment is required (sufficient to enable reproduction of a similar traffic scenario by another company). This should include for example, information relating to the access technologies used during the capture, any pertinent configuration details therein, the data rates of involved links, the nature of running or open applications, the degree of user interactivity with the device and the captured protocol layer

    o   Key statistics of the trace shall be provided— to include at least the distributions of inter-arrival times, and packet sizes, and information regarding data rates

    o   Provision of the actual trace is optional

-   For model-based approaches:

    o   Disclosure of the model and its parameters is required

    o   Some validation of the model (i.e. verifying its alignment with real-world traces, statistics or behaviours) shall be provided

-   To help improve alignment between company evaluations, the guideline traffic scenarios of sub-clause 4.2 have been created. Companies are encouraged to use traces or models whose statistical properties conform to (or are closely consistent with) those listed for the guideline traffic scenarios, although the use of other traffic scenarios for evaluation purposes is not precluded.

## 4.1.2 Simulation Environment

-   For the purposes of simulation, a suitable abstraction of the physical layer is permitted (it need not be explicitly modelled). Where appropriate, basic HARQ functionality at the sub-frame level should be included.

- Depending on the nature of the proposal, some evaluations may require that TCP is modelled. Evaluations shall state whether or not this has been performed and provide reasons. TCP modelling may apply to either traffic models or to trace-based traffic. A simplified TCP model may be used, sufficient to capture slow-start and congestion avoidance effects.

- When submitting proposals, companies should consider whether there are any potential impacts to mobility. If significant mobility aspects are identified, evaluations regarding those impacts should also be provided.

- Where appropriate, assumptions on how the network's RRC state control mechanisms operate shall be stated

## 4.1.3 Output Metrics

Metrics of interest are dependent on the nature of a particular proposal. However, the following guidelines regarding output metrics are recommended. It is expected that wherever there is perceived to be a significant impact to one of the areas covered by these metrics, the associated metric(s) will be provided and the guidelines followed.

- **UE power consumption (for the radio communications part)**

    o This may further comprise (or be related to) associated metrics such as active time and active time utilisation

    o The power consumption effects of RRC state transitions and mobility should be taken into account

    o Power consumption may be expressed in absolute terms or relative to a baseline power consumption value. Depending on the particular proposal, the baseline power consumption value may be for example that of RRC_IDLE or that of the system with/without implementation of a particular enhancement

    o Parameters that affect power consumption and which are configured by the network shall be stated, along with any associated assumptions

    o To help improve alignment and to help derive baseline values, the following relative power consumption values shall be used for one sub-frame unit of transmit or receive operation. For FDD both transmit and receive functions may take place at the same time (and their power contributions are hence summed), whereas for TDD these occur at separate times

**Table 4.1.3-1: Reference values for UE power consumption**

| Function | Relative UE Power Consumption |
|---|---|
| Tx sub-frame | [TBD]<br><br>Editors Note: possibly a function of Tx power, or two simplified mean values could be used, one for Tx of control (e.g. PUCCH) and one for Tx of data (PUSCH) |
| Rx sub-frame (PDCCH only) | [TBD] |
| Rx sub-frame (PDCCH+PDSCH) | [TBD] |
| DRX sub-frame | [TBD] |

- **Overheads and Signalling**

    o Signalling costs should be evaluated

    o System resource overheads (e.g. in terms of number or fraction of assigned/used/reserved control channel resources and RBs) should be considered

    o Effects on RRC state transition frequency, on handover frequency and on the average time spent in connected mode (vs. idle) should be reported where appropriate

-   **User Visible Metrics / QoS**

    o   Latency: Impacts or benefits to latency shall be provided, in the form of latency distributions, percentiles or bounds.

    o   Throughput: Impacts or benefits to throughput shall be provided, in the form of throughput distributions, percentiles or bounds.

    o   The data unit size (e.g. web-page, IP datagram, MAC PDU etc..) used to represent the latency and throughput metrics and distributions shall be stated

    o   If the proposal relates to differing levels of QoS, metrics associated with each of the different QoS levels shall be provided

# 4.2    Traffic Scenarios and Characterisation

The following traffic scenarios provide the primary focus for the evaluations. The emphasis is on smartphone and tablet device types (rather than PCs).

**Table 4.2-1: Traffic scenarios**

| Label | Traffic Scenario | Description |
|---|---|---|
| Top priority | | |
| A | Background Traffic | Traffic from an unattended phone with applications not in "active phase" (i.e. not including email retrieval, no IM sending etc…) |
| B | IM | Instant Messaging. Includes IM background traffic. |
| Non-top-priority | | |
| C | Gaming | Use of on-line interactive games |
| D | Interactive Content Pull | User-interactive web browsing, online maps, social network browsing, application store / music store browsing and other similar content pull by the user |
| E | HTTP Video Streaming | Segment-oriented transfer of video media |

A statistical characterisation of each of these traffic scenarios is provided in sub-clauses 4.2.1 through 4.2.5 respectively.

## 4.2.1    A) Background Traffic

Editor's note: pending outcome of RAN2 email discussion on packet inter-arrival and packet size CDFs

## 4.2.2    B) Instant Messaging

Editor's note: pending outcome of RAN2 email discussion on packet inter-arrival and packet size CDFs

## 4.2.3    C) Gaming

Editor's note: pending outcome of RAN2 email discussion on packet inter-arrival and packet size CDFs

## 4.2.4 D) Interactive Content Pull

Editor's note: pending outcome of RAN2 email discussion on packet inter-arrival and packet size CDFs

## 4.2.5 E) HTTP Video Streaming

Editor's note: pending outcome of RAN2 email discussion on packet inter-arrival and packet size CDFs

# 5 Evaluation of existing EUTRAN functionality

Editor's note: Intention is to include evaluations for existing functionality in Rel-8/9/10

# 6 Proposals and Evaluations (new functionality)

Editor's note: Intention is to describe proposals along with their evaluations within separate sub-clauses 6.1, 6.2, … etc… It may at a later stage be possible to re-structure this section such that similar proposals are logically grouped

# 7 Recommendations and Conclusions

# Annex <A>:
# <Annex title>

## A.1 <Annex Heading>

# Annex <X>:
# Change history

| Change history | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Date | TSG # | TSG Doc. | CR | Rev | Subject/Comment | | Old | New |
| 2011-09 | | | | | Initial draft version capturing the outcome of RAN2#75 | | --- | 0.0.0 |
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