**SA WG2 Meeting #159S2-2311030**

**October 09th – 13th, 2023; Xiamen, China (revision of S2-xxxxxxx)**

**Source: NTT DOCOMO**

**Title: New SID on System aspects of 5G NR Femto**

**Document for: Approval**

**Agenda Item: 30.1**

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: Study on System aspects of 5G NR Femto

Acronym: FS\_5G\_Femto

Unique identifier: TBD

Potential target Release: Rel-19

# 1 Impacts

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

# 2 Classification of the Work Item and linked work items

## 2.1 Primary classification

### This work item is a …

|  |  |
| --- | --- |
| X | Study |
|  | Normative – Stage 1 |
|  | Normative – Stage 2 |
|  | Normative – Stage 3 |
|  | Normative – Other\* |

**\* Other = e.g. testing**

## 2.2 Parent Work Item

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

### 2.3 Other related Work Items and dependencies

|  |  |  |
| --- | --- | --- |
| Other related Work /Study Items (if any) | | |
| Unique ID | Title | Nature of relationship |
| 830042 | Vertical\_LAN | CAG introduction |
| 900015 | Enhanced support of Non-Public Networks | CAG enhancements |

# 3 Justification

In 3G and 4G, 3GPP defined an architecture for Home eNodeB (HeNB)/Home NodeB (HNB) (or Femto/Femtocell is synonymous of HeNB/HNB in 3GPP and is also well-defined by other STD organizations such as Broadband Forum TR-196) in TS 22.220 and TS 36.300 that enables small access points deployed in customer premises (on a campus or at home) for access to operator, Internet and local services like local printers or local servers. In 5GS, NR Femto access is limitedly specified (e.g., TS 38.104) since the 5GS architecture is introduced in a flexible manner and no specific architecture for 5G NR Femto access deemed necessary so far.

This study item aims at studying potential overall (end-to-end) architecture enhancement and required functional and procedural impacts for supporting deployments of 5G NR Femto with focus on enabling access control for “5G NR Femto” use cases. For example, 5G NR Femto extends e.g., coverage using higher frequency bands (e.g., FR2 bands), also improves 5G indoor coverage, offloads traffic from the macro network, enables better voice quality, and better supports enterprise mobility. This will improve the overall customer service experience. In fact, it is already possible for operator to deploy 5G NR Femto for the purpose of coverage improvement. However, some enhancements for 5G NR Femto are required so that customers are willing to put it at their premises. For example, 5G NR femto enhanced such that it starts working in a plug-and-play manner and the owner needs to be able to control who can use cells of the enhanced 5G NR Femto.

In clause 4.6, TS 36.300, the concept of Home eNB Gateway (HeNB GW) is developed to support HeNB deployment for EPS. However, this study proposes to also examine mechanisms with or without HgNB GWs (similar to the HeNB GW defined in clause 4.6, TS 36.300) to support of 5G NR Femto deployments.

Furthermore, LTE femto without a local GW (LIPA) has actually caused a problem in forwarding traffic to the central network, because the traffic is too high compared to the capacity of the wireline connection that the customer has to the Internet at home. This has often led to a change in the wireline connection. A L-PSA alongside 5G NR femto can at least free the operator from having to worry about solving this problem and realize always desired traffic offloading. Therefore, need to investigate how SMF is able to determine (or find) L-PSA deployed with or near the 5G NR Femto. For example, in clause 4.3.15a.3, TS 23.401 "The (H)eNB supporting the SIPTO at the Local Network function includes the Local GW address to the MME in every INITIAL UE MESSAGE" a mechanism is defined for the LTE/EPC network. Therefore, a similar mechanism is needed for 5G NR femto deployment. Some might argue that we can simply use OAM to install configuration data in the network nodes. But if we assume a large number of network nodes, this is too much of a burden on the network. In fact, it is one of the reason, RAN WGs developed the SON concept: there are too many RAN nodes, so it is not so easy for OAM to configure them all. Also in this case, there are too many L-GWs, so we need a mechanism to find L-PSA by SMF (e.g., similar mechanism that defined in clause 4.3.15a.3, TS 23.401 for the 5GS).

In addition, for a mixed 4G/5G femto deployment, interworking should also be investigated when a 5G CAG UE can be moved to a CSG femto cell and vice versa, assuming that the CAG cell is connected to the 5GC and the CSG cell is connected to the EPC. Moreover, the scenario that a UE can move from a 5GC to an EPC that does not support CSG subscription should also be investigated.

Following are the justifications for the study objectives:

* Concept of a 5G NR Femto is currently not explicitly specified in 3GPP standards. For example, whether and how to define the overall architecture and required functional and procedural impacts for supporting 5G NR Femto deployment.
* How to define the 5G NR Femto access control mechanism based on the existing CAG concept such that the 5G NR Femto owner able to control the access.
* How to enable provisioning of subscribers allowed to access 5G NR Femto cells and how to manage 5G NR Femto access control by the Closed Access Group (CAG) owner or an authorized administrator.
* How to enable access to DN and local services (like printers or servers) i.e., offload traffic locally from the 5G NR Femto.

# 4 Objective

The following aspects will be studied:

WT#1: Whether and how to enhance the overall architecture and enable the required functional and procedural changes for supporting 5G NR Femto deployment.

NOTE 1: The study will take into account the RAN3 outcome, and coordination with RAN WG(s) is required before the study conclusion.

WT#2: How SMF is able to determine (or find) L-PSA deployed together with or near to the 5G NR Femto.

WT#3: How to enable interworking between CSG and CAG cells, e.g., to allow a UE to moved from a CAG to a CSG cell and vice versa.

NOTE 2: The scenario where a UE can move from a CAG cell connected to 5GC to EPC that does not support CSG subscription also investigated as part of WT#3.

WT#4: Study whether and how to support enabling the provisioning of subscribers allowed to access CAG cell and to manage access control by the CAG owner or an authorized administrator.

NOTE 3: Ownership of the 5G NR Femto (or CAG or both) concept and a mechanism will be defined in coordination with SA3.

## TU estimates and dependencies

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Work Task ID | TU Estimate  (Study) | TU Estimate  (Normative) | RAN Dependency  (Yes/No/Maybe) | Inter Work Tasks Dependency  Editor’s Note: This column should highlight if WT#x is self-contained, or it depends on the completion of other WTs |
| WT#1 | 1 | 0.5 | Yes | self-contained |
| WT#2 | 0.5 | 0.25 | No | self-contained |
| WT#3 | 2 | 1 | Yes | self-contained |
| WT#4 | 1 | 0.5 | No | self-contained |

Total TU estimates for the study phase: 4.5

Total TU estimates for the normative phase: 2.25

Total TU estimates: 4.5 + 2.25 = 6.75

# 5 Expected Output and Time scale

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| New specifications {One line per specification. Create/delete lines as needed} | | | | | |
| Type | TS/TR number | Title | For info  at TSG# | For approval at TSG# | Rapporteur |
| Internal TR | 23.XXX | Study on Architecture aspects of 5G Femto | TSG#xx | TSG#xx | TBD |
|  |  |  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Impacted existing TS/TR {One line per specification. Create/delete lines as needed} | | | |
| TS/TR No. | Description of change | Target completion plenary# | Remarks |
|  |  |  |  |
|  |  |  |  |

# 6 Work item Rapporteur(s)

TBD

# 7 Work item leadership

SA2

# 8 Aspects that involve other WGs

RAN impacts covered by RAN WGs (RAN3).

Security impacts covered by SA3.

Charging aspects covered by SA5.

# 9 Supporting Individual Members

|  |
| --- |
| Supporting IM name |
| NTT DOCOMO |
| Nokia |
| Nokia Shanghai Bell |
| Verizon |
| T-Mobile USA |
| AT&T |
| Samsung |
| Casa Systems |
| BT |
| Oracle |
| SK Telecom |
| Cisco |
| MATRIXX Software |
| Charter Communications |
| NEC |
| Rakuten Mobile |
| Reliance Jio |
| Telefonica |
| KPN |
| DISH Network |