**3GPP TSG-CT WG1 Meeting #124-eC1-203410**

**Electronic meeting, 2-10 June 2020**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **24.502** | **CR** | **0119** | **rev** | **3** | **Current version:** | **15.5.0** |  |
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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 |  | Core Network |  |

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| ***Title:*** |  | | | | | | | | | |
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| ***Source to WG:*** | BlackBerry UK Ltd., NTAC (?), Ministère Economie et Finances (?), The Police of the Netherlands (?), BT (?) | | | | | | | | | |
| ***Source to TSG:*** | C1 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | 5GS\_Ph1-CT | | | | |  | ***Date:*** | | | 2020-04-06 |
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| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-15 |
|  | *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 can be 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-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
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| ***Reason for change:*** | | **PROBLEM 1**  A visited country may not have deployed an N3IWF.  This visited country could require usage of LI-enabled ePDG. At present, a compliant UE, supporting connectivity with N3IWF and with ePDG, cannot be configured to use ePDG in this visited country (via DNS).  **PROBLEM 2**  The procedures do not consider the UE being attached via 3GPP access even though stage 2 gives special consideration to the case where N1 capability is disabled.  TS 23.501, subclause 6.3.6.3 specifically mandates that if “*the UE has its 5GS capability disabled in which case it shall choose an ePDG*”.  **PROBLEM 3**  Unlike subclause 7.2.4.4.2, subclause 7.2.4.4.3 omits UE behavior for when the UE has selected an ePDG IP address and the tunnel setup fails. It needs to be specified that the UE attempts another ePDG or N3IWF, while adhering the visited countries LI requirements.  **PROBLEM 4**  A UE in a visited country cannot select an ePDG in the visited country unless the UE is configured with N3AN node configuration information and registered with a VPLMN.  However, TS 23.501, subclause 6.3.6.3 does not have these limitations: “*When the UE wants to select a non-3GPP access node (either an N3IWF or an ePDG), the UE shall perform the following procedure*”.  **BACKWARDS COMPATIBILITY**  There is no impact on the protocols. The proposed changes are backwards compatible. | | | | | | | | |
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| ***Summary of change:*** | | Correct the procedure determining if the visited country requires selection of an ePDG or N3IWF in this country.  Clarified that when PLMN selection is implementation specific and the N3AN node needs to be selected in the visited country, the UE has to select a PLMN of the visited country.  Add UE behavior for tunnel error and retry handling when the UE has selected an ePDG IP address for Non-IMS service.  **NOTE**: Because there is no style “B6”, I ended up duplicating some conditions and e.g. introduce a bullet labelled C) with these duplications in 7.2.4.4.2 and 7.2.4.4.3. I ran out of styles …  **These changes are backwards compatible** | | | | | | | | |
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| ***Consequences if not approved:*** | | A visited country may require that a visiting UE is required to select an N3AN node in the visited country. The visited country may only have deployed an ePDG:   * A UE that supports N3IWF only will determine the selection of N3IWF in the country is not required. This UE will not terminate N3AN node selection due to the country mandating that selection of ePDG is required. According to the current procedures **the UE would bypasses LI in the visited country by e.g. selecting N3IWF in the home country**. * A UE that supports N3IWF and ePDG will determine the selection of N3IWF in the country is not required. The UE is not required to qeury the DNS to learn if the country mandates selection of ePDG. According to the current procedures **the UE bypasses LI in the visited country by e.g. selecting N3IWF in the home country**.   Impossible for a UE, selecting a N3AN node selection for Non-IMS service, to be compliant to tunnel error and retry handling when the N3AN node selected for Non-IMS service is an ePDG.  Impossible for a UE to select an ePDG in scenarios where this is required according to stage 2. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 2, 7.2.4.1, 7.2.4.2, 7.2.4.3, 7.2.4.4.2, 7.2.4.4.3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | Rev 4:  Removed TS 24.008 reference.  Take into account N1 capability per TS 23.501  Take into account any\_PLMN preference in condition b.2.i.A.I) | | | | | | | | |

\*\*\* First change \*\*\*

# 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".

[2] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[3] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[4] 3GPP TS 24.501: "Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[4A] 3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3".

[5] 3GPP TS 33.501: "Security architecture and procedures for 5G System".

[6] IETF RFC 7296: "Internet Key Exchange Protocol Version 2 (IKEv2)".

[7] 3GPP TS 24.302: "Access to the 3GPP Evolved Packet Core (EPC) via non-3GPP access networks; Stage 3".

[8] 3GPP TS 23.003: "Numbering, addressing and identification".

[9] IETF RFC 3748: "Extensible Authentication Protocol (EAP)".

[10] 3GPP TS 33.402: "3GPP System Architecture Evolution (SAE); Security aspects of non-3GPP accesses."

[11] IETF RFC 4303: "IP Encapsulating Security Payload (ESP)".

[12] IETF RFC 4301: "Security Architecture for the Internet Protocol".

[13] 3GPP TS 23.122: "Non-Access-Stratum (NAS) functions related to Mobile Station (MS) in idle mode".

[14] IETF RFC 2784: "Generic Routing Encapsulation (GRE)".

[15] IETF RFC 2890: "Key and Sequence Number Extensions to GRE".

[16] 3GPP TS 23.503: "Policy and Charging Control Framework for the 5G System".

[17] 3GPP TS 24.526: "User Equipment (UE) policies for 5G System (5GS); Stage 3".

[18] 3GPP TS 23.402: "Architecture enhancements for non-3GPP accesses".

[19] IEEE Std 802.11-2012: "IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".

[20] Wi-Fi Alliance: "Hotspot 2.0 (Release 2) Technical Specification, version 1.0.0", 2014-08-08.

[21] ITU-T Recommendation E.212: "The international identification plan for public networks and subscriptions", 2016-09-23.

[22] 3GPP TS 24.007: "Mobile radio interface signalling layer 3; General aspects".

[23] IETF RFC 4555: "IKEv2 Mobility and Multihoming Protocol (MOBIKE)".

[24] IETF RFC 791: "INTERNET PROTOCOL".

[25] IETF RFC 8200: "Internet Protocol, Version 6 (IPv6) Specification".

[26] IETF RFC 2474: "Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers".

[27] IETF RFC 793: "Transmission Control Protocol".

[28] 3GPP TS 24.008: "Mobile radio interface Layer 3 specification; Core network protocols; Stage 3".

[29] 3GPP TS 38.413: "NG Application Protocol (NGAP)".

\*\*\* Next change \*\*\*

#### 7.2.4.1 General

When the UE supports connectivity with N3IWF but does not support connectivity with ePDG, the UE shall perform the procedure in subclause 7.2.4.3 for selecting an N3IWF.

When the UE supports connectivity with N3IWF and ePDG, the UE shall perform the procedure in subclause 7.2.4.4 for selecting either an N3IWF or an ePDG.

NOTE: In the context of subclause 7.2.4, the condition "a UE is registered to a VPLMN via 3GPP access" (see 3GPP TS 24.501 [4]) is also met when the UE is attached to a VPLMN via 3GPP access (see 3GPP TS 24.301 [4A]). The condition "a UE is not registered to a VPLMN via 3GPP access" implies the UE is also not attached to a VPLMN via 3GPP access.

\*\*\* Next change \*\*\*

#### 7.2.4.2 Determine if the visited country mandates the selection of N3IWF or ePDG in this country

In order to determine if the visited country mandates the selection of N3IWF in this country, the UE shall perform the DNS NAPTR query using Visited Country FQDN as specified in clause 28 of 3GPP TS 23.003 [8] via the non-3GPP access network.

If the result of this query is:

- a set of one or more records containing the service instance names of the form "*n3iwf.5gc.mnc<MNC>.mcc<MCC>.pub.3gppnetwork.org*", the UE shall determine that the visited country mandates the selection of the N3IWF in this country; and

NOTE: The (<MCC>, <MNC>) pair in each record represents PLMN Id (see 3GPP TS 23.003 [8]) in the visited country which can be used for N3IWF selection in subclause 7.2.4.3 and subclause 7.2.4.4.

- no records containing the service instance names of the form "*n3iwf.5gc.mnc<MNC>.mcc<MCC>.pub.3gppnetwork.org*", the UE shall determine that the visited country does not mandate the selection of the N3IWF in this country.

The UE shall determine if the visited country mandates the selection of ePDG in this country using the procedure specified in subclause 7.2.1.4 of 3GPP TS 24.302 [7].

\*\*\* Next change \*\*\*

#### 7.2.4.3 UE procedure when the UE only supports connectivity with N3IWF

If the UE only supports connectivity with N3IWF and does not support connectivity with ePDG, the UE shall ignore the following ePDG related configuration parameters if available in the N3AN node configuration information when selecting an N3IWF:

- the home ePDG identifier configuration; and

- the preference parameter in each N3AN node selection information entry in the N3AN node selection information.

The UE shall proceed as follows:

a) if the UE is located in its home country:

1) if the N3AN node configuration information is provisioned:

i) if the home N3IWF identifier configuration is provisioned in the N3AN node configuration information and contains an IP address, the UE shall use the IP address of the home N3IWF identifier configuration as the IP address of the N3IWF;

ii) if the home N3IWF identifier configuration is provisioned in the N3AN node configuration information and does not contain an IP address, the UE shall use the FQDN of the home N3IWF identifier configuration as the N3IWF FQDN; and

iii) if the home N3IWF identifier configuration is not provisioned in the N3AN node configuration information, the UE shall construct an N3IWF FQDN based on the FQDN format of the HPLMN's N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the HPLMN stored on the USIM as specified in 3GPP TS 23.003 [8]; and

2) if the N3AN node configuration information is not provisioned on the UE, the UE shall construct the N3IWF FQDN based on the Operator Identifier FQDN format using the PLMN ID of the HPLMN stored on the USIM;

and for the above cases constructing or using an N3IWF FQDN, the UE shall use the DNS server function to resolve the N3IWF FQDN to the IP address(es) of the N3IWF(s). The UE shall select as the IP address of the N3IWF a resolved IP address of an N3IWF with the same IP version as its local IP address; and

b) if the UE is not located in its home country:

1) if the N3AN node configuration information is provisioned and the UE is registered to a VPLMN via 3GPP access:

i) if an N3AN node selection information entry for the VPLMN is available in the N3AN node selection information of the N3AN node configuration information, the UE shall construct an N3IWF FQDN based on FQDN format of the VPLMN's N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the VPLMN as specified in 3GPP TS 23.003 [8]; and

ii) if an N3AN node selection information entry for the VPLMN is not available in the N3AN node selection information of the N3AN node configuration information, the UE shall construct an N3IWF FQDN based on the FQDN format of the 'Any\_PLMN' N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the VPLMN as specified in 3GPP TS 23.003 [8];

and for the above cases, the UE shall use the DNS server function to resolve the constructed N3IWF FQDN to the IP address(es) of the N3IWF(s). The UE shall select as the IP address of the N3IWF a resolved IP address of an N3IWF with the same IP version as its local IP address; and

2) if one of the following is true:

- the UE is not registered to a PLMN via 3GPP access and the UE uses WLAN; or

- the N3AN node configuration information is not provisioned;

the UE shall perform two DNS queries (see 3GPP TS 23.003 [8]) as specified in subclause 7.2.4.2 to determine if the visited country mandates the selection of N3IWF or ePDG in this country and:

i) if selection of N3IWF in visited country is mandatory:

A) if the UE is registered to a VPLMN via 3GPP access and the PLMN ID of VPLMN is included in one of the returned DNS records, the UE shall construct an N3IWF FQDN based on the Operator Identifier FQDN format using the PLMN ID of the VPLMN in 3GPP access as described in 3GPP TS 23.003 [8]; and

B) if the UE is not registered to a PLMN via 3GPP access or the UE is registered to a VPLMN via 3GPP access and the PLMN ID of VPLMN is not included in any of the returned DNS records:

- if the N3AN node configuration information is provisioned, the UE shall select a PLMN included in the DNS response that has highest PLMN priority (see 3GPP TS 24.526 [17]) in the N3AN node selection information of the N3AN node configuration information and the UE shall construct an N3IWF FQDN based on the FQDN format of the selected PLMN's N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the selected PLMN as specified in 3GPP TS 23.003 [8]; and

- if the N3AN node configuration information is not provisioned or the N3AN node selection information of the N3AN node configuration information does not contain any of the PLMNs in the DNS response, selection of a PLMN of the visited country is UE implementation specific. If the UE does not select a PLMN, the UE shall terminate the N3AN node selection procedure. If the UE selects a PLMN, the UE shall construct an N3IWF FQDN based on the Operator Identifier FQDN format using the PLMN ID of the selected PLMN as described in 3GPP TS 23.003 [8];

and for the above cases, the UE shall use the DNS server function to resolve the constructed N3IWF FQDN to the IP address(es) of the N3IWF(s). The UE shall select as the IP address of the N3IWF a resolved IP address of an N3IWF with the same IP version as its local IP address;

ii) if the UE determines that selection of N3IWF and ePDG in the visited country is not mandatory:

A) if the N3AN node configuration information is provisioned and the N3AN node selection information of the N3AN node configuration information contains one or more PLMNs in the visited country, the UE shall select a PLMN that has highest PLMN priority (see 3GPP TS 24.526 [17]) in the N3AN node selection information and the UE shall construct an N3IWF FQDN based on the FQDN format of the selected PLMN's N3AN node selection information entry in the N3AN node selection information as specified in 3GPP TS 23.003 [8] using the PLMN ID of the selected PLMN; and

B) if the N3AN node configuration information is not provisioned or the N3AN node configuration information is provisioned and the N3AN node selection information of the N3AN node configuration information contains no PLMNs in the visited country:

- if the home N3IWF identifier configuration is provisioned in the N3AN node configuration information (see 3GPP TS 24.526 [17]) and contains an IP address, the UE shall use the IP address of the home N3IWF identifier configuration as the IP address of the N3IWF;

- if the home N3IWF identifier configuration is provisioned in the N3AN node configuration information (see 3GPP TS 24.526 [17]) and does not contain an IP address, the UE shall use the FQDN of the home N3IWF identifier configuration as the N3IWF FQDN; and

- if the home N3IWF identifier configuration is not provisioned in the N3AN node configuration information, the UE shall construct an N3IWF FQDN based on the Operator Identifier FQDN format using the PLMN ID of the HPLMN as described in 3GPP TS 23.003 [8];

and for the above cases constructing or using an N3IWF FQDN, the UE shall use the DNS server function to resolve the N3IWF FQDN to the IP address(es) of the N3IWF(s). The UE shall select as the IP address of the N3IWF a resolved IP address of an N3IWF with the same IP version as its local IP address; and

iii) if no DNS response is received or bullet i) and ii) do not apply, the UE shall terminate the N3AN node selection procedure.

Following bullet a) and b) above, once the UE selected the IP address of the N3IWF, the UE shall initiate the IKEv2 SA establishment procedure as specified in subclause 7.3.

If the IKEv2 SA establishment procedure towards an N3IWF in the HPLMN fails due to no response to an IKE\_SA\_INIT request message, and the selection of N3IWF in the HPLMN is performed using home N3IWF identifier configuration and there are more pre-configured N3IWFs in the HPLMN, the UE shall repeat the tunnel establishment attempt using the next FQDN or IP address(es) of the N3IWF in the HPLMN.

If the IKEv2 SA establishment procedure towards to any of the received IP addresses of the selected N3IWF fails due to no response to an IKE\_SA\_INIT request message, then the UE shall repeat the N3IWF selection as described in this subclause, excluding the N3IWFs for which the UE did not receive a response to the IKE\_SA\_INIT request message.

NOTE: The time the UE waits before reattempting access to another N3IWF or to an N3IWF that it previously did not receive a response to an IKE\_SA\_INIT request message, is implementation specific.

\*\*\* Next change \*\*\*

##### 7.2.4.4.2 N3AN node selection for IMS service

If the N3AN node selection is required for an IMS service, the UE shall use the preference parameter in the N3AN node selection information entries of the N3AN node selection information to determine whether selection of N3IWF or ePDG is preferred in a given PLMN.

The UE shall proceed as follows:

a) if the UE is located in its home country:

1) if the N3AN node configuration information is provisioned:

i) if the preference parameter in the HPLMN's N3AN node selection information entry of the N3AN node selection information indicates that N3IWF is preferred and the UE's N1 mode capability for 3GPP access is not disabled (see 3GPP TS 24.501 [4]):

A) if the home N3IWF identifier configuration is provisioned in the N3AN node configuration information and contains an IP address, the UE shall use the IP address of the home N3IWF identifier configuration as the IP address of the N3IWF;

B) if the home N3IWF identifier configuration is provisioned in the N3AN node configuration information and does not contain an IP address, the UE shall use the FQDN of the home N3IWF identifier configuration as the N3IWF FQDN; and

C) if the home N3IWF identifier configuration is not provisioned in the N3AN node configuration information, the UE shall construct an N3IWF FQDN based on the FQDN format of the HPLMN's N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the HPLMN stored on the USIM as specified in clause 28 of 3GPP TS 23.003 [8]; and

ii) if the preference parameter in the HPLMN's N3AN node selection information entry of the N3AN node selection information indicates that ePDG is preferred or the UE's N1 mode capability for 3GPP access is disabled:

A) if the home ePDG identifier configuration is provisioned in the N3AN node configuration information and contains an IP address, the UE shall use the IP address of the home ePDG identifier configuration as the IP address of the ePDG;

B) if the home ePDG identifier configuration is provisioned in the N3AN node configuration information and does not contains an IP address, the UE shall use the FQDN of the home ePDG identifier configuration as the ePDG FQDN; and

C) if the home ePDG identifier configuration is not provisioned in the N3AN node configuration information, the UE shall construct an ePDG FQDN based on the FQDN format of HPLMN's N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the HPLMN stored on the USIM as specified in clause 19 of 3GPP TS 23.003 [8]; and

2) if the N3AN node configuration information is not provisioned on the UE, the UE shall either construct a N3IWF FQDN or a N3IWF FQDN based on the Operator Identifier FQDN format using the PLMN ID of the HPLMN stored on the USIM. If the the UE's N1 mode capability for 3GPP access is disabled, the UE shall not construct the N3IWF FQDN;

and for the above cases constructing or using an N3IWF FQDN or ePDG FQDN, the UE shall use the DNS server function to resolve the N3IWF FQDN or ePDG FQDN to the IP address(es) of the N3IWF(s) or ePDG(s). The UE shall select as the IP address of the N3IWF or of the ePDG a resolved IP address of an N3IWF or an ePDG with the same IP version as its local IP address; and

b) if the UE is not located in its home country:

1) if the N3AN node configuration information is provisioned and the UE is registered to a VPLMN via 3GPP access:

i) if an N3AN node selection information entry for the VPLMN is available in the N3AN node selection information of the N3AN node configuration information:

A) if the preference parameter in the VPLMN's N3AN node selection information entry of the N3AN node configuration information indicates that N3IWF is preferred and the UE's N1 mode capability for 3GPP access is not disabled, the UE shall construct an N3IWF FQDN based on the FQDN format of the VPLMN's N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the VPLMN as specified in clause 28 of 3GPP TS 23.003 [8]; and

B) if the preference parameter in the VPLMN's N3AN node selection information entry of the N3AN node configuration information indicates that ePDG is preferred or the UE's N1 mode capability for 3GPP access is disabled, the UE shall construct an ePDG FQDN based on the FQDN format of the VPLMN's N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the VPLMN as specified in clause 19 of 3GPP TS 23.003 [8]; and

ii) if an N3AN node selection information entry for the VPLMN is not available in the N3AN node selection information of the N3AN node configuration information:

A) if the preference parameter in the 'Any\_PLMN' N3AN node selection information entry of the N3AN node configuration information indicates that N3IWF is preferred and the UE's N1 mode capability for 3GPP access is not disabled, the UE shall construct an N3IWF FQDN based on the FQDN format of the 'Any\_PLMN' N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the VPLMN as specified in clause 28 of 3GPP TS 23.003 [8]; and

B) if the preference parameter in the 'Any\_PLMN' N3AN node selection information entry of the N3AN node configuration information indicates that ePDG is preferred or the UE's N1 mode capability for 3GPP access is disabled, the UE shall construct an ePDG FQDN based on the FQDN format of the 'Any\_PLMN' N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the VPLMN as specified in clause 19 of 3GPP TS 23.003 [8];

and for above case, the UE shall use the DNS server function to resolve the constructed N3IWF FQDN or ePDG FQDN to the IP address(es) of the N3IWF(s) or ePDG(s). The UE shall select as the IP address of the N3IWF or the ePDG a resolved IP address of an N3IWF or ePDG with the same IP version as its local IP address; and

2) if one of the following is true:

- the UE is not registered to a PLMN via 3GPP access and the UE uses WLAN; or

- the N3AN node configuration information is not provisioned;

the UE shall perform two DNS queries (see 3GPP TS 23.003 [8]) as specified in subclause 7.2.4.2 to determine if the visited country mandates the selection of N3IWF or ePDG in this country, and:

i) if selection of N3IWF or ePDG in the visited country is mandatory:

A) if the UE is registered to a VPLMN via 3GPP access and the PLMN ID of VPLMN is included in one of the returned DNS records:

I) if selection of N3IWF in the visited country is mandatory and selection of ePDG in the visited country is mandatory, the UE shall either construct an N3IWF FQDN based on the Operator Identifier FQDN format using the PLMN ID of the VPLMN as described in clause 28 of 3GPP TS 23.003 [8] or construct an ePDG FQDN based on the Operator Identifier FQDN format using the PLMN ID of the VPLMN as described in clause 19 of 3GPP TS 23.003 [8]. The UE decision to construct either a N3IWF FQDN or an ePDG FQDN depends on the preference parameter in the 'Any\_PLMN' N3AN node selection information entry of the N3AN node configuration information, if provisioned, when the UE's N1 mode capability for 3GPP access is not disabled. If UE's N1 mode capability for 3GPP access is disabled, the UE constructs the ePDG FQDN. If N3AN node configuration information is not provisioned and the UE's N1 mode capability for 3GPP access is not disabled, the UE decision to construct either a N3IWF FQDN or an ePDG FQDN is implementation dependent;

II) if only selection of N3IWF in the visited country is mandatory, the UE shall construct an N3IWF FQDN based on the Operator Identifier FQDN format using the PLMN ID of the VPLMN as described in clause 28 of 3GPP TS 23.003 [8]; and

III) if only selection of ePDG in the visited country is mandatory, the UE shall construct an ePDG FQDN based on the Operator Identifier FQDN format using the PLMN ID of the VPLMN as described in clause 19 of 3GPP TS 23.003 [8]; and

B) if the UE is not registered to a PLMN via 3GPP access or the UE is registered to a VPLMN via 3GPP access, the PLMN ID of VPLMN is not included in any of the returned DNS records and the N3AN node configuration information is provisioned, the UE shall select an a PLMN included in the DNS response that has highest PLMN priority (see 3GPP TS 24.526 [17]) in the N3AN node selection information of the N3AN node configuration information and the UE shall:

I) if selection of N3IWF in the visited country is mandatory, selection of ePDG in the visited country is mandatory, the UE's N1 mode capability for 3GPP access is not disabled and the preference parameter in the 'Any\_PLMN' N3AN node selection information entry of the N3AN node configuration information indicates that N3IWF is preferred, the UE shall construct an N3IWF FQDN based on the Operator Identifier FQDN format using the PLMN ID of the VPLMN as described in clause 28 of 3GPP TS 23.003 [8];

II) if selection of N3IWF in the visited country is mandatory, selection of ePDG in the visited country is mandatory, and either the preference parameter in the 'Any\_PLMN' N3AN node selection information entry of the N3AN node configuration information indicates that ePDG is preferred or the UE's N1 mode capability for 3GPP access is disabled, the UE shall construct an ePDG FQDN based on the Operator Identifier FQDN format using the PLMN ID of the VPLMN as described in clause 19 of 3GPP TS 23.003 [8];

III) if selection of N3IWF in the visited country is mandatory, construct an N3IWF FQDN based on the FQDN format of the selected PLMN's N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the selected PLMN as specified in clause 28 of 3GPP TS 23.003 [8]; or

IV) if selection of ePDG in the visited country is mandatory, construct an ePDG FQDN based on the FQDN format of the selected PLMN's N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the selected PLMN as specified in clause 19 of 3GPP TS 23.003 [8]; and

C) if the UE is not registered to a PLMN via 3GPP access or the UE is registered to a VPLMN via 3GPP access, the PLMN ID of VPLMN is not included in any of the returned DNS records and the N3AN node configuration information is not provisioned or the N3AN node selection information of the N3AN node configuration information does not contain any of the PLMNs in the DNS response, selection of a PLMN of the visited country is UE implementation specific. If the UE does not select a PLMN, the UE shall terminate the N3AN node selection procedure. If the UE selects a PLMN, the UE shall:

I) if selection of N3IWF in the visited country is mandatory, construct an N3IWF FQDN based on the Operator Identifier FQDN format using the PLMN ID of the selected PLMN as described in clause 28 of 3GPP TS 23.003 [8]; or

II) if selection of ePDG in the visited country is mandatory, construct an ePDG FQDN based on the Operator Identifier FQDN format using the PLMN ID of the selected PLMN as described in clause 19 of 3GPP TS 23.003 [8];

and for the above cases, the UE shall use the DNS server function to resolve the constructed N3IWF FQDN or the constructed ePDG FQDN to the IP address(es) of the N3IWF(s) or ePDG(s), respectivelly. The UE shall select as the IP address of the N3IWF or the ePDG a resolved IP address of an N3IWF or an ePDG with the same IP version as its local IP address;

ii) if the UE determines that selection of N3IWF and ePDG in the visited country is not mandatory:

A) if the N3AN node configuration information is provisioned and the N3AN node selection information of the N3AN node configuration information contains one or more PLMNs in the visited country, the UE shall select a PLMN that has highest PLMN priority (see 3GPP TS 24.526 [17]) in the N3AN node selection information, if the UE's N1 mode capability for 3GPP access is:

- not disabled, select between constructing an FQDN for either N3IWF or ePDG based on the preference parameter for the selected PLMN's N3AN node selection information entry in the N3AN node selection information, or

- disabled, select an FQDN for an ePDG; and

the UE shall construct the selected N3IWF FQDN or ePDG FQDN based on the FQDN format of the selected PLMN's N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the selected PLMN as specified in clause 28 or clause 19 of 3GPP TS 23.003 [8], respectivelly; and

B) if the N3AN node configuration information is not provisioned or the N3AN node configuration information is provisioned and the N3AN node selection information of the N3AN node configuration information contains no PLMN in the visited country:

- if the home N3IWF identifier configuration or home ePDG identifier configuration is provisioned in the N3AN node configuration information (see 3GPP TS 24.526 [17]) and contains an IP address, the UE shall use the IP address of the configuration as the IP address of the N3IWF or ePDG. If the UE's N1 mode capability for 3GPP access is disabled, the UE shall choose the IP address of the ePDG, if provisioned;

- if the home N3IWF identifier configuration or home ePDG identifier configuration is provisioned in the N3AN node configuration information (see 3GPP TS 24.526 [17]) and does not contains an IP address, the UE shall use the FQDN of the configuration as N3IWF FQDN or ePDG FQDN. If the UE's N1 mode capability for 3GPP access is disabled, the UE shall use the ePDG FQDN, if provisioned; and

- if the home N3IWF identifier configuration and home ePDG identifier configuration are not provisioned in the N3AN node configuration information, the UE shall construct an N3IWF FQDN or ePDG FQDN based on the Operator Identifier FQDN format using the PLMN ID of the HPLMN as described in clause 28 or clause 19 of 3GPP TS 23.003 [8]. If the UE's N1 mode capability for 3GPP access is disabled, the UE shall construct the ePDG FQDN;

and for the above cases constructing or using an N3IWF FQDN or an ePDG FQDN, the UE shall use the DNS server function to resolve the FQDN to the IP address(es) of the N3IWF(s) or ePDG(s). The UE shall select as the IP address of the N3IWF or the ePDG a resolved IP address of an N3IWF or ePDG with the same IP version as its local IP address; and

iii) if no DNS response is received, the UE shall terminate the N3AN node selection procedure.

Following bullet a) and b) above, once the UE selected the IP address of the N3IWF or the ePDG,

a) if the IP address of N3IWF is selected, the UE shall:

i) initiate the IKEv2 SA establishment procedure as specified in subclause 7.3;

ii) if the IKEv2 SA establishment procedure towards an N3IWF in the HPLMN fails due to no response to an IKE\_SA\_INIT request message or the UE is informed during registration over non-3GPP access that the IMS voice over PS session is not supported over non-3GPP access, and the selection of N3IWF in the HPLMN is performed using home N3IWF identifier configuration and there are more pre-configured N3IWFs in the HPLMN, repeat the tunnel establishment attempt using the next FQDN or IP address(es) of the N3IWF in the HPLMN;

iii) if the IKEv2 SA establishment procedure towards any of the received IP addresses of the selected N3IWF fails due to no response to an IKE\_SA\_INIT request message or the UE is informed during registration over non-3GPP access that the IMS voice over PS session is not supported over non-3GPP access, attempt to select an ePDG in the same PLMN as specified in 3GPP TS 24.302 [7] instead; and

iv) if the UE fails to connect to either N3IWF or ePDG in the same PLMN, repeat the N3AN node selection as described in this subclause, excluding the N3IWFs for which the UE did not receive a response to the IKE\_SA\_INIT request message;

NOTE 1: The time the UE waits before reattempting access to another N3IWF or to an N3IWF that it previously did not receive a response to an IKE\_SA\_INIT request message, is implementation specific.

b) if the IP address of ePDG is selected, the UE shall:

i) initiate tunnel establishment as specified in 3GPP TS 24.302 [7];

ii) if tunnel establishment as specified in 3GPP TS 24.302 [7] towards an ePDG in the HPLMN fails due to no response to an IKE\_SA\_INIT request message, and the selection of ePDG in the HPLMN is performed using home ePDG identifier configuration and there are more pre-configured ePDG in the HPLMN, repeat the tunnel establishment attempt using the next FQDN or IP address(es) of the ePDG in the HPLMN;

iii) if tunnel establishment as specified in 3GPP TS 24.302 [7] towards any of the received IP addresses of the selected ePDG fails due to no response to an IKE\_SA\_INIT request message, attempt to select an N3IWF in the same PLMN instead; and

iv) if the UE fails to connect to either ePDG or N3IWF in the same PLMN, repeat the N3AN node selection as described in this subclause, excluding the ePDGs for which the UE did not receive a response to the IKE\_SA\_INIT request message.

NOTE 2: The time the UE waits before reattempting access to another ePDG or to an ePDG that it previously did not receive a response to an IKE\_SA\_INIT request message, is implementation specific.

\*\*\* Next change \*\*\*

##### 7.2.4.4.3 N3AN node selection for Non-IMS service

If the N3AN node selection is required for a non-IMS service, the UE shall ignore the preference parameter in the N3AN node selection information entries of the N3AN node selection information.

The UE shall proceed as follows:

a) if the UE is located in its home country:

1) if the N3AN node configuration information is provisioned:

i) if the home N3IWF identifier configuration is provisioned in the N3AN node configuration information and contains an IP address, the UE shall use the IP address of the home N3IWF identifier configuration as the IP address of the N3IWF;

ii) if the home N3IWF identifier configuration is provisioned in the N3AN node configuration information and does not contain an IP address, the UE shall use the FQDN of the home N3IWF identifier configuration as the N3IWF FQDN; and

iii) if the home N3IWF identifier configuration is not provisioned in the N3AN node configuration information, the UE shall construct an N3IWF FQDN based on the FQDN format of the HPLMN's N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the HPLMN stored on the USIM as specified in clause 28 of 3GPP TS 23.003 [8]; and

2) if the N3AN node configuration information is not provisioned, the UE shall construct the N3IWF FQDN based on the Operator Identifier FQDN format using the PLMN ID of the HPLMN stored on the USIM;

and for the above cases constructing or using an N3IWF FQDN, the UE shall use the DNS server function to resolve the N3IWF FQDN to the IP address(es) of the N3IWF(s) or ePDG(s). The UE shall select as the IP address of the N3IWF a resolved IP address of an N3IWF with the same IP version as its local IP address; and

b) if the UE is not located in its home country:

1) if the N3AN node configuration information is provisioned and the UE is registered to a VPLMN via 3GPP access:

i) if an N3AN node selection information entry for the VPLMN is available in the N3AN node selection information of the N3AN node configuration information, the UE shall construct an N3IWF FQDN based on the FQDN format of the VPLMN's N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the VPLMN as specified in clause 28 of 3GPP TS 23.003 [8]; and

ii) if an N3AN node selection information entry for the VPLMN is not available in the N3AN node selection information of the N3AN node configuration information, the UE shall construct an N3IWF FQDN based on the FQDN format of the 'Any\_PLMN' N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the VPLMN as specified in clause 28 of 3GPP TS 23.003 [8]; and

and for above case, the UE shall use the DNS server function to resolve the constructed N3IWF FQDN to the IP address(es) of the N3IWF(s). The UE shall select as the IP address of the N3IWF a resolved IP address of an N3IWF with the same IP version as its local IP address; and

2) if one of the following is true:

- the UE is not registered to a PLMN via 3GPP access and the UE uses WLAN; or

- the N3AN node configuration information is not provisioned;

the UE shall perform two DNS queries (see 3GPP TS 23.003 [8]) as specified in subclause 7.2.4.2 to determine if the visited country mandates the selection of N3IWF or ePDG in this country, and:

i) if selection of N3IWF or ePDG in the visited country is mandatory:

A) if the UE is registered to a VPLMN via 3GPP access and the PLMN ID of VPLMN is included in one of the returned DNS records:

I) if selection of N3IWF in the visited country is mandatory and selection of ePDG in the visited country is mandatory, the UE shall either construct an N3IWF FQDN based on the Operator Identifier FQDN format using the PLMN ID of the VPLMN as described in clause 28 of 3GPP TS 23.003 [8] or construct an ePDG FQDN based on the Operator Identifier FQDN format using the PLMN ID of the VPLMN as described in clause 19 of 3GPP TS 23.003 [8]. The UE decision to construct either a N3IWF FQDN or an ePDG FQDN depends on the preference parameter in the 'Any\_PLMN' N3AN node selection information entry of the N3AN node configuration information, if provisioned. If N3AN node configuration information is not provisioned, the UE decision to construct either a N3IWF FQDN or an ePDG FQDN is implementation dependent;

II) if only selection of N3IWF in the visited country is mandatory, the UE shall construct an N3IWF FQDN based on the Operator Identifier FQDN format using the PLMN ID of the VPLMN as described in clause 28 of 3GPP TS 23.003 [8]; and

III) if only selection of ePDG in the visited country is mandatory, the UE shall construct an ePDG FQDN based on the Operator Identifier FQDN format using the PLMN ID of the VPLMN as described in clause 19 of 3GPP TS 23.003 [8]; and

B) if the UE is not registered to a PLMN via 3GPP access or the UE is registered to a VPLMN via 3GPP access, the PLMN ID of VPLMN is not included in any of the returned DNS records and the N3AN node configuration information is provisioned, the UE shall select an a PLMN included in the DNS response that has highest PLMN priority (see 3GPP TS 24.526 [17]) in the N3AN node selection information of the N3AN node configuration information and the UE shall:

I) if selection of N3IWF in the visited country is mandatory, selection of ePDG in the visited country is mandatory, the N3AN node configuration information is provisioned, and the preference parameter in the 'Any\_PLMN' N3AN node selection information entry of the N3AN node configuration information indicates that N3IWF is preferred, the UE shall construct an N3IWF FQDN based on the Operator Identifier FQDN format using the PLMN ID of the VPLMN as described in clause 28 of 3GPP TS 23.003 [8];

II) if selection of N3IWF in the visited country is mandatory, selection of ePDG in the visited country is mandatory, the N3AN node configuration information is provisioned, and the preference parameter in the 'Any\_PLMN' N3AN node selection information entry of the N3AN node configuration information indicates that ePDG is preferred, the UE shall construct an ePDG FQDN based on the Operator Identifier FQDN format using the PLMN ID of the VPLMN as described in clause 19 of 3GPP TS 23.003 [8];

III) if selection of N3IWF in the visited country is mandatory, construct an N3IWF FQDN based on the FQDN format of the selected PLMN's N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the selected PLMN as specified in clause 28 of 3GPP TS 23.003 [8]; or

IV) if selection of ePDG in the visited country is mandatory, construct an ePDG FQDN based on the FQDN format of the selected PLMN's N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the selected PLMN as specified in clause 19 of 3GPP TS 23.003 [8]; and

C) if the UE is not registered to a PLMN via 3GPP access or the UE is registered to a VPLMN via 3GPP access, the PLMN ID of VPLMN is not included in any of the returned DNS records and the N3AN node configuration information is not provisioned or the N3AN node selection information of the N3AN node configuration information does not contain any of the PLMNs in the DNS response, selection of a PLMN of the visited country is UE implementation specific. If the UE does not select a PLMN, the UE shall terminate the N3AN node selection procedure. If the UE does not select a PLMN, the UE shall terminate the N3AN node selection procedure. If the UE selects a PLMN, the UE shall:

I) if selection of N3IWF in the visited country is mandatory, construct an N3IWF FQDN based on the Operator Identifier FQDN format using the PLMN ID of the selected PLMN as described in clause 28 of 3GPP TS 23.003 [8]; or

II) if selection of ePDG in the visited country is mandatory, construct an ePDG FQDN based on the Operator Identifier FQDN format using the PLMN ID of the selected PLMN as described in clause 19 of 3GPP TS 23.003 [8];

and for the above cases, the UE shall use the DNS server function to resolve the constructed N3IWF FQDN or ePDG FQDN to the IP address(es) of the N3IWF(s) or the ePDG(s). The UE shall select as the IP address of the N3IWF or the ePDG a resolved IP address of an N3IWF or an ePDG with the same IP version as its local IP address;

ii) if the UE determines that selection of N3IWF and ePDG in the visited country is not mandatory:

A) if the N3AN node configuration information is provisioned and the N3AN node selection information of the N3AN node configuration information contains one or more PLMNs in the visited country, the UE shall select a PLMN that has highest PLMN priority (see 3GPP TS 24.526 [17]) in the N3AN node selection information, select between constructing an FQDN for either N3IWF or ePDG based on the preference parameter for the selected PLMN's N3AN node selection information entry in the N3AN node selection information, and the UE shall construct an N3IWF FQDN or ePDG FQDN based on the FQDN format of the selected PLMN's N3AN node selection information entry in the N3AN node selection information using the PLMN ID of the selected PLMN as specified in clause 28 or clause 19 of 3GPP TS 23.003 [8], respectivelly; and

B) if the N3AN node configuration information is not provisioned or the N3AN node configuration information is provisioned and the N3AN node selection information of the N3AN node configuration information contains no PLMN in the visited country:

- if the home N3IWF identifier configuration or home ePDG identifier configuration is provisioned in the N3AN node configuration information (see 3GPP TS 24.526 [17]) and contains an IP address, the UE shall use the IP address of the configuration as the IP address of the N3IWF or ePDG;

- if the home N3IWF identifier configuration or home ePDG identifier configuration is provisioned in the N3AN node configuration information (see 3GPP TS 24.526 [17]) and does not contains an IP address, the UE shall use the FQDN of the configuration as N3IWF FQDN or ePDG FQDN; and

- if the home N3IWF identifier configuration and home ePDG identifier configuration are not provisioned in the N3AN node configuration information, the UE shall construct an N3IWF FQDN or ePDG FQDN based on the Operator Identifier FQDN format using the PLMN ID of the HPLMN as described in clause 28 or clause 19 of 3GPP TS 23.003 [8], respectivelly;

and for the above cases constructing or using an N3IWF FQDN or an ePDG FQDN, the UE shall use the DNS server function to resolve the FQDN to the IP address(es) of the N3IWF(s) or ePDG(s). The UE shall select as the IP address of the N3IWF or the ePDG a resolved IP address of an N3IWF or ePDG with the same IP version as its local IP address; and

iii) if no DNS response is received, the UE shall terminate the N3AN node selection procedure.

Following bullet a) and b) above, once the UE selected the IP address of the N3IWF or the ePDG,

a) if the IP address of N3IWF is selected, the UE shall:

1) initiate the IKEv2 SA establishment procedure as specified in subclause 7.3;

2) if the IKEv2 SA establishment procedure towards an N3IWF in the HPLMN fails due to no response to an IKE\_SA\_INIT request message, and the selection of N3IWF in the HPLMN is performed using home N3IWF identifier configuration and there are more pre-configured N3IWFs in the HPLMN, repeat the tunnel establishment attempt using the next FQDN or IP address(es) of the N3IWF in the HPLMN;

3) if the IKEv2 SA establishment procedure towards any of the IP addresses of the N3IWF of the selected PLMN fails due to no response to an IKE\_SA\_INIT request message, repeat the N3AN node selection as described in this subclause with N3IWF of another PLMN; and

4) if the IKEv2 SA establishment procedure towards any of the received IP addresses of the N3IWF of any fails due to no response to an IKE\_SA\_INIT request message, attempt to select an ePDG as specified in 3GPP TS 24.302 [7] and use tunnel establishment as specified in 3GPP TS 24.302 [7];

NOTE 2: The time the UE waits before reattempting access to another N3IWF or to an N3IWF that it previously did not receive a response to an IKE\_SA\_INIT request message, is implementation specific.

b) if the IP address of ePDG is selected, the UE shall:

i) initiate tunnel establishment as specified in 3GPP TS 24.302 [7];

ii) if tunnel establishment as specified in 3GPP TS 24.302 [7] towards an ePDG in the HPLMN fails due to no response to an IKE\_SA\_INIT request message, and the selection of ePDG in the HPLMN is performed using home ePDG identifier configuration and there are more pre-configured ePDG in the HPLMN, repeat the tunnel establishment attempt using the next FQDN or IP address(es) of the ePDG in the HPLMN;

iii) if tunnel establishment as specified in 3GPP TS 24.302 [7] towards any of the received IP addresses of the selected ePDG fails due to no response to an IKE\_SA\_INIT request message, attempt to select an N3IWF in the same PLMN instead; and

iv) if the UE fails to connect to either ePDG or N3IWF in the same PLMN, repeat the N3AN node selection as described in this subclause, excluding the ePDGs for which the UE did not receive a response to the IKE\_SA\_INIT request message.

NOTE 3: The time the UE waits before reattempting access to another ePDG or to an ePDG that it previously did not receive a response to an IKE\_SA\_INIT request message, is implementation specific.

\*\*\* No more changes \*\*\*