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Contents

Intellectual Property Rights	2
Legal Notice	2
Modal verbs terminology.....	2
Foreword.....	5
1 Scope	6
1.1 References	6
1.2 Definitions and abbreviations.....	7
1.2.1 Definitions	7
1.2.2 Abbreviations.....	8
2 Roaming	8
2.1 General requirements	8
2.2 International roaming	8
2.3 National roaming.....	8
2.4 Roaming in shared networks	8
3 Provisions for providing continuity of service	9
3.1 Location registration.....	9
3.2 Network selection.....	9
3.2.1 General.....	9
3.2.2 Procedures.....	10
3.2.2.1 General	10
3.2.2.2 At switch-on or recovery from lack of coverage.....	11
3.2.2.3 User reselection.....	14
3.2.2.4 Mobile Station reactions to indications of service restriction from the network.....	14
3.2.2.4.1 "Permanent" PLMN restriction.....	14
3.2.2.4.2 "Partial" and "temporary" PLMN restrictions	14
3.2.2.4.3 PLMN restrictions for PS services	15
3.2.2.5 Periodic network selection attempts.....	15
3.2.2.6 Investigation PLMN Scan	16
3.2.2.7 Void.....	17
3.2.2.8 Steering Of Roaming.....	17
3.2.3 Network selection for Multi-mode terminals with 3GPP Capability	17
4 Access control	18
4.1 Purpose	18
4.2 Allocation	18
4.3 Operation.....	18
4.3.1 Access Class Barring	18
4.3.2 Service Specific Access Control	19
4.3.3 Access Control for CSFB	20
4.3.4 Extended Access Barring.....	21
4.3.4.1 General	21
4.3.4.2 Overriding extended access barring	21
4.3.5 Application specific Congestion control for Data Communication (ACDC)	22
4.3.5.1 Service description.....	22
4.3.5.2 Requirements	22
4.3.5.2.1 General	22
4.3.5.2.2 ACDC Categories	23
4.3.6 Access Control for Indirect 3GPP Communications	23
4.4 Emergency Calls	24
4.4a Multimedia Priority Service	24
4.5 Control of UE Capabilities	24
4.6 Prevention of mobile-originating signalling and/or data traffic	25
5 Support of Localised Service Area (SoLSA)	25
5.1 Network selection.....	25

5.2	The Idle-mode operation	25
5.2.1	Subscriber moving from a normal environment to his localised service area.....	25
5.2.2	Subscriber moving away from his localised service area to a normal environment	26
5.2.3	Subscriber staying in his localised service area	26
5.3	LSA only access	26
5.4	Exclusive access	26
5.5	Preferential access	26
6	Support of 3GPP - WLAN Interworking	26
6.1	Void.....	27
6.2	Void.....	27
6.3	Void.....	27
7	Administrative restriction of subscribers' access	27
7.1	Allowed Location and Routing Area identities access	27
7.2	Void.....	27
7.3	UE configured radio technology restriction	27
8	Support of Home NodeB and Home E-NodeB	28
9	Control of traffic from UE-based applications toward associated server.....	28
9.1	Description	28
9.2	Requirements.....	28
10	3GPP PS Data Off	29
10.1	Description	29
10.2	Requirements.....	29
Annex A (informative): Change history		31
History		37

Foreword

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1 Scope

The purpose of this TS is to describe the service access procedures as presented to the user.

Definitions and procedures are provided in this TS for international roaming, national roaming and regionally provided service. These are mandatory in relation to the technical realization of the Mobile Station (UE).

1.1 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] Void
- [2] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [3] 3GPP TS 23.122: "Non Access Stratum functions related to Mobile Station (MS) in idle mode".
- [4] ITU-T Recommendation Q.1001: "General aspects of Public Land Mobile Networks".
- [5] 3GPP TS 22.043: "Support of Localised Service Area (SoLSA). Stage 1".
- [6] 3GPP TS 22.234: "Requirements on 3GPP system to wireless local area network (WLAN) interworking".
- [7] 3GPP TS 22.101: "Service aspects; Service principles".
- [8] 3GPP TS 22.278: "Service requirements for the Evolved Packet System (EPS)".
- [9] Void
- [10] 3GPP TS 25.304: "User Equipment (UE) procedures in idle mode and procedures for cell reselection in connected mode".
- [11] Void
- [12] Void
- [13] 3GPP TS 36.331: "E-UTRA Radio Resource Control (RRC)".
- [14] 3GPP TS 22.220: "Service requirements for Home NodeBs and Home eNodeBs".
- [15] 3GPP2 C.S0004-A v6.0: "Signaling Link Access Control (LAC) Standard for cdma2000 Spread Spectrum Systems – Addendum 2"
- [16] 3GPP TS 22.153: "Multimedia priority service".
- [17] 3GPP TS 36.306: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio access capabilities"
- [18] 3GPP TS 43.064: "General Packet Radio Service (GPRS); Overall description of the GPRS radio interface; Stage 2"
- [19] ITU-T Recommendation E.212: "The international identification plan for public networks and subscriptions"

[20] 3GPP TS 26.114: " IP Multimedia Subsystem (IMS); Multimedia Telephony; Media handling and interaction".

1.2 Definitions and abbreviations

1.2.1 Definitions

In addition to those below, the definitions and abbreviations listed in 3GPP TR 21.905 [2] are applicable.

3GPP PS Data Off: A feature which when configured by the HPLMN and activated by the user prevents transport via PDN connections or PDU sessions in 3GPP access of all IP packets except IP packets required by 3GPP PS Data Off Exempt Services.

3GPP PS Data Off Exempt Services: A set of operator services that are allowed even if the 3GPP PS Data Off feature has been activated in the UE by the user.

Disaster Condition: This is the condition that a government decides whether applicable or not based on, e.g. a natural disaster or a man-made disaster. When this condition applies service interruptions and failures will be mitigated.

PLMN: A Public Land Mobile Network (PLMN) is a network established and operated by an Administration or RPOA for the specific purpose of providing land mobile communication services to the public. It provides communication possibilities for mobile users. For communications between mobile and fixed users, interworking with a fixed network is necessary.

A PLMN may provide service in one, or a combination, of frequency bands.

As a rule, a PLMN is limited by the borders of a country. Depending on national regulations there may be more than one PLMN per country.

A relationship exists between each subscriber and his home PLMN (HPLMN). If communications are handled over another PLMN, this PLMN is referred to as the visited PLMN (VPLMN).

PLMN Area: The PLMN area is the geographical area in which a PLMN provides communication services according to the specifications to mobile users. In the PLMN area, the mobile user can set up calls to a user of a terminating network. The terminating network may be a fixed network, the same PLMN, another PLMN or other types of PLMN.

Terminating network users can also set up calls to the PLMN.

The PLMN area is allocated to a PLMN. It is determined by the service and network provider in accordance with any provisions laid down under national law. In general, the PLMN area is restricted to one country. It can also be determined differently, depending on the different telecommunication services, or type of UE.

If there are several PLMNs in one country, their PLMN areas may overlap. In border areas, the PLMN areas of different countries may overlap. Administrations will have to take precautions to ensure that cross border coverage is minimized in adjacent countries unless otherwise agreed.

NOTE 1: ITU-T Recommendation Q.1001 [4] does not contain a definition of the PLMN area.

System Area: The System Area is defined as the group of PLMN areas accessible by UEs.

Interworking of several PLMNs and interworking between PLMNs and fixed network(s) permit public land mobile communication services at international level.

NOTE 2: The System Area according to [4] Recommendation Q.1001 corresponds to the System Area.

Service Area: The Service Area is defined in the same way as the Service Area according to ITU-T Recommendation Q.1001 [4]. In contrast to the PLMN area it is not based on the coverage of a PLMN. Instead it is based on the area in which a fixed network user can call a mobile user without knowing his location. The Service Area can therefore change when the signalling system is being extended, for example.

Shared MCC: MCC assigned by ITU-T as shared MCC according to ITU-T E.212 [19], except within this specification for PLMN selection purposes the MCC of value 999 is not considered a shared MCC.

Regionally Provided Service: Regionally Provided Service is defined as a service entitlement to only certain geographical part(s) of a PLMN, as controlled by the network operator.

Localised Service Area (LSA): The localised service area concept shall give the operator a basis to offer subscribers different services (e.g. tariffs or access rights) depending on the location of the subscriber. An LSA consists of a cell or a number of cells within a PLMN. (3GPP TS 22.043 [5]).

Tracking Area: E-UTRAN utilises Tracking Areas (TA) for UE access control, location registration, paging and mobility management. The TA is independent of Location Areas (LA) and Routing Areas (RA). A TA comprises one or more E-UTRA cells. Service requirements for E-UTRAN are specified in 3GPP TS 22.278 [8].

1.2.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [2] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [2].

ACDC	Application specific Congestion control for Data Communication
EAB	Extended Access Barring
SSAC	Service Specific Access Control

2 Roaming

2.1 General requirements

A UE with a valid IMSI may roam and access service in the area authorized by the entitlement of the subscription.

If a communication has been established, the UE will in principle not suffer an interruption within the PLMN area (provided the entitlement of the subscription allows it). Exceptions are possible if no network resources or radio coverage are available locally.

However, if the UE leaves the PLMN area, an established communication may terminate. If the user then wants to continue, another network providing service has to be selected and a new communication has to be established (see clause 3).

Subject to roaming agreements, a visited network shall be able to prevent incoming roamers from using a particular radio access technology (e.g. when the home network has not implemented this radio access technology).

2.2 International roaming

International roaming is a service whereby a UE of a given PLMN is able to obtain service from a PLMN of another country.

The availability of International Roaming is subject to inter-PLMN agreements.

2.3 National roaming

National Roaming is a service whereby a UE of a given PLMN is able to obtain service from another PLMN of the same country, anywhere, or on a regional basis.

The availability of National Roaming depends on the home PLMN of the requesting UE and the visited PLMN; it does not depend on subscription arrangements.

2.4 Roaming in shared networks

The following requirements are applicable to GERAN, UTRAN, E-UTRAN and NG-RAN sharing scenarios:

- Mechanisms shall be specified to enable flexible allocation of visiting roamers among core network operators that have roaming agreements with the same roaming partners. The core network operators shall be able to pre-define their relative share of visiting roamers and distribute the visiting roamers that apply automatic network selection to different core networks connected to the radio access network accordingly.
- When network sharing exists between different operators and a user roams into the shared network it shall be possible for that user to register with a core network operator (among the network sharing partners) that the user's home operator has a roaming agreement with, even if the operator is not operating a radio access network in that area.
- The selection of a core network operator among those connected to the shared radio access network can either be manual (i.e. performed by the user after obtaining a list of available core network operators) or automatic (i.e. performed by the UE according to user and operator preferred settings). For further information see clause 3.2.

3 Provisions for providing continuity of service

3.1 Location registration

PLMNs shall provide a location registration function with the main purpose of providing continuity of service to UEs over the whole system area. The location registration function shall be such as to allow:

- Fixed subscribers to call a UE by only using the directory number of the UE irrespective of where the UE is located in the system area at the time of the call.
- UEs to access the system irrespective of the location of the UE.
- UEs to identify when a change in location area has taken place in order to initiate automatic location updating procedures.

3.2 Network selection

3.2.1 General

The UE shall support both manual and automatic network selection mechanisms (modes). The UE shall select the last mode used, as the default mode, at every switch-on.

As an optional feature of the ME, the user shall be able to set a preference in the ME for the mode that shall be used at switch on. If set, then the ME shall select this preference rather than the default mode.

NOTE: By defaulting to the last mode used, e.g. manual network selection, the undesired automatic selection of an adjacent PLMN instead of the desired HPLMN in border areas, can be avoided at switch-on.

The user shall be given the opportunity to change mode at any time.

Except as defined below, the MMI shall be at the discretion of the UE manufacturer.

The UE shall contain display functions by which Available PLMNs and the Selected PLMN can be indicated.

In order not to confuse the user, the same definitions of PLMN names shall be applied consistently both in registered mode and in the list presented to the user when in manual mode.

In shared networks a radio access network can be part of more than one PLMN. This shall be transparent to the user, i.e. the UE shall be able to indicate those PLMNs to the user, and the UE shall support network selection among those PLMNs, as in non-shared networks.

3.2.2 Procedures

3.2.2.1 General

In the following procedures the UE selects and attempts registration on PLMNs.

In this TS, the term "PLMN Selection" defines a UE based procedure, whereby candidate PLMNs are chosen, one at a time, for attempted registration.

A User Controlled PLMN Selector data field exists on the USIM to allow the user to indicate a preference for network selection. It shall be possible for the user to update the User Controlled PLMN Selector data field, but it shall not be possible to update this data field over the radio interface, e.g. using SIM Application Toolkit.

It shall be possible to have an Operator Controlled PLMN Selector list and a User Controlled PLMN Selector list stored on the SIM/USIM card. Both PLMN Selector lists may contain a list of preferred PLMNs in priority order. It shall be possible to have an associated Access Technology identifier e.g., NG-RAN, satellite NG-RAN, E-UTRAN (WB-S1 mode, NB-S1 mode), satellite E-UTRAN (WB-S1 mode, NB-S1 mode), UTRAN, GERAN or GERAN EC-GSM-IoT associated with each entry in the PLMN Selector lists.

Optionally, it may be possible to have an Operator Controlled Lower Selection-priority PLMN Selector list for PLMN selection. This list may be stored either in the USIM or provisioned in the ME or both. If the list is both stored in the USIM and provisioned in the ME, only the list stored in the USIM shall be used by the UE. This list contains PLMNs and associated Access Technology identifiers combinations, in priority order. The support of Operator Controlled Lower Selection-priority PLMN Selector list in the network selection procedure is optional for the UE.

For UEs supporting any, or a combination, of NB-IoT, GERAN EC-GSM-IoT [18] and Category M1 or M2 of E-UTRA [17], the 5G system shall support a mechanism to have an Operator controlled signal threshold per access technology on the USIM to be used for network selection. The signal threshold is specific for a certain Access Technology and shall apply to all PLMNs with the corresponding access technology combinations.

NOTE 1: The use of the Operator controlled signal threshold per access technology is intended for IoT stationary devices, without user interaction.

NOTE 2: The allowed range of the Operator controlled signal threshold per access technology is between the cell selection criterion and the high quality signal as defined in TS 23.122 [3].

The UE shall utilise the following information stored in the USIM related to network selection, e.g. HPLMN, Operator controlled PLMN Selector list, User Controlled PLMN Selector list, Forbidden PLMN list, Operator controlled signal threshold, and if supported by the UE, Operator Controlled Lower Selection-priority PLMN Selector list.

NOTE 3: A PLMN in a Selector list, including HPLMN, may have multiple occurrences, with different access technology identifiers.

The UE shall ignore those PLMN + access technology entries in the User Controlled PLMN selector and Operator Controlled PLMN selector lists where the associated Access Technology is not supported by the UE. In the case that there are multiple associated Access Technology identifiers in an entry the UE shall not ignore the entry if it includes any associated Access Technology that is supported by the UE.

It shall be possible to handle cases where one network operator accepts access from access networks with different network IDs. It shall also be possible to indicate to the UE that a group of PLMNs are equivalent to the registered PLMN regarding PLMN selection, cell selection/re-selection and handover.

It shall be possible for the home network operator to identify alternative Network IDs as the HPLMN. It shall be possible for the home network operator to store in the USIM an indication to the UE that a group of PLMNs are treated as the HPLMN regarding PLMN selection. Any PLMN to be declared as an equivalent to the HPLMN shall be present within the EHPLMN list and is called an EHPLMN. The EHPLMN list replaces the HPLMN derived from the IMSI. When the EHPLMN list is present, any PLMN in this list shall be treated as the HPLMN in all the network and cell selection procedures.

If registration on a PLMN is successful, the UE shall indicate this PLMN (the "registered PLMN") and be capable of making and receiving calls on it. The identity of the registered PLMN shall be stored on the SIM/USIM. However, if registration is unsuccessful, the UE shall ensure that there is no registered PLMN stored in the SIM/USIM.

If a registration is unsuccessful because the IMSI is unknown in the home network, or the UE is illegal, then the UE shall not allow any further registration attempts on any network, until the UE is next powered-up or a SIM/USIM is inserted.

If the registration is unsuccessful due to the lack to service entitlement, specific behaviour by the UE may be required, see clause 3.2.2.4.

To avoid unnecessary registration attempts, lists of forbidden PLMNs, TAs and LAs are maintained in the UE, see clause 3.2.2.4 and 3GPP TS 23.122 [3].

Registration attempts shall not be made by UEs without a SIM/USIM inserted.

An UE/ME which has not successfully registered shall nevertheless be able to make emergency call attempts on an available PLMN (which supports the emergency call teleservice), without the need for the user to select a PLMN. An available PLMN is determined by radio characteristics (3GPP TS 23.122 [3]).

3.2.2.2 At switch-on or recovery from lack of coverage

If the Operator controlled signal threshold per access technology is set on the USIM, it shall be used for the selection of the last registered PLMN (and/or EHPLMN/HPLMN) and for the automatic mode network selection steps described in this clause. In particular, if the Operator controlled signal threshold per access technology is set on the USIM the UE shall only select a network if

- the network selection conditions as described below are met and
- the received signal quality of the candidate PLMN/access technology combination is equal to or higher than the Operator controlled signal threshold per access technology.

At switch on, when in coverage of the last registered PLMN as stored in the SIM/USIM, the UE will attach to that network.

As an option, in automatic selection mode, when no EHPLMN list is present, the UE may select the HPLMN. When the EHPLMN list is present, the UE may select the highest priority EHPLMN among the available EHPLMNs. The operator shall be able to control the UE behaviour by USIM configuration.

As an option, if the UE is in manual network selection mode at switch-on

- if the last registered PLMN is unavailable and no equivalent PLMN is available,
- and the UE finds it is in coverage of either the HPLMN or an EHPLMN

then the UE should register on the corresponding HPLMN or EHPLMN. The UE remains in manual mode.

As an option, if the UE is in automatic network selection mode at switch-on, and if the last registered PLMN is identified as Operator Controlled Lower Selection-priority, the UE may skip RPLMN selection and move to the Automatic network selection mode specified below.

If the UE returns to coverage of the PLMN on which it is already registered (as indicated by the registered PLMN stored in the SIM/USIM), the UE shall perform a location update to a new location area if necessary. As an alternative option to this, if the UE is in automatic network selection mode and it finds coverage of the HPLMN or any EHPLMN, the UE may register on the HPLMN (if the EHPLMN list is not present) or the highest priority EHPLMN of the available EHPLMNs (if the EHPLMN list is present) and not return to the last registered PLMN. If the EHPLMN list is present and not empty, it shall be used. The operator shall be able to control by USIM configuration whether an UE that supports this option shall follow this alternative behaviour.

NOTE: At switch-on and at recovery from lack of coverage, a UE in automatic network selection mode can attempt registration once the RPLMN or, if the above option is applicable, the HPLMN or EHPLMN is found on an access technology.

The default behaviour for a UE is to select the last registered PLMN.

If there is no registered PLMN stored in the SIM/USIM, or if this PLMN is unavailable and no equivalent PLMN is available, or the attempted registration fails, the UE shall follow one of the following procedures for network selection:

A) Automatic network selection mode

The UE shall select and attempt registration on other PLMNs, if available and allowable, if the location area is not in the list of "forbidden LAs for roaming" and the tracking area is not in the list of "forbidden TAs for roaming" (see 3GPP TS 23.122 [3]), in the following order:

- i) An EHPLMN if the EHPLMN list is present or the HPLMN (derived from the IMSI) if the EHPLMN list is not present for preferred access technologies in the order specified. In the case that there are multiple EHPLMNs present then the highest priority EHPLMN shall be selected. It shall be possible to configure a voice capable UE so that it shall not attempt registration on a PLMN if all cells identified as belonging to the PLMN do not support the corresponding voice service;
- ii) each entry in the "User Controlled PLMN Selector with Access Technology" data field in the SIM/USIM (in priority order). It shall be possible to configure a voice capable UE so that it shall not attempt registration on a PLMN if all cells identified as belonging to the PLMN do not support the corresponding voice service;
- iii) each entry in the "Operator Controlled PLMN Selector with Access Technology" data field in the SIM/USIM (in priority order). It shall be possible to configure a voice capable UE so that it shall not attempt registration on a PLMN if all cells identified as belonging to the PLMN do not support the corresponding voice service;
- iv) other PLMN/access technology combinations with sufficient received signal quality (see 3GPP TS 23.122 [3]) in random order, excluding any PLMN/access technology combination listed in the "Operator Controlled Lower Selection-priority PLMN Selector with Access Technology" list. It shall be possible to configure a voice capable UE so that it shall not attempt registration on a PLMN if all cells identified as belonging to the PLMN do not support the corresponding voice service;
- v) all other PLMN/access technology combinations in order of decreasing signal quality, excluding any PLMN/access technology combination listed in the "Operator Controlled Lower Selection-priority PLMN Selector with Access Technology" list. It shall be possible to configure a voice capable UE so that it shall not attempt registration on a PLMN if all cells identified as belonging to the PLMN do not support the corresponding voice service;
- vi) each entry (PLMN/access technology combination) in the "Operator Controlled Lower Selection-priority PLMN Selector with Access Technology" list (in priority order);

In the case of a UE operating in UE operation mode A or B, an allowable PLMN is one which is not in the "Forbidden PLMN" data field in the SIM/USIM. This data field may be extended in the ME memory (see clause 3.2.2.4). In the case of a UE operating in UE operation mode C, an allowable PLMN is one which is not in the "Forbidden PLMN" data field in the SIM/USIM or in the list of "forbidden PLMNs for GPRS service" in the ME.

If the UE uses the Operator controlled signal threshold per access technology and no candidate PLMN/access technology combination fulfils the Operator controlled signal threshold criteria, the UE shall repeat the network selection without using the Operator controlled signal threshold per access technology.

If there is no available PLMN except for PLMNs in the "Forbidden PLMN" data field in the SIM/USIM, and the available PLMNs indicate that Disaster Condition applies, this PLMN shall be considered allowable for registration to the UE while the Disaster Condition is applicable.

If successful registration is achieved, the UE shall indicate the selected PLMN.

If registration cannot be achieved on any PLMN and at least one PLMN offering restricted local operator services has been found, the UE shall obtain user consent for restricted local operator services and the UE may use a list of preferred PLMNs for restricted local operator services stored in the ME. If none of the preferred PLMNs for restricted local operator services is available, the UE shall select any available PLMN offering restricted local operator services. If one of these PLMNs for restricted local operator service is chosen, the UE shall indicate the choice. If none are selected, the UE shall wait until a new PLMN is detected, or new location areas or tracking areas of an allowed PLMN are found which are not in the forbidden LA or TA list(s), and then repeat the procedure.

If registration cannot be achieved on any PLMN and no PLMN offering restricted local operator services has been found, the UE shall indicate "no service" to the user, wait until a new PLMN is detected, or new location areas or tracking areas of an allowed PLMN are found which are not in the forbidden LA or TA list(s), and then repeat the procedure. When registration cannot be achieved, different (discontinuous) PLMN search schemes may be used in order to minimize the access time while maintaining battery life, e.g. by prioritising the search in favour of BCCH carriers which have a high probability of belonging to an available and allowable PLMN.

B) Manual network selection mode

The UE shall indicate PLMNs, including "Forbidden PLMNs", which are available. If there are none, this shall also be indicated. The HPLMN of the user may provide on the USIM additional information about the available PLMNs, if this is provided then the UE shall indicate that information to the user. This information, provided as free text may include:

- Preferred partner;
- roaming agreement status;
- supported services.

Furthermore, the UE may indicate whether the available PLMNs are present on one of the PLMN selector lists (e.g. EHPLMN, User Controlled, Operator Controlled or Forbidden) as well as not being present on any of the lists.

For the purpose of presenting the names of the available PLMNs to the user, the ME shall use the USIM defined names if available or other PLMN naming rules in priority order as defined in 3GPP TS 22.101 [7] (Country/PLMN indication).

Any available PLMNs shall be presented in the following order:

- i) HPLMN (if the EHPLMN list is not present); or if one or more of the EHPLMNs are available then based on an optional data field on the USIM either the highest priority available EHPLMN is to be presented to the user or all available EHPLMNs are presented to the user in priority order; if the data field is not present, then only the highest priority available EHPLMN is presented;
- ii) PLMNs contained in the "User Controlled PLMN Selector" data field in the SIM/USIM (in priority order);
- iii) PLMNs contained in the "Operator Controlled PLMN Selector" data field in the SIM/USIM (in priority order);
- iv) other PLMN/access technology combinations with sufficient received signal level (see 3GPP TS 23.122 [3]) in random order, excluding any PLMN/access technology combination listed in the "Operator Controlled Lower Selection-priority PLMN Selector with Access Technology" list;
- v) all other PLMN/access technology combinations in order of decreasing signal strength, excluding any PLMN/access technology combination listed in the "Operator Controlled Lower Selection-priority PLMN Selector with Access Technology" list.
- vi) each entry (PLMN/access technology combination) in the "Operator Controlled Lower Selection-priority PLMN Selector with Access Technology" list (in priority order);

If a PLMN does not support voice services, then this shall be indicated to the user.

The user may select the desired PLMN and the UE shall attempt registration on this PLMN. (This may take place at any time during the presentation of PLMNs.)

If registration cannot be achieved on any PLMN and at least one PLMN offering restricted local operator services has been found, the UE shall obtain user consent for restricted local operator services and offer the user to select one of these networks. If one of these networks is selected, the UE shall indicate the selected PLMN, wait until a new PLMN is detected, or new location areas or tracking areas of an allowed PLMN are found which are not in the forbidden LA or TA list(s), and then repeat the procedure.

If the registration cannot be achieved on any PLMN and no PLMN offering restricted local operator services is selected, the UE shall indicate "No Service". The user may then select and attempt to register on another or the same PLMN following the above procedure. The UE shall not attempt to register on a PLMN which has not been selected by the user.

Once the UE has registered on a PLMN selected by the user, the UE shall not automatically register on a different PLMN unless:

- i) The new PLMN is declared as an equivalent PLMN by the registered PLMN;

or,

- ii) The user selects automatic mode.

If a PLMN is selected but the UE cannot register on it because registration is rejected with the cause "PLMN not allowed", the UE shall add the PLMN to the "Forbidden PLMN" list (clause 3.2.2.4.1). The UE shall not re-attempt to register on that network unless the same PLMN is selected again by the user.

If a PLMN is selected but the UE cannot register for PS services on it because registration is rejected with the cause "GPRS services not allowed in this PLMN", the UE shall not re-attempt to register for E-UTRAN or UTRAN PS or GERAN PS on that network. The PLMN is added to the list "Forbidden PLMN's for GPRS services". The UE shall not re-attempt to register for E-UTRAN or UTRAN PS or GERAN PS on that network unless the same PLMN is selected again by the user. The reception of the cause "GPRS services not allowed in this PLMN", does not affect the CS service.

For requirements to restrict the access of a UE to one or several specific RATs see section 7.1.

If a PLMN is selected but the UE cannot register on it for other reasons, the UE shall, upon detection of a new LA (not in a forbidden LA list) of the selected PLMN, attempt to register on the PLMN.

If the UE is registered on a PLMN but loses coverage, different (discontinuous) carrier search schemes may be used to minimize the time to find a new valid BCCH carrier and maintain battery life, e.g. by prioritizing the search in favour of BCCH carriers of the registered PLMN.

3.2.2.3 User reselection

At any time, the user may request the UE to initiate reselection and registration onto an alternative available PLMN, according to the following procedures, dependent upon the operating mode.

A) Automatic Network Selection Mode

The UE shall follow the procedure defined in clause 3.2.2.2.A) above, including the use of Operator signal threshold per access technology, if set on the USIM, as described in 3.2.2.2.

B) Manual Network Selection Mode

The procedure of 3.2.2.2 B) is followed.

3.2.2.4 Mobile Station reactions to indications of service restriction from the network

Different types of UE behaviour are required to support, for example, national roaming, regionally provided service and temporary international roaming restrictions. The behaviour to be followed by the UE is indicated by the network.

3.2.2.4.1 "Permanent" PLMN restriction

When a registration attempt by the UE is rejected by a network with an indication of "permanent" PLMN restriction, the PLMN identity shall be written to a list of "Forbidden PLMNs" stored in a data field in the SIM/USIM.

If a successful registration is achieved on a PLMN in the "Forbidden PLMN" list, the PLMN shall be deleted from the list. However, if successful registration is achieved on a PLMN in the "Forbidden PLMN" list while Disaster Condition applies, the PLMN shall not be deleted from "Forbidden PLMN" list.

When in automatic mode, the UE may indicate any PLMNs which will not be selected due to their presence in the "Forbidden PLMN" list.

If a UE receives an equivalent PLMN list containing a PLMN which is included in the "Forbidden PLMN" list, this PLMN shall be removed from the equivalent PLMN list before this is stored by the UE.

3.2.2.4.2 "Partial" and "temporary" PLMN restrictions

When a registration attempt by the UE is rejected by a network due to a "partial" or a "temporary" PLMN restriction, the UE shall perform one of the following procedures determined by the indication in the location update reject cause sent by the network (see 3GPP TS 23.122 [3]):

- i) The UE shall store the tracking area identity or location area identity in the list of "5GS forbidden TA, forbidden TAs or forbidden LAs for regional provision of service" respectively and shall enter the limited service state. The UE shall remain in that state until it moves to a cell in a location area where service is allowed;

- ii) The UE shall store the tracking area identity or the location area identity in the list of "5GS forbidden TA, forbidden TAs or forbidden LAs for roaming" respectively and shall use one of the following procedures according to the PLMN selection Mode:

A) Automatic network selection mode:

The procedure of 3.2.2.2. A).

B) Manual network selection mode:

The procedure of 3.2.2.2.B).

- iii) The UE shall store the tracking area identity or location area identity in the list of "5GS forbidden TA, forbidden TAs or forbidden LAs for roaming" respectively and shall search for a suitable cell in the same PLMN.

NOTE: A suitable cell will belong to a different TA or LA which is not in the "forbidden TAs or LAs for roaming". When a TA supports multiple systems (e.g. 5GS and EPS), a cell of the TA may be a suitable cell for one system while the cell is not a suitable cell for other systems..

3.2.2.4.3 PLMN restrictions for PS services

When a registration attempt for PS services by the UE is rejected by the network with the cause "GPRS services not allowed in this PLMN", the PLMN identity shall be written to a list of "forbidden PLMNs for GPRS service" in the ME. This list is deleted when the UE is switched off or when the SIM/USIM is removed; the maximum number of possible entries in this list is implementation dependent, but must be at least one entry (see 3GPP TS 23.122 [3]).

If a successful registration is achieved on a PLMN in the "forbidden PLMNs for GPRS service" list, the PLMN shall be deleted from the list.

3.2.2.5 Periodic network selection attempts

If the Operator controlled signal threshold per access technology is not set on the USIM, a UE in Automatic Mode shall make periodic attempts to look for a higher priority PLMN including associated Access Technology of the same country as the currently received PLMN including associated Access Technology or for a higher priority PLMN including associated Access Technology that uses a Shared MCC (e.g. MCC=901). If the currently received PLMN including associated Access Technology uses a Shared MCC, also a higher priority PLMN including associated Access Technology using any non-Shared MCC shall be considered. For the ranking of PLMNs the UE shall use the order used in clause 3.2.2.2. In the case that there is no associated Access Technology identifier, the mobile shall assume that all Access Technologies provided by a PLMN are of equal priority. Moreover, periodic network selection shall not lead to change of access technology within the registered PLMN.

When a Disaster Condition is applicable, a UE in Automatic Mode that is registered to a PLMN in the "Forbidden PLMN" data field in the SIM/USIM may make periodic attempts to look for an allowable PLMN of the same country as the currently received PLMN.

In the case that the UE has stored a list of equivalent PLMNs, the UE shall only select a PLMN if it has a higher priority than all the PLMNs, in the list of equivalent PLMNs, which are of the same country as the currently registered PLMN.

NOTE 1: In the context of this 3GPP TS, the term country is to be interpreted not as a political entity but as a single Mobile Country Code (MCC). For example the USA and India have multiple MCC. Such cases are in fact treated as exceptions in the 3GPP specifications. For all other countries, multiple MCCs may be used, however the specifications have not taken this into account and there could be adverse effects such as the UE being unable to detect that multiple MCCs are within the same country.

NOTE 2: There are some situations where one MCC represents multiple political entities or where an MCC is independent of political entities. Examples include Shared MCCs, where international satellite operations typically use the Shared MCC with value 901.

NOTE 3: For the purposes of PLMN selection, the associated Access Technology using a Shared MCC is restricted to the satellite NG-RAN.

In the case that there are multiple EHPLMNs available, the UE shall not attempt to select a higher priority EHPLMN when an EHPLMN has already been selected. The priorities of EHPLMNs are only applicable when the UE is on a VPLMN and multiple EHPLMNs are available.

The UE shall only make reselection attempts while in idle mode. In case of GPRS terminals, the UE shall only make reselection attempts while in Idle or Stand-by mode. In case of terminals operating E-UTRA and/or NR, the UE shall only make reselection attempts while in Idle or RRC-Inactive mode.

In the case of a UE receiving an eMBMS transport service when in idle mode, the UE may postpone the higher priority PLMN search and any reselection attempt until the eMBMS transport service has finished or been stopped.

The interval between attempts shall be stored in the SIM/USIM.

Only the service provider shall be able to select for which of the previous situations, periodic network selection shall be attempted and to set the interval value.

For UEs supporting only Access Technologies other than the following: NB-IoT, GERAN EC-GSM-IoT and Category M1 [17] of E-UTRAN enhanced-MTC the UE shall interpret the interval value to be between 6 minutes and 8 hours, with a step size of 6 minutes.

For UEs only supporting any of the following, or a combination of, NB-IoT, GERAN EC-GSM-IoT [18], and Category M1[13] of E-UTRAN enhanced-MTC, the UE shall interpret the interval value to be between 2 and 240 hours, with a step size of 2 hours between 2 and 80 hours and a step size of 4 hours between 80 and 240 hours.

For UEs supporting a combination of IoT and non-IoT Access Technologies the UE shall interpret the interval value to determine the timer value as above based on the Access Technology currently in use by the UE.

A different interval value may be applied to entries listed in the “Operator Controlled Lower Selection-priority PLMN Selector with Access Technology” list for UEs performing periodic network selection, if this list is supported by the UE.

One interval value shall be designated to indicate that no periodic attempts shall be made.

In the absence of a permitted value in the SIM/USIM, or the SIM/USIM is phase 1 and therefore does not contain the datafield, then a default value of 60 minutes, shall be used by the UE except for those UEs only supporting any of the following, or a combination of: NB-IoT, GERAN EC-GSM-IoT [18], and Category M1 [17] of E-UTRAN enhanced-MTC. For those UEs a default value of 72 hours shall be used.

NOTE 4: Use of values less than 60 minutes may result in excessive UE battery drain.

Periodic network selection based on Operator controlled signal threshold criteria

If the Operator controlled signal threshold per access technology is set on the USIM, the UE shall perform the periodic network selection procedure considering all PLMNs, of higher or lower priority than the current PLMN, in the same order as in clause 3.2.2.2, with the following conditions:

- the UE shall select a higher priority PLMN/access technology combination if the target PLMN's access technology signal quality is equal to or higher than the Operator controlled signal threshold per access technology;
- the UE shall select a lower priority PLMN/access technology combination only if the RPLMN's access technology signal quality is lower than the Operator controlled signal threshold per access technology, and the target PLMN's access technology signal quality is equal or higher than the Operator controlled signal threshold per access technology.

NOTE 5: The UE does not perform the periodic attempts if the RPLMN is a HPLMN or EHPLMN, and the RPLMN's access technology signal quality is equal or higher than the Operator controlled signal threshold per access technology.

If no PLMN, including the RPLMN, fulfils the Operator controlled signal threshold criteria, the UE shall perform the normal periodic network selection for higher priority PLMNs (as described above), without applying the Operator controlled signal threshold per access technology.

3.2.2.6 Investigation PLMN Scan

The operator shall be able to control by SIM/USIM configuration whether a UE that is capable shall perform an investigation scan. This investigation scan shall be performed after each successful PLMN selection as well as during limited service state. The investigation scan shall search for a higher prioritised PLMN that does not offer CS voice

service. If such a PLMN is available, the user shall be informed. This enables the user to switch to such a PLMN using manual selection if the user so prefers. The investigation scan shall not be performed when no SIM/USIM is inserted.

3.2.2.7 Void

3.2.2.8 Steering Of Roaming

Steering to a specific VPLMN

It shall be possible for the HPLMN at any time to direct a UE, that is in automatic mode, to search for a specific VPLMN and, if it is available, move to that VPLMN as soon as possible. This VPLMN shall then be regarded as the highest priority VPLMN as defined by the operator, though any EHPLMN or PLMN on the User Controlled PLMN list shall have higher priority. This process shall be done transparently and without inconvenience to the user.

If the Operator controlled signal threshold per access technology is set on the USIM, the UE shall only select the VPLMN if the signal quality is equal to or higher than the Operator controlled signal threshold per access technology, otherwise the steering request shall be ignored.

If the UE is in manual mode, the steering request shall be ignored.

If the UE is registered on a VPLMN that is present on the User Controlled PLMN List, the steering request shall be ignored. PLMNs contained on the User Controlled PLMN List shall have priority over the steered-to-PLMN.

The UE shall attempt to register on the specified VPLMN even if the specified VPLMN is present on a Forbidden List.

This mechanism shall be available to the HPLMN even if the VPLMN the UE is registered on is compliant to an earlier release of the 3GPP specifications.

VPLMN Redirection

It shall be possible for the HPLMN to request a UE, that is in automatic mode, to find and register on a different VPLMN from the one it is currently using or trying to register on, if another VPLMN, that is not in a Forbidden List, is available. The original VPLMN shall then be treated as the lowest priority VPLMN and would not be selected by the UE unless it is the only one available to the UE or has been selected in manual mode. This process shall be done transparently and without inconvenience to the user.

If the UE is in manual mode, the redirection request shall be ignored.

If the UE is registered on a VPLMN that is present on the User Controlled PLMN List, the redirection request shall be ignored.

This mechanism shall be available to the HPLMN even if the VPLMN the UE is registered on is compliant to an earlier release of the 3GPP specifications.

3.2.3 Network selection for Multi-mode terminals with 3GPP Capability

Different types of Multi-mode terminals combining different technologies and systems in one terminal can be produced. It is not possible to foresee all possible configurations and provide a detailed technical specification for network and system selection for all possible multi-mode terminal configurations. The following provides the generic requirements for network and system selection for Multi-mode terminals with 3GPP Capability. These requirements are mandatory for a 3GPP capable multi-mode terminal, unless otherwise is explicitly specified elsewhere in the 3GPP Technical Specifications.

- a multi-mode terminal, when in 3GPP mode of operation shall be compliant to the 3GPP specifications, including PLMN selection, cell selection and re-selection, paging reception etc.,
- As consequence, the multi-mode terminal when entering 3GPP mode of operation shall act as if it were a 3GPP only UE which had just been switched-on. Similarly, when leaving the 3GPP mode of operation the multimode terminal shall act as if it were a 3GPP only UE which had just been switched-off

When the multimode terminal is in 3GPP mode, the switching between modes in the multi-mode terminal is considered an overlay functionality selecting mode of operation. For the design of the overlay functionality the following requirements shall be fulfilled:

- The overlay functionality shall include a mechanism to avoid ping-pong between systems, e.g., a timer or hysteresis function;
- The overlay functionality shall not include network priority mechanisms, which conflict with the network priority mechanisms specified in 3GPP specifications, e.g., the Periodic network selection attempts scanning within 3GPP based systems for PLMNs of higher priority than the current serving PLMN;
- Any functionality in the overlay system, such as background scan of other systems, shall not impact the fulfilment of 3GPP protocol requirements (in particular in regard to paging, cell selection, cell re-selection and PLMN selection);
- As specified in this technical specification, the 3GPP technical specification provides the capability for the user to set their own 3GPP PLMN selection preferences; as well as the user can manually select any 3GPP PLMN. This has been done to ensure a fair competition environment. These principles shall be maintained in the design of the overlay functionality.

4 Access control

4.1 Purpose

Under certain circumstances, it will be desirable to prevent UE users from making access attempts (including emergency call attempts) or responding to pages in specified areas of a PLMN. Such situations may arise during states of emergency, or where 1 of 2 or more co-located PLMNs has failed.

Broadcast messages should be available on a cell by cell basis indicating the class(es) or categories of subscribers barred from network access.

The use of these facilities allows the network operator to prevent overload of the access channel under critical conditions.

It is not intended that access control be used under normal operating conditions.

It should be possible to differentiate access control between CS and PS domains. Details are specified in TS23.122[3] and TS25.304 [10]. Not all RATs need to support this functionality.

4.2 Allocation

All UEs are members of one out of ten randomly allocated mobile populations, defined as Access Classes 0 to 9. The population number is stored in the SIM/USIM. In addition, UEs may be members of one or more out of 5 special categories (Access Classes 11 to 15), also held in the SIM/USIM. These are allocated to specific high priority users as follows. (The enumeration is not meant as a priority sequence):

- Class 15 - PLMN Staff;
- 14 - Emergency Services;
- 13 - Public Utilities (e.g. water/gas suppliers);
- 12 - Security Services;
- 11 - For PLMN Use.

4.3 Operation

4.3.1 Access Class Barring

If the UE is a member of at least one Access Class which corresponds to the permitted classes as signalled over the radio interface, and the Access Class is applicable in the serving network, access attempts are allowed. Additionally, in the case of the access network being UTRAN the serving network can indicate that UEs are allowed to respond to

paging and perform location registration (see, sec 3.1), even if their access class is not permitted. Otherwise access attempts are not allowed. Also, the serving network can indicate that UEs are restricted to perform location registration, although common access is permitted. If the UE responded to paging it shall follow the normal defined procedures and react as specified to any network command.

NOTE: The network operator can take the network load into account when allowing UEs access to the network.

Access Classes are applicable as follows:

- Classes 0 - 9 - Home and Visited PLMNs;
- Classes 11 and 15 - Home PLMN only if the EHPLMN list is not present or any EHPLMN;
- Classes 12, 13, 14 - Home PLMN and visited PLMNs of home country only. For this purpose the home country is defined as the country of the MCC part of the IMSI.

Any number of these classes may be barred at any one time.

In the case of multiple core networks sharing the same access network, the access network shall be able to apply Access Class Barring for the different core networks individually.

The following are the requirements for enhanced Access control on E-UTRAN.

- The serving network shall be able to broadcast mean durations of access control and barring rates (e.g. percentage value) that commonly applied to Access Classes 0-9 to the UE. The same principle as in UMTS is applied for Access Classes 11-15;
- E-UTRAN shall be able to support access control based on the type of access attempt (i.e. mobile originating data or mobile originating signalling), in which indications to the UEs are broadcasted to guide the behaviour of UE. E-UTRAN shall be able to form combinations of access control based on the type of access attempt e.g. mobile originating and mobile terminating, mobile originating, or location registration. The 'mean duration of access control' and the barring rate are broadcasted for each type of access attempt (i.e. mobile originating data or mobile originating signalling);
- The UE determines the barring status with the information provided from the serving network, and perform the access attempt accordingly. The UE draws a uniform random number between 0 and 1 when initiating connection establishment and compares with the current barring rate to determine whether it is barred or not. When the uniform random number is less than the current barring rate and the type of access attempt is indicated allowed, then the access attempt is allowed; otherwise, the access attempt is not allowed. If the access attempt is not allowed, further access attempts of the same type are then barred for a time period that is calculated based on the 'mean duration of access control' provided by the network and the random number drawn by the UE;
- The serving network shall be able to indicate whether or not a UE shall apply Access Class Barring for SMS access attempts in SMS over SGs, SMS over IMS (SMS over IP), and SMS over S102. This indication is valid for Access Classes 0-9 and 11-15;
- The serving network shall be able to indicate whether or not a UE shall apply Access Class Barring for MMTEL voice access attempts. This indication is valid for Access Classes 0-9 and 11-15;
- The serving network shall be able to indicate whether or not a UE shall apply Access Class Barring for MMTEL video access attempts. This indication is valid for Access Classes 0-9 and 11-15.

4.3.2 Service Specific Access Control

Additionally to the above requirements in 4.3.1;

- In E-UTRAN it shall be possible to support a capability called Service Specific Access Control (SSAC) to apply independent access control for telephony services (MMTEL) for mobile originating session requests from idle-mode and connected-mode as following:
 - The serving network shall be able to indicate (as specified in sub-clause 4.3.1) whether or not a UE subject to SSAC shall also apply Access Class Barring.
 - EPS shall provide a capability to assign a service probability factor [13] and mean duration of access control for each of MMTEL voice and MMTEL video:

- assign a barring rate (percentage) commonly applicable for Access Classes 0-9;
- assign a flag barring status (barred /unbarred) for each Access Class in the range 11-15;
- SSAC shall not apply to Access Class 10;
- SSAC can be provided by the VPLMN based on operator policy without accessing the HPLMN;
- SSAC shall provide mechanisms to minimize service availability degradation (i.e. radio resource shortage) due to the mass simultaneous mobile originating session requests and maximize the availability of the wireless access resources for non-barred services;
- The serving network shall be able to broadcast mean durations of access control, barring rates for Access Classes 0-9, barring status for Access class in the range 11-15 to the UE;
- The UE determines the barring status with the information provided from the serving network, and perform the access attempt accordingly. The UE draws a uniform random number between 0 and 1 when initiating connection establishment and compares with the current barring rate to determine whether it is barred or not. When the uniform random number is less than the current barring rate and the type of access attempt is indicated allowed, then the access attempt is allowed; otherwise, the access attempt is not allowed. If the access attempt is not allowed, further access attempts of the same type are then barred for a time period that is calculated based on the 'mean duration of access control' provided by the network and the random number drawn by the UE.

4.3.3 Access Control for CSFB

Access control for CSFB provides a mechanism to prohibit UEs to access E-UTRAN to perform CSFB. It minimizes service availability degradation (i.e. radio resource shortage, congestion of fallback network) caused by mass simultaneous mobile originating requests for CSFB and increases the availability of the E-UTRAN resources for UEs accessing other services.

When an operator determines that it is appropriate to apply access control for CSFB, the network may broadcast necessary information to provide access control for CSFB for each class to UEs in a specific area. The network shall be able to separately apply access control for CSFB, SSAC and enhanced Access control on E-UTRAN.

The following requirements apply for CSFB to 1xRTT:

- In E-UTRAN, the network may apply access control for mobile originating session requests on CSFB from 1xRTT/E-UTRAN UE, The parameters received by the UE are dealt with in accordance with CDMA2000 procedures in 3GPP2 C.S0004-A: "Signaling Link Access Control (LAC) Standard for cdma2000 Spread Spectrum Systems – Addendum 2" [15].

For CSFB to UTRAN or GERAN, the necessary information in the broadcast to provide access control for CSFB is the same as that specified in Clause 4.3.1. In addition to those requirements the following apply:

- Access control for CSFB shall apply for Access Class 0-9 and Access Class 11-15. It shall not apply for Access Class 10;
- Access control for CSFB shall be applied for idle mode UE;
- Access control for CSFB shall apply to all CSFB services;
- Access control for CSFB may be provided by the VPLMN based on operator policy without accessing the HPLMN;
- If Access control for CSFB, according to the UE's access class, disallows originating session requests for CSFB then a UE shall not send mobile originating session requests for CSFB;
- If Access control for CSFB is applied by the UE for a mobile originating session request for CSFB, the UE shall bypass enhanced Access control on E-UTRAN for that session.
- The criteria on which a UE determines whether Access control for CSFB allows or disallows originating session requests for CSFB are equivalent to those for enhanced Access control on E-UTRAN, as described in clause 4.3.1;

- If access is not granted for the UE, mobile originating session requests for CSFB shall be restricted for a certain period of time to avoid overload of E-UTRAN due to continuous mobile originating session requests from the same UE. The duration of the period shall be determined using the same operation specified in Clause 4.3.1;
- In case the network does not provide the Access control for CSFB information, the UE shall be subject to access class barring for Access Classes 0-9 and 11-15 as described in Clause 4.3.1.

4.3.4 Extended Access Barring

4.3.4.1 General

Extended Access Barring (EAB) is a mechanism for the operator(s) to control Mobile Originating access attempts from UEs that are configured for EAB in order to prevent overload of the access network and/or the core network. In congestion situations, the operator can restrict access from UEs configured for EAB while permitting access from other UEs. UEs configured for EAB are considered more tolerant to access restrictions than other UEs. When an operator determines that it is appropriate to apply EAB, the network broadcasts necessary information to provide EAB control for UEs in a specific area. The following requirements apply for EAB:

- The UE is configured for EAB by the HPLMN;
- EAB shall be applicable to all 3GPP Radio Access Technologies used in EPS or UMTS;

NOTE: When a UE configured for EAB is located in 5G system, the UE is considered as configured for delay tolerant service.

- EAB shall be applicable regardless of whether the UE is in a Home or a Visited PLMN;
- A network may broadcast EAB information;
- EAB information shall define whether EAB applies to UEs within one of the following categories:
 - a) UEs that are configured for EAB;
 - b) UEs that are configured for EAB and are neither in their HPLMN nor in a PLMN that is equivalent to it;
 - c) UEs that are configured for EAB and are neither in the PLMN listed as most preferred PLMN of the country where the UE is roaming in the operator-defined PLMN selector list on the SIM/USIM, nor in their HPLMN nor in a PLMN that is equivalent to their HPLMN.
- EAB information shall also include extended barring information for Access Classes 0-9;
- A UE configured for EAB shall use its allocated Access Class(es), as defined in sub-clause 4.2, when evaluating the EAB information that is broadcast by the network, in order to determine if its access to the network is barred;
- If a UE that is configured for EAB answers to paging, initiates an emergency call or, is a member of an Access Class in the range 11-15 and according to clause 4.3.1 that Access Class is permitted by the network, then the UE shall ignore any EAB information that is broadcast by the network;
- If the network is not broadcasting the EAB information, the UE shall be subject to access barring as described in clause 4.3.1;
- If the EAB information that is broadcast by the network does not bar the UE, the UE shall be subject to access barring as described in clause 4.3.1;
- In the case of multiple core networks sharing the same access network, the access network shall be able to apply the EAB for the different core networks individually.

4.3.4.2 Overriding extended access barring

Overriding Extended Access Barring is a mechanism for the operator to allow UEs that are configured for EAB to access the network under EAB conditions. The following requirements apply:

- The UE configured with EAB may be configured by the HPLMN with a permission to override EAB;

- For a UE configured with the permission to override EAB, the user or application (upper layers in UE) may request the UE to activate PDN connection(s) for which EAB does not apply;
- The UE shall override any EAB restriction information that is broadcast by the network as long as it has an active PDN connection for which EAB does not apply.

4.3.5 Application specific Congestion control for Data Communication (ACDC)

4.3.5.1 Service description

Application specific Congestion control for Data Communication (ACDC) is an access control mechanism for the operator to allow/prevent new access attempts from particular, operator-identified applications in the UE in idle mode. ACDC does not apply to UEs in connected mode. The network can prevent/mitigate overload of the access network and/or the core network. This feature is optional.

4.3.5.2 Requirements

4.3.5.2.1 General

The following requirements apply:

- This feature shall be applicable to UTRAN PS Domain and E-UTRAN;
- This feature shall be applicable to UEs in idle mode only that are not a member of one or more of Access Classes 11 to 15;
- ACDC shall not apply to MMTEL voice, MMTEL video, SMS over IMS (SMS over IP) emergency call and paging response;

NOTE 1: Even if any of the above services are initiated by application, ACDC does not apply, but they are subject to other applicable access control methods.

- The home network shall be able to configure a UE with at least four and a maximum of sixteen ACDC categories to each of which particular, operator-identified applications are associated. The categories shall be ordered as specified in sub-clause 4.3.5.2.2;

NOTE 2: Provisioning of the ACDC categories in the UE is the responsibility of the home network, and the categorization is outside the scope of 3GPP.

NOTE 3: A mechanism needs to be provided that enables the UE to verify that the provisioning of the configuration originates from a trusted source.

- The serving network shall be able to broadcast, in one or more areas of the RAN, control information, indicating barring information per each ACDC category, and whether a roaming UE shall be subject to ACDC control;

NOTE 4: The barring information may be similar to ACB information, and include mean durations of access control (i.e., barring timer) and barring rates (i.e., percentage value). If the barring timer is running due to a previous access attempt from an application in a certain given matched ACDC category, the UE may only allow access attempts from applications in higher ACDC categories (according to the corresponding barring information for those higher categories). If the barring timer is running due to a previous access attempt from an application in a certain given unmatched ACDC category or a uncategorised application, the UE may only allow access attempts from applications in higher ACDC categories than the lowest ACDC category broadcast (according to the corresponding barring information for those higher categories).

- The UE shall be able to control whether or not an access attempt for a certain application is allowed, based on this broadcast barring information and the configuration of ACDC categories in the UE;
- The serving network shall be able to simultaneously indicate ACDC with other forms of access control;
 - When both ACDC and ACB controls are indicated, ACDC shall override ACB;

- If a UE is configured for both EAB and ACDC, and the serving network simultaneously broadcasts EAB information and ACDC barring information:
 - If the UE determines as specified in sub-clause 4.3.4.1 that access to the network is not barred or as specified in sub-clause 4.3.4.2 that it is permitted to override an EAB restriction, then access to the network is subject to ACDC;
 - If the UE determines as specified in sub-clause 4.3.4.1 that access to the network is barred and as specified in sub-clause 4.3.4.2 that it is not permitted to override the EAB restriction, then access to the network is barred.
- In the case of multiple core networks sharing the same access network, the access network shall be able to apply ACDC for the different core networks individually. For the mitigation of congestion in a shared RAN, barring rates should be set equal for all Participating Operators.

4.3.5.2.2 ACDC Categories

When configuring the UE with categories of applications, the home network shall proceed as follows:

- Applications whose use is expected to be restricted the least shall be assigned the highest ACDC category; and
- Applications whose use is expected to be restricted more than applications in the highest category shall be assigned the second-to-highest ACDC category, and so on; and
- Applications whose use is expected to be restricted the most shall either be assigned the lowest ACDC category, or not be categorised at all.

For a UE with ACDC categories configured, the applications on the UE that are not assigned to any ACDC category shall be treated by the UE as part of the lowest ACDC category broadcast by the serving network. If the operator requires differentiation with respect to these uncategorized applications, the operator should avoid assigning applications to the lowest ACDC category. When applying ACDC, the serving network broadcasts barring information starting from the highest to the lowest ACDC category. The home network and the serving network may use different categorisation. The serving network decides if ACDC applies to roaming UEs.

The number of ACDC categories in the UE may not be the same as the number of ACDC categories broadcast by the serving network. This may happen, e.g. when the UE is roaming and the number of categories broadcast by the serving network is different from the home network. Therefore, the following rules shall apply:

- If the serving network broadcasts more ACDC categories than the UE's configuration, the UE shall use barring information for the matching ACDC category and shall bar uncategorised applications using the barring information for the lowest category broadcast by the serving network, and shall ignore barring information for unmatched categories.
- If the serving network broadcasts barring information for fewer ACDC categories than the UE's configuration, the UE shall use barring information for the matching ACDC category and shall bar other applications using the barring information for the lowest category broadcast by the serving network.

NOTE: A matching ACDC category is an ACDC category for which barring information is broadcast by the serving network and that has the same rank as the rank of a configured ACDC category in the UE. An unmatched ACDC category is either an ACDC category for which barring information is broadcast by the serving network but with no corresponding ACDC category configured in the UE, or an ACDC category configured in the UE but with no corresponding barring information broadcast by the serving network.

4.3.6 Access Control for Indirect 3GPP Communications

For the case where an Evolved ProSe Remote UE is trying to access the network via an Evolved ProSe UE-to-Network Relay, the following requirements apply:

- Access control for CSFB shall not apply to an Indirect 3GPP Communication;
- ACB, EAB and ACDC shall apply when the Evolved ProSe UE-to-Network Relay is in IDLE mode and when the access control information for the respective access control is broadcast by the network;

- SSAC shall apply when the Evolved ProSe UE-to-Network Relay is either in IDLE or CONNECTED mode and when the access control information for SSAC is broadcast by the network;
- The interaction between ACDC, EAB and ACB (defined in paragraph 4.3.5.2.1) shall be based on the Evolved ProSe Remote UE's configuration;
- During the access control procedure, the requirements in subsections of 4.3.1, 4.3.2, 4.3.4 and 4.3.5 shall be performed by Evolved ProSe Remote UE using the following parameters:
 - Access control parameters broadcast by the cell where the Evolved ProSe UE-to-Network Relay is camped on or connected to shall be used in all access control procedures;
 - Access Class of the Evolved ProSe Remote UE shall be used;
 - For ACB, the type of access attempt (i.e. mobile originating data, mobile originating signalling, response to paging or emergency call) of the Evolved ProSe Remote UE shall be used;
 - For EAB, the following information shall be used:
 - Whether or not the Evolved ProSe Remote UE is configured with EAB;
 - Whether or not the Evolved ProSe Remote UE is configured with a permission to override EAB;
 - Whether the PLMN is the Evolved ProSe Remote UE's Home PLMN, equivalent PLMN or preferred PLMN. The PLMN where the Evolved ProSe UE-to-Network Relay is camped/connected shall be used to make this determination.
- For SSAC, the type of access attempt (MMTEL voice or MMTEL video) of the Evolved ProSe Remote UE shall be used;
- For ACDC, the ACDC category of the application that triggered the access attempt in the Evolved ProSe Remote UE shall be used.

4.4 Emergency Calls

An additional control bit known as "Access Class 10" is also signalled over the radio interface to the UE. This indicates whether or not network access for Emergency Calls is allowed for UEs with access classes 0 to 9 or without an IMSI. For UEs with access classes 11 to 15, Emergency Calls are not allowed if both "Access class 10" and the relevant Access Class (11 to 15) are barred. Otherwise, Emergency Calls are allowed.

4.4a Multimedia Priority Service

Multimedia Priority Service (TS 22.153 [16]) shall be assigned its own unique access class value (i.e., one of the special access classes 11 to 15). The assigned access class value for Multimedia Priority Service is based on regional/national regulatory requirements and operator policy.

4.5 Control of UE Capabilities

To protect the user from the effects of a misbehaving UE (e.g. causing additional charges, degraded performance) and to protect the network operator's network capacity, including radio resources and network signalling and processing, means shall be provided for the HPLMN/EHPLMN and the VPLMN to provide an indication to the UE as to which network provided services or functions it is not allowed to use.

The Selective UE Capabilities list shall be maintained in the UE and the UE shall not request any services indicated as disabled. At registration the HPLMN/EHPLMN or VPLMN may interrogate the status of the list and provide a new list.

The Selective UE Capabilities list shall not be deleted at switch off and will remain valid until a new list is provided by the network. The Selective UE Capabilities list relates to the ME and not to the subscription.

It should be ensured that UEs are not maliciously disabled, including malicious disabling by a VPLMN, or accidentally disabled, or kept disabled, and there shall be a mechanism for restoring disabled UEs in all situations (e.g. in the case that the serving network does not support the control of UE Capabilities).

The UE should use the indications given in the Selective UE Capabilities list to inform the user of the non-availability of services or functions.

There shall be a means for the network to provide an optional customer service number(s) which can be used, by the user, to assist in determining the cause of non-availability of specific services. The specifications should also provide the capability for the network to include an optional text string that will be displayed by the UE.

The UE Capabilities list shall take precedence over subscribed services.

The services to be included in the list are:

- Call Control functions;
- Supplementary Services;
- Emergency Calls (including the (U)SIM-less case and subject to regional regulatory requirements, i.e. emergency calls shall not be disabled in regions where support of them is required);
- SMS, via CS and PS;
- LCS, via CS and PS;
- GPRS based services;
- MBMS;
- IMS.

4.6 Prevention of mobile-originating signalling and/or data traffic

The network shall be able to control the behavior of UEs in E-UTRAN in connected mode to prevent mobile originating signalling and/or data traffic, while the access barring mechanisms specified under Clause 4.3 are being applied to UEs in idle mode.

5 Support of Localised Service Area (SoLSA)

SoLSA consists of a set of service features that give the operator a basis to offer subscribers different services (e.g. tariffs or access rights) depending on the location of the subscriber. (3GPP TS 22.043 [5]). The following section is only applicable to the support of SoLSA functionality in GERAN.

5.1 Network selection

The standard automatic and manual network selection procedures will be used.

Manual network selection may be required when the PLMN providing the users SoLSA service is not the one on which the user is currently registered.

At manual network selection the UE shall provide the means to present the subscribers LSA(s) for each PLMN presented.

5.2 The Idle-mode operation

The UE shall always select a valid LSA with the highest priority.

5.2.1 Subscriber moving from a normal environment to his localised service area

The UE shall have the ability to prioritise allowed LSA cells in reselection, making it possible to camp on a LSA cell earlier (the function shall be network controlled).

5.2.2 Subscriber moving away from his localised service area to a normal environment

The UE shall have the ability to prioritise allowed LSA cells in reselection, making it possible to camp on a LSA cell longer (the function shall be network controlled).

5.2.3 Subscriber staying in his localised service area

The UE shall have the ability to prioritise allowed LSA cells in reselection by being more persistent (the function shall be network controlled).

NOTE: Typically in indoor environments there are occasional reflections and "disturbances" due to macro cells, e.g. near the windows. In such a case LSA cells should be favoured even though there is higher field strength available from the outdoor cells.

5.3 LSA only access

It shall be possible to allow LSA user to access PLMN only within his LSAs. A LSA user is not allowed to receive and/or originate a call outside the allowed LSA area.

When UE is out of the allowed LSA area it shall be registered in PLMN but indicate subscriber/service specific "out of LSA area" notification. It shall be a network-controlled function to prevent terminated or/and originated calls. Emergency calls are however always allowed.

5.4 Exclusive access

Access to exclusive access cells is restricted to defined LSA subscribers.

Non-LSA subscriber shall consider exclusive access cells as not suitable, only allowing to camp for emergency calls (limited service state 3GPP TS 23.122 [3]).

5.5 Preferential access

As a network-controlled function, it shall be possible in LSA to allocate resources at call setup and during the active mode to LSA users compared to non-LSA users.

6 Support of 3GPP - WLAN Interworking

Support of 3GPP-WLAN interworking and network selection is captured in TS 22.234 [6]

NOTE: The requirement specification 22.234 is no longer maintained from Release 12 onwards.

6.1 Void

6.2 Void

6.3 Void

7 Administrative restriction of subscribers' access

7.1 Allowed Location and Routing Area identities access

Means shall be standardised for an administrative restriction of subscribers' access without the need of having explicit Tracking/Location/Routing Area identities in the individual subscription profiles.

To achieve this it shall be possible to indicate per subscriber, in subscription data, allowed categories of Tracking/Location/Routing Areas. It shall be possible to use this subscription information to restrict subscribers' access to categories of Tracking/Location/Routing Areas in serving networks accordingly.

As a minimum, at least one of the following categories shall be available:

- a) GERAN;
- b) UTRAN;
- c) E-UTRAN;
- d) NG-RAN.

There might be cases where the visited network has not separated the Location/Routing area categories, in which case the administrative restriction of subscribers' access to only GERAN or UTRAN will not be possible.

In EPS, an operator may introduce subscriptions supporting the 5G NR Dual Connectivity in E-UTRAN. It shall be possible to indicate in subscription data that a subscriber's access to the 5G NR Dual Connectivity in E-UTRAN service is restricted.

This administrative restriction of subscribers' access shall be an optional feature.

7.2 Void

7.3 UE configured radio technology restriction

A UE shall support a Man Machine Interface setting for the user to disable use of one or more of the UE's radio technologies, regardless of PLMNs. Radio technologies that individually can be disabled is dependent on supported radio technology of the UE such as GSM/EDGE, WCDMA, E-UTRA, and NR.

A UE shall support a Man Machine Interface setting enabling the user to re-enable use of one or more of the UE's radio technologies for access to a radio access network, regardless of PLMNs. The user can only re-allow a radio technology that the user has previously disallowed.

NOTE: The described MMI user setting is a proprietary function of most legacy UE products to allow a user of a UE to change the radio capabilities of the UE. Legacy radio technologies may lack means to mitigate some security attack. If severe enough, the home operator may want to disallow their subscribers to access a radio access network with such radio technology. This configuration of the UE is valid for all PLMNs.

A UE shall support a secure mechanism for the home operator to disallow selection of one or more of the UE's radio technologies for access to a radio access network, regardless of PLMNs. Radio technologies that individually can be disallowed are at least GSM/EDGE, WCDMA, E-UTRA, and NR.

A UE shall support a secure mechanism for the home operator to re-allow selection of one or more of the UE's radio technologies for access to a radio access network, regardless of PLMNs. Radio technologies that individually can be re-allowed are at least GSM/EDGE, WCDMA, E-UTRA, and NR. The home operator can only re-allow a radio technology that the home operator has previously disallowed.

For a prioritized service (e.g., Emergency Services, MPS, Mission Critical Services), the UE shall support a mechanism to automatically override user and network disallowed RATs when there are no PLMNs on the allowed radio technologies identified that the UE is able to access.

Upon power-cycle or when the USIM is disabled, the UE configuration of enabled/disabled radio technologies configured by the user shall remain as it was before such events happen. The radio technologies disallowed by the HPLMN shall remain as it was before a power cycle. The radio technologies disallowed by the HPLMN shall be bound to the USIM

8 Support of Home NodeB and Home E-NodeB

The service requirements for Home NodeB and Home eNodeB can be found in [14].

9 Control of traffic from UE-based applications toward associated server

9.1 Description

This feature allows operators to control traffic from UEs to an application on a third-party server or the third-party server itself. When an application on a third-party server or the third-party server itself becomes congested or fails the traffic towards that server need to be controlled to avoid/mitigate potential issues caused by resulting unproductive use of 3GPP network resource. This will also make it possible to allow 3GPP network to help third party servers to handle overload and recover from failures (see [7]).

9.2 Requirements

Under network control, the UE shall be able to control (i.e. block and/or prioritize) traffic from UEs to an application on a third-party server or the third-party server itself without affecting traffic to other applications on the third-party server or to other third-party servers.

For this purpose, the UE shall be able to identify the traffic towards the third-party server or the application on the third-party server.

When congestion or failure of the application on the third-party server or the third-party server abates, the control shall be applied in a phased manner to gradually restore traffic according to operator policy.

This feature and other forms of access control shall be able to be applied simultaneously.

In case of simultaneous application of ACDC and this feature, this feature shall take precedence over ACDC to control traffic from applications in the UE, only when such traffic is allowed by ACDC.

This feature shall be applicable both to new connections being set up and to existing connections from the UE towards an application on a third-party server or the third-party server.

10 3GPP PS Data Off

10.1 Description

3GPP PS Data Off is a feature which, when configured by the HPLMN and activated by the user, prevents transport via PDN connections or PDU sessions in 3GPP access networks of all data packets except IP packets required by 3GPP PS Data Off Exempt Services.

10.2 Requirements

The 3GPP system shall provide a mechanism by which an operator can configure which operator services are defined as 3GPP PS Data Off Exempt Services for their own subscribers.

When 3GPP PS Data Off is activated in the UE, in order to preserve charging consistency:

- the UE shall inform the network that 3GPP PS Data Off is activated;
- the UE shall cease the sending of uplink IP Packets of all services that are not 3GPP PS Data Off Exempt Services via PDN connections in 3GPP access networks;
- the network shall cease the sending of downlink IP Packets to the UE for all services that are not 3GPP PS Data Off Exempt Services via PDN connections in 3GPP access networks;
- the UE shall cease the sending of uplink traffic over non-IP PDN types via PDN connections in 3GPP access networks; and
- the network shall cease the sending of downlink traffic over non-IP PDN types via PDN connections in 3GPP access networks;
- the UE shall cease the sending of uplink IP packets of all services that are not 3GPP PS data Off Exempt Services via PDU sessions in 3GPP access networks;
- the network shall cease the sending of downlink IP packets to the UE for all services that are not 3GPP PS data Off Exempt Services via PDU sessions in 3GPP access networks;
- the UE shall cease the sending of uplink unstructured and ethernet data via PDU sessions in 3GPP access networks;
- the network shall cease the sending of downlink unstructured and ethernet data via PDU sessions in 3GPP access networks.

NOTE 1: Disabling of traffic on both the uplink and downlink is needed in order to provide consistency of charging between HPLMN and VPLMN, as well as consistency between what the user expects and what the user may be billed for.

Each of the following operator services shall be configurable by the HPLMN operator to be part of the 3GPP PS Data Off Exempt Services:

- MMTel Voice;
- SMS over IMS;
- USSD over IMS (USSI);
- MMTel Video;
- Services over IMS Data Channel;
- Particular IMS services not defined by 3GPP, where each such IMS service is identified by an IMS communication service identifier;
- Device Management over PS;

- Management of USIM files over PS (e.g. via Bearer Independent Protocol); and
- IMS Supplementary Service configuration via the Ut interface using XCAP.
- User plane location services protocol (LCS-UPP).

NOTE 1a: IMS Data Channel is defined in 3GPP TS 26.114[20].

NOTE 1b: Services over IMS Data Channel are treated as a whole to be exempt or not to be exempt. Usage of individual applications on the data channel can be controlled by operators when the PS Data Off Exempt of services over IMS Data Channel is on.

NOTE 1c: 3GPP PS Data Off Exempt for LCS-UPP in roaming is subject to agreement between operators.

3GPP PS Data Off may be activated based on roaming status, and the HPLMN may configure up to two sets of 3GPP PS Data Off Exempt Services for its subscribers: one is used when in HPLMN and another when roaming.

NOTE 2: The updating to the sets of configured 3GPP Data Off Exempt Services in the VPLMNs and HPLMN is not guaranteed to take effect in real time. The updating to the sets of configured 3GPP Data Off Exempt Services in the UEs is not guaranteed take effect in real time.

The user should be made aware of the operator services that are 3GPP PS Data Off Exempt Services.

NOTE 3: The system can support falling back to operate over the CS domain in case an operator service is not configured to be a 3GPP PS Data Off Exempt Service and an equivalent CS domain operator service exists for the operator service.

Annex A (informative): Change history

Change history											
TSG SA#	SA Doc.	SA1 Doc	Spec	CR	Rev	Rel	Cat	Subject/Comment	Old	New	Work Item
Jun 1999			02.04					Transferred to 3GPP SA1	7.0.0	3.0.0	
SA#04			02.04						3.0.0		
SP-05	SP-99479	S1-99610	22.011	0001		R99	D	Editorial changes for alignment	3.0.0	3.0.1	
SP-06	SP-99524	S1-991032	22.011	0002		R99	B	COMPACT Cell Selection Part 2	3.0.1	3.1.0	
SP-06	SP-99606		22.011	0003	1	R99	B	Network Selection	3.0.1	3.1.0	
SP-06	SP-99607		22.011	0004	1	R99	B	Control of user preference field	3.0.1	3.1.0	
SP-07	SP-000055	S1-000138	22.011	0012		R99	F	Corrections to 22.011	3.1.0	3.2.0	
SP-07	SP-000055	S1-000139	22.011	0013		R99	C	Removal of "Home Environment Specific Network Selection Procedure"	3.1.0	3.2.0	
SP-07	SP-000071	S1-000161	22.011	0014		R00	B	Network Selection	3.1.0	4.0.0	
SP-08	SP-000211	S1-000335	22.011	0016		R00	B	Reselection attempts of GPRS terminals	4.0.0	4.1.0	
SP-09	SP-000372	S1-000549	22.011	0018		R4	F	Alignment with 23.122 on selection procedure	4.1.0	4.2.0	
SP-11	SP-010036	S1-010245	22.011	0021		Rel-4	A	CR to 02.11 on Roaming restrictions for GPRS (Release4)	4.2.0	4.3.0	GPRS
SP-11	SP-010151		22.011	0023		Rel-4	A	Equivalent handling of PLMNs with different PLMN codes	4.2.0	4.3.0	GSM / UMTS inter-working
SP-12	SP-010244	S1-010495	22.011	0025		Rel-4	A	Partial PLMN access restriction	4.3.0	4.4.0	
SP-12	SP-010244	S1-010514	22.011	0027		Rel-4	A	Periodic Network Selection Attempt improvement	4.3.0	4.4.0	
SP-12	SP-010244	S1-010517	22.011	0029		Rel-4	A	Default value for background scanning timer	4.3.0	4.4.0	
SP-14	SP-010685	S1-011341	22.011	0031		Rel-4	A	CR to 22.011 R4 'Interaction between equivalent PLMN list and periodic network selection attempts'	4.4.0	4.5.0	
SP-14	SP-010684	S1-011334	22.011	0035		Rel-4	A	CR to 22.011 R4 'Editorial improvements'	4.4.0	4.5.0	
SP-14	SP-010688	S1-011336	22.011	0037		Rel-4	A	CR to 22.011 R4 'Clarification on the UE behaviour when receiving a registration rejection'	4.4.0	4.5.0	
SP-14	SP-010687	S1-011338	22.011	0039		Rel-4	A	CR to 22.011 R4 'Simplification of the procedure for user PLMN reselection'	4.4.0	4.5.0	
SP-14	SP-010686	S1-011339	22.011	0041		Rel-4	A	CR to 22.011 R4 'Interaction between "equivalent PLMN" list and "Forbidden PLMN" list'	4.4.0	4.5.0	
SP-14	SP-010757	---	22.011	0042	2	Rel-4	A	Interaction between ePLMN and manual mode	4.4.0	4.5.0	
SP-15	SP-010158	---	22.011	0045	1	Rel-4	A	CR to 22.011 Rel-4: clarification of the term 'country' NOTE: special dispensation was given by SA #15 to allow some leeway on the position of the note.	4.5.0	4.6.0	
SP-16	SP-020238	S1-021058	22.011	0046		Rel-4	F	Editorial corrections on 22.011	4.6.0	4.7.0	CORRECT
SP-16	SP-020267	S1-021043	22.011			Rel-5		Updated from Rel-4 to Rel5	4.7.0	5.0.0	
SP-17	SP-020547	S1-021826	22.011	0049		Rel-5	A	CR to 22.011 Rel 5 - correction to periodic PLMN scan	5.0.0	5.1.0	TEI4
SP-19	SP-030035	S1-030236	22.011	0050	-	Rel-6	B	Netshare CR to TS 22.011	5.1.0	6.0.0	NTShar-CR
SP-20	SP-030249	S1-030504	22.011	0051		Rel-6	B	Network Selection requirements for WLAN Interworking	6.0.0	6.1.0	WLAN-CR
SP-20	SP-030248	S1-030532	22.011	0052		Rel-6	B	Network selection in shared networks	6.0.0	6.1.0	NTShar-CR
SP-22	SP-030774	-	22.011	0053	1	Rel-6	B	Administrative restriction of subscribers' access	6.1.0	6.2.0	TEI
SP-23	SP-040088	S1-040200	22.011	0054	-	Rel-6	C	Periodic network selection attempts enhancement	6.2.0	6.3.0	TEI
SP-23	SP-040089	S1-040257	22.011	0056	-	Rel-6	F	Priority usage of UICC parameters for I-WLAN	6.2.0	6.3.0	WLAN
SP-23	SP-040101	S1-040260	22.011	0057	-	Rel-6	D	Extraction of redundant WLAN network selection information [– now in WLAN TS22.234]	6.2.0	6.3.0	WLAN

SP-24	SP-040287	S1-040438	22.011	0058	-	Rel-6	F	Behaviour of Single Mode mobiles with regards to the use of access technology in the PLMN selector lists	6.3.0	6.4.0	TEI6
SP-24	SP-040287	S1-040442	22.011	0060	-	Rel-6	F	Use of access technology in Periodic Network Selection attempts	6.3.0	6.4.0	TEI6
SP-24	SP-040287	S1-040443	22.011	0061	-	Rel-6	F	Clarification on the use of the RAT during network selection	6.3.0	6.4.0	TEI6
SP-24	SP-040295	S1-040526	22.011	0064	-	Rel-6	F	Priority usage of UICC parameters for I-WLAN	6.3.0	6.4.0	WLAN-CR
SP-24	SP-040299	S1-040445	22.011	0062	-	Rel-7	F	Multimode terminals with 3GPP capability	6.3.0	7.0.0	TEI7
SP-24	SP-040298	S1-040448	22.011	0063	-	Rel-7	B	Support of multiple HPLMN codes	6.3.0	7.0.0	TEI7
SP-27	SP-050063	S1-050233	22.011	0066	-	Rel-7	B	Addition of "Network Control of UE Capabilities"	7.0.0	7.1.0	Network Protection
SP-27	SP-050063	S1-050245	22.011	0067	-	Rel-7	B	Reinstate CR016 for GPRS Terminal PLMN Reselection	7.0.0	7.1.0	TEI-4
SP-29	SP-050521	S1-050903	22.011	0068	-	Rel-7	C	Enhancement of the EHPLMN feature to allow load balancing	7.1.0	7.2.0	TEI7
SP-31	SP-060221	-	22.011	0069	2	Rel-7	C	The Last RPLMN	7.2.0	7.3.0	NSP-CR
SP-31	SP-060033	S1-060330	22.011	0070	-	Rel-7	B	Confirmed Roaming	7.2.0	7.3.0	NSP-CR
SP-31	SP-060033	S1-060331	22.011	0071	-	Rel-7	F	Capability of UE to read USIM information for Network Selection	7.2.0	7.3.0	NSP-CR
SP-31	SP-060033	S1-060332	22.011	0072	-	Rel-7	C	Displaying all available EHPLMNs in Manual Mode	7.2.0	7.3.0	NSP-CR
SP-31	SP-060033	S1-060333	22.011	0073	-	Rel-7	B	Requirement for presentation of additional information in manual mode	7.2.0	7.3.0	NSP-CR
SP-31	SP-060033	S1-060335	22.011	0074	-	Rel-7	B	Network selection mode at switch-on	7.2.0	7.3.0	NSP-CR
SP-31	SP-060033	S1-060352	22.011	0075	-	Rel-7	B	Steering of Roaming	7.2.0	7.3.0	NSP-CR
SP-32	SP-060311	S1-060630	22.011	0076	-	Rel-7	C	Clarification on confirmed roaming applicability	7.3.0	7.4.0	NSP-CR
SP-32	SP-060311	S1-060632	22.011	0077	-	Rel-7	C	Incomplete PLMN list for manual mode information	7.3.0	7.4.0	NSP-CR
SP-32	SP-060426	-	22.011	0078	1	Rel-7	C	Exception in Manual network selection mode when HPLMN is available at power-on	7.3.0	7.4.0	NSP-CR
SP-32	SP-060451	S1-060649	22.011	0079	3	Rel-7	C	Interaction of steering of roaming with User controlled and forbidden PLMN list	7.3.0	7.4.0	NSP-CR
SP-34	SP-060762	S1-061314	22.011	0080	-	Rel-7	F	Additional Information in Manual Mode	7.4.0	7.5.0	NSP-CR
SP-35	SP-070119	S1-070182	22.011	0081	1	Rel-7	F	Removal of "Confirmed Roaming" enhancement (section 3.2.2.7)	7.5.0	7.6.0	NSP-CR
SP-35	SP-070119	S1-070294	22.011	0083	2	Rel-7	C	Single EHPLMN Display Name in Manual Mode (CR to 22.011)	7.5.0	7.6.0	NSP-CR
SP-35	SP-070129	S1-070285	22.011	0082	2	Rel-8	C	Administrative restriction of subscribers' access	7.6.0	8.0.0	SAE-R
SP-36	SP-070474	-	22.011	0085	-	Rel-8	A	Clarification on User Controlled PLMNs in SoR	8.0.0	8.1.0	NSP-CR
SP-38	SP-070855	S1-071842	22.011	0091	-	Rel-8	C	EPS Alignment - References and Definitions	8.1.0	8.2.0	AIPN-SAE-R
SP-38	SP-070855	S1-071910	22.011	0092	1	Rel-8	C	EPS Alignment - 3.2.2 Procedures	8.1.0	8.2.0	AIPN-SAE
SP-38	SP-070855	S1-071911	22.011	0093	1	Rel-8	C	EPS Alignment - 7 Administrative restriction of subscribers' access	8.1.0	8.2.0	AIPN-SAE
SP-38	SP-070855	S1-071925	22.011	0099	1	Rel-8	B	Additional requirement for location registration	8.1.0	8.2.0	AIPN-SAE
SP-38	SP-070859	S1-071943	22.011	0098	2	Rel-8	F	Correction to EHPLMN terminology and editorials	8.1.0	8.2.0	TEI8
SP-38	SP-070913	-	22.011	0090	2	Rel-8	A	EHPLMN case added to the optimisation for automatic network selection	8.1.0	8.2.0	NSP-CR
SP-38	SP-070934	-	22.011	0095	2	Rel-8	F	DSAC requirement in UMTS	8.1.0	8.2.0	TEI8
SP-38	SP-070942	-	22.011	0094	4	Rel-8	B	PPAC requirement	8.1.0	8.2.0	PPACR
SP-39	SP-080026	S1-080155	22.011	0101	1	Rel-8	A	EHPLMN recovery lack of coverage	8.2.0	8.3.0	NSP-CR

SP-39	SP-080034	S1-080351	22.011	0102	2	Rel-8	B	HNB/HeNB - Closed Subscriber Group (CSG) definitions for UTRA and E-UTRA	8.2.0	8.3.0	HomeNB
SP-39	SP-080042	S1-080326	22.011	0107	1	Rel-8	C	basic access control enhancement for EPS	8.2.0	8.3.0	AIPN-SAE
SP-39	SP-080041	S1-080331	22.011	0108	1	Rel-8	C	Barring of inbound roamers of previous release networks from E-UTRAN	8.2.0	8.3.0	TEI8
SP-39	SP-080188	-	22.011	0109	4	Rel-8	B	HNB/HeNB - Closed Subscriber Group (CSG) requirements for UTRA and E-UTRA	8.2.0	8.3.0	HomeNB
SP-40	SP-080301	S1-080655	22.011	0114	1	Rel-8	D	Delete CSGs related access restriction requirements	8.3.0	8.4.0	HomeNB
SP-40	SP-080301	S1-080656	22.011	0115	2	Rel-8	F	Introduction of length for HNBID	8.3.0	8.4.0	HomeNB
SP-40	SP-080301	S1-080767	22.011	0116	3	Rel-8	F	HNB/HeNB - Closed Subscriber Group (CSG) requirements for UTRA and E-UTRA	8.3.0	8.4.0	HomeNB
SP-40	SP-080432	-	22.011	0117	3	Rel-8	F	Relation between EPS Services and GPRS Services	8.3.0	8.4.0	SAE
SP-40	SP-080301	S1-080663	22.011	0118	-	Rel-8	C	Removal of GERAN - E-UTRAN connected mode handover requirement from HeNB	8.3.0	8.4.0	HomeNB
SP-40	SP-080453	-	22.011	0119	4	Rel-8	C	PPAC restriction to UTRAN	8.3.0	8.4.0	PPACR
								Corrects typos in previous line of history table.	8.4.0	8.4.1	
SP-41	SP-080493	S1-082333	22.011	0122	2	Rel-8	F	Correction on definition of length for HNBID	8.4.1	8.5.0	HomeNB
SP-41	SP-080493	S1-082354	22.011	0120	2	Rel-8	F	Essential correction to manual CSG selection	8.4.1	8.5.0	HomeNB
SP-41	SP-080493	S1-082389	22.011	0123	2	Rel-8	F	Additional HNB/HeNB operator requirements	8.4.0	8.5.0	HomeNB
SP-41	SP-080493	S1-082393	22.011	0128	2	Rel-8	F	Terminology alignment and generalization of requirements	8.4.1	8.5.0	HomeNB
SP-42	SP-080771	S1-083443	22.011	132	2	Rel-8	F	Correction to the maximum limit requirement of CSG members	8.5.0	8.6.0	HomeNB
SP-42	SP-080771	S1-083250	22.011	0133	1	Rel-8	F	HNB/HeNB and pre-release 8 USIM	8.5.0	8.6.0	HeNB
SP-42	SP-080773	S1-083380	22.011	0134	1	Rel-8	F	PPAC CR alignment with CT1	8.5.0	8.6.0	PPAC
SP-42	SP-080771	S1-084409	22.011	0137	2	Rel-8	F	Correction of HNB/HeNB display requirements and manual CSG selection	8.5.0	8.6.0	HomeNB
SP-42	SP-080874	S1-084408	22.011	0139	2	Rel-8	C	Home network independent support of roamers in CSG	8.5.0	8.6.0	HomeNB
SP-42	SP-080771	S1-084410	22.011	0140	1	Rel-8	B	HNB mobility	8.5.0	8.6.0	HomeNB
SP-42	SP-080785	S1-084389	22.011	0136	2	Rel-9	B	SSAC Services Specific Access Control Requirements	8.6.0	9.0.0	SSACR
SP-43	SP-090195	S1-090161	22.011	0142	1	Rel-9	D	Removing the content of chapter 8 and add a reference instead.	9.0.0	9.1.0	EHNB
SP-45	SP-090669	-	22.011	0156	1	Rel-9	F	Description Alignment of Access Class Barring for E-UTRAN with Stage 3	9.1.0	9.2.0	TEI9
SP-46	SP-090841	S1-094330	22.011	0158	1	Rel-9	F	Alignment between SSAC and Common AC	9.2.0	9.3.0	SSAC
SP-48	SP-100442	S1-101221r	22.011	0161	4	Rel-10	B	Access control for CSFB	9.3.0	10.0.0	TEI10
SP-49	SP-100580	S1-102153	22.011	0166	-	Rel-10	F	Clarification on roaming in shared networks	10.0.0	10.1.0	TEI10
SP-49	SP-100580	S1-102178	22.011	0163	1	Rel-10	F	Clarification of ACB for CSFB	10.0.0	10.1.0	TEI10
SP-49	SP-100580	S1-102178	22.011	0163	1	Rel-10	F	Clarification of ACB for CSFB	10.0.0	10.1.0	TEI10
SP-50	SP-100893	S1-103336	22.011	0168	12	Rel-10	B	Access Control for Machine Type Communications	10.1.0	10.2.0	NIMTC
SP-50	SP-100805	S1-103328	22.011	0171	-	Rel-10	F	Clarification of Access Class Barring for CSFB	10.1.0	10.2.0	TEI10
-								LTE logo changed into LTE Advanced logo	10.2.0	10.2.1	-
SP-51	SP-110162	S1-110409	22.011	0175	3	Rel-10	F	Clarifications for Extended Access Barring	10.2.1	10.3.0	NIMTC
SP-52	SP-110374	S1-111118	22.011	0181	-	Rel-11	F	Clarification on applicability of EAB	10.3.0	11.0.0	SIMTC
SP-52	SP-110374	S1-111376	22.011	0178	2	Rel-11	B	Clarification on how EAB is applied in Shared Network	10.3.0	11.0.0	SIMTC
SP-53	SP-110582	S1-112243	22.011	0182	2	Rel-11	F	Support of countries with multiple MCC values	11.0.0	11.1.0	TEI11

SP-54	SP-110813	S1-113443	22.011	0186	1	Rel-11	F	Applicability of Access Class Barring in a FULL-MOCN configuration	11.1.0	11.2.0	TEI11
SP-59	SP-130123	S1-131287	22.011	0191	2	Rel-11	F	Overriding extended access barring	11.2.0	11.3.0	TEI11
SP-59	SP-130110	S1-131279	22.011	0194	2	Rel-12	B	Prevention of mobile-originating signalling and/or data traffic of UEs in E-UTRAN in connected mode based on the criteria for the access barring mechanisms	11.2.0	12.0.0	PMOC
SP-63	SP-140064	S1-140057	22.011	200	-	Rel-12	C	Requirement for SSAC in CONNECTED	12.0.0	12.1.0	TEI12
SP-63	SP-140065	S1-140154	22.011	0202	-	Rel-12	B	Prioritization of MO-SMS for ACB	12.0.0	12.1.0	TEI12
SP-63	SP-140065	S1-140329	22.011	0198	5	Rel-12	B	Prioritization of MMTEL for ACB	12.0.0	12.1.0	TEI12
SP-64	SP-140233	S1-141306	22.011	0203	2	Rel-13	B	Access control mechanism for operator-identified applications	12.1.0	13.0.0	ACDC
SP-65	SP-140507	S1-143622	22.011	0206	2	Rel-13	C	Number and usage of ACDC categories	13.0.0	13.1.0	ACDC
SP-65	SP-140523	S1-143484	22.011	0205	1	Rel-13	A	I-WLAN clean up	13.0.0	13.1.0	TEI12
SP-68	SP-150267	S1-151621	22.011	214	2	Rel-13	F	Number of ACDC categories and ACDC in idle mode	13.1.0	13.2.0	ACDC-ST1
SP-68	SP-150270	S1-151546	22.011	213	2	Rel-13	A	Access Class for MPS (Rel-13 Mirror)	13.1.0	13.2.0	ePRIOR-ST1
SP-69	SP-150535	S1-152405	22.011	217	1	Rel-13	F	Handling of uncategorized ACDC applications	13.2.0	13.3.0	ACDC
SP-69	SP-150539	S1-152456	22.011	215	1	Rel-14	B	Enhancements for control of traffic from UE-based applications toward associated server	13.2.0	14.0.0	CATS
SP-70	SP-150747	S1-154542	22.011	0225	1	Rel-14	A	Corrections of ACDC Requirements	14.0.0	14.1.0	ACDC-ST1
SP-70	SP-150758	S1-154589	22.011	0224	3	Rel-14	B	Requirements to support a defined set of services when 3GPP PS Data Off is configured by the HPLMN	14.0.0	14.1.0	PS_DATA_OFF
SP-71	SP-160111	S1-160526	22.011	0224	7	Rel-14	B	3GPP PS Data Off	14.1.0	14.2.0	PS_DATA_OFF
SP-71	SP-160091	S1-160283	22.011	0229	1	Rel-14	A	Correction of ACDC requirement for IMS services	14.1.0	14.2.0	ACDC-ST1
SP-71	SP-160091	S1-160311	22.011	0233		Rel-14	A	Barring of applications in unmatched ACDC categories	14.1.0	14.2.0	ACDC
SP-71	SP-160111	S1-160322	22.011	0234	1	Rel-14	F	Removal of non-approved CR#0224rev3 on 3GPP PS Data Off	14.1.0	14.2.0	PS_DATA_OFF
SP-72	SP-160352	S1-161087	22.011	0236		Rel-14	A	Extension of periodic network selection attempts interval	14.2.0	14.3.0	TEI13
SP-74	SP-160894	S1-163439	22.011	0239	2	Rel-14	F	Enable CS equivalent services for PS Data Off exempted services	14.3.0	14.4.0	PS_Data_Off
SP-75	SP-170151	S1-170350	22.011	0246	1	Rel-14	F	PS Data Off handling of services supported by BIP	14.4.0	14.5.0	PS_Data_Off
SP-75	SP-170153	S1-170354	22.011	0242	2	Rel-14	B	Access Control for Evolved ProSe Remote UE	14.4.0	14.5.0	REAR
SP-75	SP-170154	S1-171441	22.011	0251	1	Rel-14	F	Access Technology differentiation	14.4.0	14.5.0	TEI14
SP-75	SP-170155	S1-170124	22.011	0244		Rel-15	B	Administrative restriction of subscribers' access to 5G-RAN	14.4.0	15.0.0	SMARTER
SP-75	SP-170155	S1-170233	22.011	0243	1	Rel-15	B	Add support of 5G in PLMN Selection	14.4.0	15.0.0	SMARTER
SP-75	SP-170155	S1-171184	22.011	0249		Rel-15	B	Administrative restriction of subscribers' access to E-UTRAN with NR DC	14.4.0	15.0.0	SMARTER
SP-75	SP-170160	S1-171467	22.011	0248	4	Rel-15	C	Optimisation of network selection in case of an operator supporting only a subset of specific access technologies	14.4.0	15.0.0	HORNS
SP-76	SP-170450	S1-172210	22.011	0257	1	Rel-15	F	Adding missing abbreviations and reference	15.0.0	15.1.0	TEI15
SP-76	SP-170446	S1-172379	22.011	0256	1	Rel-15	F	Alignment of PLMN selection with stage 3	15.0.0	15.1.0	HORNS
SP-76	SP-170442	S1-172423	22.011	0255	2	Rel-15	A	Correction to ACDC access control	15.0.0	15.1.0	ACDC-ST1
SP-76	SP-170440	S1-172207	22.011	0260		Rel-15	A	Removal of ACB-skip	15.0.0	15.1.0	REAR

SP-76	SP-170446	S1-172016	22.011	0253		Rel-15	F	Removal of Optimisation of network selection requirements not Agreed at SA#75	15.0.0	15.1.0	HORNS
SP-76	SP-170439	S1-172209	22.011	0261		Rel-15	A	Removal of VPLMN-specific 3GPP PS Data Off Exempt services	15.0.0	15.1.0	PS_Data_Off
SP-77	SP-170689	S1-173273	22.011	0263	1	Rel-15	A	CR on REAR	15.1.0	15.2.0	REAR
SP-77	SP-170695	S1-173551	22.011	0268	2	Rel-15	F	RAT identifiers for PLMN selection in 5G	15.1.0	15.2.0	TEI15
SP-78	SP-170987	S1-174600	22.011	0270	2	Rel-16	B	Selective Legacy Radio Disabling	15.2.0	16.0.0	TEI16
SP-79	SP-180142	S1-180635	22.011	0275	3	Rel-16	C	Selective Legacy Radio Disabling	16.0.0	16.1.0	TEI16
SP-79	SP-180228	-	22.011	277		Rel-16	A	Addition of RLOS availability into Automatic PLMN Selection	16.0.0	16.1.0	PARLOS
SP-80	SP-180305	S1-181395	22.011	0283	1	Rel-16	F	Alignment of RLOS availability into Automatic PLMN Selection	16.1.0	16.2.0	PARLOS
SP-80	SP-180308	S1-181566	22.011	0281	2	Rel-16	A	Clarification to forbidden TA	16.1.0	16.2.0	TEI15
SP-80	SP-180308	S1-181678	22.011	0287	1	Rel-16	A	IoT periodic network selection attempt timers	16.1.0	16.2.0	TEI15
SP-81	SP-180751	S1-182254	22.011	0296		Rel-16	A	Correction to EAB	16.2.0	16.3.0	TEI14
SP-81	SP-180751	S1-182655	22.011	0300		Rel-16	A	PS Data Off handling of non-IP PDN types	16.2.0	16.3.0	PS_Data_Off
SP-81	SP-180752	S1-182096	22.011	0291		Rel-16	A	Clarification to Delay Tolerant	16.2.0	16.3.0	SMARTE R
SP-81	SP-180756	S1-182633	22.011	0289	1	Rel-16	C	Delaying periodic higher priority PLMN searches and reselection attempts when receiving eMBMS service in idle mode	16.2.0	16.3.0	TEI16
SP-81	SP-180907	-	22.011	0297	5	Rel-16	F	Clarification on the PLMN selection mode for RLOS	16.2.0	16.3.0	PARLOS

Change history											
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment				New version	
2018-12	SP-82	SP-180999	0301	4	F	correction on PLMN selection in RLOS				16.4.0	
2018-12	SP-82	SP-180999	0302	3	F	Clarification on disabling of legacy radio				16.4.0	
2019-12	SP-86	SP-191032	0307	2	B	On PLMN selection for MINT				17.0.0	
2020-03	SP-87	SP-200123	0310	1	F	Clarification on the traffic handling over non-3GPP access for PS DATA Off				17.1.0	
2020-09	SA#89e	SP-200794	315	1	F	Corrections to Service accessibility specification				17.2.0	
2020-12	SA#90e	SP-201029	319	0	F	Satellite access RAT identifier for PLMN selection				17.3.0	
2020-12	SA#90e	SP-201029	321	1	F	Requirement Alignment related to PLMN reselection				17.3.0	
2021-09	SA#93e	SP-211096	0324		D	Correction of 'air interface' terminology				17.4.0	
2021-09	SA#93e	SP-211068	0322	4	B	Signal level Enhanced Network Selection				18.0.0	
2021-12	SP#94e	SP-211487	0327	1	A	Periodic network selection with shared MCC				18.1.0	
2022-03	SP#95e	SP-220082	0330		D	Clean-up of the references for quality improvement				18.2.0	
2022-06	SA#96	SP-220433	340	1	A	Clarifications on PLMN search for FPLMN Registered UEs				18.3.0	
2022-06	SA#96	SP-220428	336	1	A	Clarification of Shared MCC definition				18.3.0	
2022-12	SA#98	SP-221258	0342		F	Clarification of SENSE requirement under disaster roaming condition				18.4.0	
2022-12	SA#98	SP-221258	0344	2	F	Clarification on the periodic network selection for SENSE				18.4.0	
2023-03	SA#99	SP-230228	0348	3	B	PS Data Off for IMS Data Channel Service				19.0.0	
2023-06	SA#100	SP-230530	0351	1	A	Clarification on selection of Forbidden PLMN during Disaster Conditions when Operator controlled signal threshold applies				19.1.0	
2023-09	SA#101	SP-231041	0352		D	Quality improvements for TS22.011 Release 19				19.2.0	
2024-03	SA#103	SP-240202	0359	3	F	Clarification on the PS Data Off exemption for services over Data Channel				19.3.0	
2024-09	SA#105	SP-241145	0363	1	F	Location services user plane protocol and 3GPP PS data off				19.4.0	
2024-12	SA#106	SP-241760	0370	2	A	Alignment on Satellite E-UTRA				19.5.0	
2024-12	SA#106	SP-241762	0364	3	F	Clarification on support of 3GPP PS data off for 5G				19.5.0	
2025-09	SA#109	SP-250979	0373	3	B	Lower Selection-priority for PLMN Selection				19.6.0	

History

Document history		
V19.6.0	October 2025	Publication