**3GPP TSG RAN Meeting #71RP-160671**

**Göteborg, Sweden, 7.-10. March, 2016**

**Source: NTT DOCOMO**

**Title: New SID Proposal: Study on New Radio Access Technology**

**Document for: Discussion**

**Agenda Item: 9.1**

3GPP™ Work Item Description

For guidance, see [3GPP Working Procedures](http://www.3gpp.org/About/WP.htm), article 39; and [3GPP TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm).  
Comprehensive instructions can be found at <http://www.3gpp.org/Work-Items>

# Title: Study on NR New Radio Access Technology

## Acronym: FS\_ NR\_newRAT

## Unique identifier:

NOTE: If this is a RAN WID including Core and Perf. part, then Title, Acronym and Unique identifier refer to the feature WI. Please tick (X) the applicable box(es) in the table below:

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

## 1 3GPP Work Area

|  |  |
| --- | --- |
| X | **Radio Access** |
|  | **Core Network** |
|  | **Services** |

## 2 Classification of WI and linked work items

### 2.0 Primary classification

This work item is a …

|  |  |
| --- | --- |
| X | Study Item (go to 2.1) |
|  | Feature (go to 2.2) |
|  | Building Block (go to 2.3) |
|  | Work Task (go to 2.4) |

NOTE: Core, Performance and Testing parts of RAN WIs are usually Building Blocks.  
If you are in doubt, please contact MCC.

### 2.1 Study Item

|  |  |  |
| --- | --- | --- |
| Related Work Item(s) (if any] | | |
| Unique ID | Title | Nature of relationship |
| FS\_NG\_Req | Study on Scenarios and Requirements for the New Radio Access Technology |  |
| FS\_CM\_Above6GHz | Study on channel model for frequency spectrum above 6 GHz |  |

Go to §3.

### 2.2 Feature

|  |  |  |
| --- | --- | --- |
| Related Study Item or Feature (if any) | | |
| Unique ID | Title | Nature of relationship |
|  |  |  |

Go to §3.

### 2.3 Building Block

|  |  |  |
| --- | --- | --- |
| Parent Feature (or Study Item) | | |
| Unique ID | Title | TS |
|  |  |  |

This work item is …

|  |  |
| --- | --- |
|  | Stage 1 (go to 2.3.1) |
|  | Stage 2 (go to 2.3.2) |
|  | Stage 3 (go to 2.3.3) |
|  | Test spec (go to 2.3.4) |
|  | Other (go to 2.3.5) |

#### 2.3.1 Stage 1

|  |  |  |
| --- | --- | --- |
| Source of external requirements (if any) | | |
| Organization | Document | Remarks |
|  |  |  |

Go to §3.

#### 2.3.2 Stage 2

|  |  |  |
| --- | --- | --- |
| Corresponding stage 1 work item | | |
| Unique ID | Title | TS |
|  |  |  |

|  |  |  |
| --- | --- | --- |
| Other source of stage 1 information | | |
| TS or CR(s) | Clause | Remarks |
|  |  |  |

**If no identified source of stage 1 information, justify:**

Go to §3.

#### 2.3.3 Stage 3

|  |  |  |
| --- | --- | --- |
| Corresponding stage 2 work item (if any) | | |
| Unique ID | Title | TS |
|  |  |  |

|  |  |  |
| --- | --- | --- |
| Else, corresponding stage 1 work item | | |
| Unique ID | Title | TS |
|  |  |  |

|  |  |  |
| --- | --- | --- |
| Other justification | | |
| TS or CR(s) or external document | Clause | Remarks |
|  |  |  |

**If no identified source of stage 2 information, justify:**

Go to §3.

#### 2.3.4 Test spec

|  |  |  |
| --- | --- | --- |
| Related Work Item(s) | | |
| Unique ID | Title | TS |
|  |  |  |

Go to §3.

#### 2.3.5 Other

|  |  |  |  |
| --- | --- | --- | --- |
| Related Work Item(s) | | | |
| Unique ID | Title | Nature of relationship | TS / TR |
|  |  |  |  |

Go to §3.

### 2.4 Work task

|  |  |  |
| --- | --- | --- |
| Parent Building Block | | |
| Unique ID | Title | TS |
|  |  |  |

## 3 Justification

Work has started in ITU and 3GPP to develop requirements and specifications for new radio (NR) systems, as in the Recommendation ITU-R M.2083 “Framework and overall objectives of the future development of IMT for 2020 and beyond”, as well as 3GPP SA1 study item New Services and Markets Technology Enablers (SMARTER) and SA2 study item Architecture for NR System. In addition, a joint RAN-SA document [SP-150149] from RAN#67 outlines the “NR” timeline for 3GPP, further detailed in the September RAN workshop on NR [RWS-150073].

3GPP has to identify and develop the technology components needed for successfully standardizing the NR system timely satisfying both the urgent market needs, and the more long-term requirements set forth by the ITU-R IMT-2020 process. Further, the NR system should be able to use any spectrum band ranging at least up to 100 GHz that may be made available for wireless communications even in a more distant future.

The [SP-150149] foresaw the following timeline

1. September 2015: RAN workshop
2. September 2015: Initiation of the channel modelling work needed for the NR
3. December 2015: Initiation of the RAN Study Item: scope & requirements for the NR
4. March 2016: Initiation of the RAN WG SI: Identification and evaluation of solutions

RAN#68 saw the first draft study item proposals for discussion for points 2) [RP-150781] and 3) [RP-150813], and further RAN#69 saw the first draft study item proposals for 4) in [RP-151278] and [RP-151551]. A study item on 2) [RP-151606] started in RAN#69.

This study item will address point 4) and build on the work done in the three preceding steps, discussions in the RAN workshop on NR, and the draft SIDs submitted to RAN#69.

## 4 Objective

### 4.1 Objective of SI or Core part WI or Testing part WI

The study aims to develop an NR access technology to meet a broad range of use cases including enhanced mobile broadband, massive MTC, critical MTC, and additional requirements defined during the RAN requirements study.

The new RAT will consider frequency ranges up to 100 GHz [TR38.913].

Detailed objectives of the study item are:

1. Target a single technical framework addressing all usage scenarios, requirements and deployment scenarios defined in TR38.913 including
   * Enhanced mobile broadband
   * Massive machine-type-communications
   * Ultra reliable and low latency communications
2. The new RAT shall be inherently forward compatible
   * It is assumed that the normative specification would occur in two phases: Phase I (to be completed in June 2018) and Phase II (to be completed in December 2019)
   * Phase I specification of the new RAT must be forward compatible (in terms of efficient co-cell/site/carrier operation) with Phase II specification and beyond, and backward compatibility to LTE is not required
   * Phase II specification of the new RAT builds on the foundation of Phase I specification, and meets all the set requirements for the new RAT.
   * Smooth future evolution beyond Phase II needs to be ensured to support later advanced features and to enable support of service requirements identified later than Phase II specification.
3. Initial work of the study item should allocate high priority on gaining a common understanding on what is required in terms of radio protocol structure and architecture to fulfil objective 1 and 2, with focus on progressing in the following areas
   * Fundamental physical layer signal structure for new RAT
     + Waveform based on OFDM, with potential support of non-orthogonal waveform and multiple access
       - FFS: other waveforms if they demonstrate justifiable gain
     + Basic frame structure(s)
     + Channel coding scheme(s)
   * Radio interface protocol architecture and procedures
   * Radio Access Network architecture, interface protocols and procedures,

Study on the above 2 bullets shall at least cover:

* + - Study the feasibility of different options of splitting the architecture into a “central unit” and a “distributed unit”, with potential interface in between, including transport, configuration and other required functional interactions between these nodes [RAN2, RAN3];
      * Study the alternative solutions with regard to signaling, orchestration, …, and OAM, where applicable [in co-operation with SA5];
    - Study and outline the RAN-CN interface and functional split [in co-operation with SA2] [RAN2, RAN3];
    - Study and identify the basic structure and operation of realization of RAN Networks functions (NFs). Study to what extent it is feasible to standardize RAN NFs, the interfaces of RAN NFs and their interdependency [RAN3];
    - Study and identify specification impacts of enabling the realization of Network Slicing [in co-operation with SA2] [RAN2, RAN3];
    - Study and identify additional architecture requirements e.g. support for QoS concept, SON, support of sidelink for D2D [RAN1, RAN2, RAN3].
  + Fundamental RF aspects – especially where they may impact decisions on the above, e.g.,
    - Study and identify the aspects related to the testability of RF and performance requirements

1. Study and identify the technical features necessary to enable the new radio access to meet objective 1 and 2, also including:
   * Tight interworking between the new RAT and LTE
   * Interworking with non-3GPP systems
   * Operation in licensed bands (paired and unpaired), and licensed assisted operations in unlicensed bands
     + [Standalone operation in unlicensed bands is FFS]
   * Efficient multiplexing of traffic for different services and use cases on the same contiguous block of spectrum
   * Stand alone operation in licensed bands

Note 1: The scope of Phase I will be determined when agreeing on Phase I WID(s).

Note 2: Stated KPI values and deployment scenarios to be aligned to scenarios and requirement SI outcome

1. Provide performance evaluation of the technologies identified for the new RAT and analysis of the expected specification work
2. Identify relevant RF parameters used to be used for sharing and co-existence studies
3. Study and identify technical solutions that enable support for wireless relay

### 4.2 Objective of Performance part WI

NOTE: Leave empty if the WI proposal does not contain a RAN performance part.

### 4.3 RAN time budget proposal

NOTE: For WIs/SIs under RAN WG5 leadership this section is not filled out. Otherwise:  
For a not yet approved WI/SI the rapporteur has to fill out the last row of the table(s) below up to the target date of the WI/SI (if necessary add further tables): Indicate the number of time units (1 TU ~ 2h), i.e. one value for each session/field. If no time unit is needed, leave the field empty.  
For WI/SI already approved in the past, the tables below will no longer be updated in the WI/SI description (i.e. the tables reflect the status of the initial approval). But changes can be proposed in the status report of the WI/SI.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **RAN #71 Q2/2016 RAN #72** | | | | | | | |
| R1N | R2N | R3N | R4N | R1N | R2N | R3N | R4N |
| 84bis | 93bis | 91bis | 78bis | 85 | 94 | 92 | 79 |
| **12** | **6** | **6** | **1.5** | **20** | **6** | **6** | **2** |

|  |  |  |  |
| --- | --- | --- | --- |
| **RAN #72 Q3/2016 RAN#73** | | | |
| R1N | R2N | R3N | R4N |
| 86 | 95 | 93 | 80 |
| **[20]** | **[8]** | **[4]** | **[8]** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **RAN #73 Q4/2016 RAN#74** | | | | | | | |
| R1N | R2N | R3N | R4N | R1N | R2N | R3N | R4N |
| 86bis | 95bis | 93bis | 80bis | 87 | 96 | 94 | 81 |
| **[24]** | **[8]** | **[4]** | **[8]** | **[24]** | **[8]** | **[4]** | **[8]** |

|  |  |  |  |
| --- | --- | --- | --- |
| **RAN #74 Q1/2017 RAN#75** | | | |
| R1N | R2N | R3N | R4N |
| 88 | 97 | 95 | 82 |
| **[24]** | **[8]** | **[4]** | **[12]** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **RAN #75 Q2/2017 RAN#76** | | | | | | | |
| R1N | R2N | R3N | R4N | R1N | R2N | R3N | R4N |
| 88bis | 97bis | 95bis | 82bis | 89 | 98 | 96 | 83 |
|  |  |  | **[12]** |  |  |  | **[12]** |

L: LTE, U: UMTS, J: Joint, RD: RRM/demodulation

NOTE: In case further explanation of the time budget proposal is needed, then please explain this below.

**additional comments to the time budget proposal:**

Completion date is proposed to be June 2018. Exact TU allocation for each involved WG is TBD.

This study is assumed to be handled in separate parallel sessions in RAN1 and in parallel and joint sessions in RAN2. It is assumed that 2-3 days of meeting time are needed initially in both RAN1 and RAN2, increasing to 3-4 days of meeting time during the study. For RAN3 and RAN4 the work in study item phase can probably be handled in existing sessions. Note also that additional meetings and possibly additional ad hoc meetings with limited agenda may be scheduled as needed in any working group.

## 5 Service Aspects

## 6 MMI-Aspects

## 7 Charging Aspects

## 8 Security Aspects

## 9 Impacts

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Affects:** | UICC apps | ME | AN | CN | Others |
| **Yes** |  | x | x |  |  |
| **No** |  |  |  |  |  |
| **Don't know** | x |  |  | x | x |

## 10 Expected Output and Time scale

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| New specifications | | | | | | |
| Spec No. | Title | 1st rsp. WG | 2nd rsp. WG(s) | Presented for information at plenary# | Approved at plenary # | Comments |
| 38.9xx | TR for Study on New Radio Access Technology | RANP | RAN1,  RAN2, RAN3, RAN4 | RAN#75 | RAN#76 (June 2017) |  |
| 38.8xx | TR for Study on New Radio Access Technology Physical Layer Aspects | RAN1 |  | RAN#75 | RAN#76 (June 2017) | RAN1 internal |
| 38.8xx | TR for Study on New Radio Access Technology Radio Interface Protocol Aspects | RAN2 |  | RAN#75 | RAN#76 (June 2017) | RAN2 internal |
| 38.8xx | TR for Study on New Radio Access Technology:  Radio Access Architecture and Interface | RAN3 |  | RAN#75 | RAN#76 (June 2017) | RAN3 internal |
| 38.8xx | TR for Study on New Radio Access Technology:  RF and co-existence aspects | RAN4 |  | RAN#75 | RAN#76 (June 2017) | RAN4 internal |

NOTE: If this is a RAN WID including Core and Perf. part, then all new Core part specs have to be listed first and then all new Perf. part specs. Indicate "Core part" or "Perf. part" under Comments for each spec.  
By default a new specs can only be new for one of both parts.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Affected existing specifications [None in the case of Study Items] | | | | |
| Spec No. | CR | Subject of the CR | Approved at plenary# | Comments |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

NOTE: If this is a RAN WID including Core and Perf. part, then all new Core part specs have to be listed first and then all new Perf. part specs. Indicate "Core part" or "Perf. part" under Comments for each spec.  
If an existing spec is affected by both (Core part and Perf. part), then it has to be listed twice with appropriate approval dates.

## 11 Work item rapporteur(s)

<FamilyName>, <GivenName>

Kazuaki Takeda

**Company: NTT DOCOMO, INC.**

**Email: kazuaki.takeda.bs@nttdocomo.com**

## 12 Work item leadership

RAN1 (primary), RAN2/3/4 (secondary)

NOTE: If this is a RAN WID including Core and Perf. part, then this WG specifies the WG leading the Core part.  
RAN WG4 is by default leading the Perf. part.

## 13 Supporting Individual Members

|  |
| --- |
| Supporting IM name |
| NTT DOCOMO |
| Alcatel-Lucent |
| Alcatel-lucent Shanghai Bell |
| AT&T |
| CATT |
| CMCC |
| Ericsson |
| Fujitsu |
| HiSilicon |
| Huawei |
| III |
| Intel |
| InterDigital |
| ITRI |
| KDDI |
| KT |
| Lenovo |
| LG Electronics |
| MediaTek |
| Mitsubishi Electric |
| Motorola Mobility |
| NEC |
| Nokia Networks |
| OPPO |
| Orange |
| Panasonic |
| Qualcomm |
| Samsung |
| Sharp |
| Sierra Wireless |
| SK Telecom |
| Softbank |
| Sony |
| SPREADTRUM |
| T-Mobile USA |
| Telecom Italia |
| Verizon |
| Vodafone |
| Xilinx |
| ZTE |

form change history:

2013-12-06 v1.14.1 modified §11 to read: <FamilyName>, <GivenName>, (If the person is new to 3GPP work, give full contact coordinates, in particular, email address.)

2013-10-03 v1.14.0 removal of embedded help text

v1.13.2: adds tdoc header

v1.13.1: minor changes resulting from discussions at CT#41 & SA#41

v1.13.0: mods to enforce linkage amongst stages 1, 2, 3

draft mods Scarrone-Meredith 2008-07 ff

v1.12.1: removes revision marks following approval at SP-29  
v1.12.0: includes provision for Study Items (SP-29)

v1.11.0: includes those changes from v1.8.0 agreed at SP-25.

v1.10.0: full circle

v1.9.0: a clean sheet

v1.8.0: includes comments from SA#24

v1.7.0: includes comments from RAN, CN and T #24; also includes “early implementation” data

v1.6.0: includes comments made during review period prior to TSGs#24

v1.5.0: includes comments made at TSGs#23 (Phoenix)

v1.4.0: offered to SA#23 for approval

v1.3.0: offered to CN#23, RAN#23 and T#23 for comments

DRAFT4 v1.3.0: 2004-03-09: Incorporation of comments from Leaders list

DRAFT3 v1.3.0: 2004-02-19: Incorporation of comments from MCC members

DRAFT2 v1.3.0: 2004-01-29: Complete redraft:

v1.2.0: 2002-07-04: "USIM" box changed to "UICC apps"

2003-05-28: spelling of “rapporteur” corrected

2002-07-04: "USIM" box changed to "UICC apps"