



**Digital cellular telecommunications system (Phase 2+) (GSM);  
Universal Mobile Telecommunications System (UMTS);  
LTE;  
Service aspects;  
Handover requirements between UTRAN  
and GERAN or other radio systems  
(3GPP TS 22.129 version 15.0.0 Release 15)**



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# Contents

Intellectual Property Rights .....	2
Foreword.....	2
Modal verbs terminology.....	2
Foreword.....	5
1 Scope .....	6
1.1 Situations in which Service Requirements apply .....	6
2 References .....	7
3 Definitions and Abbreviations.....	7
3.1 Definitions .....	7
3.2 Abbreviations .....	8
4 General Principles governing service continuity.....	8
4.0 General Principles for service continuity .....	8
4.1 Service Continuity Scenarios .....	8
4.2 Service Continuity requirements .....	8
4.2.1 Service continuity for CS.....	8
4.2.2 Service continuity for GPRS.....	9
4.2.3 Service continuity for IM Services .....	9
4.3 General Operational Considerations.....	9
4.3.1 Coverage environment.....	9
4.3.2 Inter PLMN Handover Issues .....	9
4.3.3 Charging and Network Management .....	10
4.3.4 Cost and efficiency .....	10
4.3.5 Security .....	10
4.4 Performance Requirements .....	10
4.4.1 Temporary degradation of service caused by handover.....	10
5 Requirements for Handover .....	10
5.1 Handover due to UE Movement.....	10
5.2 Handover due to negotiated service requirement .....	10
5.3 Handover between Radio Access Modes .....	11
5.4 Cell capacity.....	11
5.5 Handover of a Multicall .....	11
5.6 Access Rights .....	11
5.7 Handover for shared networks.....	11
6 Requirements for Handover from UTRAN to GERAN .....	12
6.1 Operational Requirements .....	12
6.1.2 GERAN bands .....	12
6.2 Performance Requirements .....	12
6.2.1 Detection Time of Potential GERAN Handover Candidates.....	12
6.2.2 Number of GERAN handover candidates to detect .....	12
6.2.3 Probability of Connection Loss .....	12
6.3 Specific Requirements for Individual Services from UTRAN to GERAN .....	12
6.3.1 Speech.....	12
6.3.2 Short Message Service.....	12
6.3.3 Cell Broadcast.....	12
6.3.4 USSD.....	13
6.3.5 Facsimile.....	13
6.3.6 Data Bearer Services.....	13
6.3.6.1 Circuit Switched Data .....	13
6.3.6.2 Packet Switched Data.....	13
6.3.7 Supplementary Services.....	13
6.4 Requirements on multiple bearer services handover from UTRAN to GERAN .....	13
7 Requirements for Handover from GERAN to UTRAN .....	13

7.1	Operational Requirements .....	13
7.1.2	GERAN bands .....	13
7.2	Performance Requirements .....	14
7.3	Specific Requirements for Individual Service Handover from GERAN to UTRAN .....	14
7.3.1	Speech.....	14
7.3.2	Short Message Service.....	14
7.3.3	Cell Broadcast.....	14
7.3.4	USSD.....	14
7.3.5	Facsimile.....	14
7.3.6	Data Bearer Services.....	14
7.3.6.1	Circuit Switched Data .....	14
7.3.6.2	Packet Switched Data.....	14
7.3.7	Supplementary services .....	14
7.4	Requirements on multiple bearer services handover from GERAN to UTRAN .....	14
8	Cross Phase Compatibility for this release.....	15
8.1	Compatibility with Existing Specifications .....	15
8.2	Compatibility with Future 3GPP specifications .....	15
8.2.1	Requirements for Service Capabilities.....	15
8.2.2	Inter PLMN Handover Issues .....	15
8.2.3	Handover between Environments .....	16
8.3	Support of Multicall with Simultaneous Voice Calls .....	16
<b>Annex A (informative):</b>	<b>Illustration of elements in inter-PLMN handover .....</b>	<b>17</b>
<b>Annex B (informative):</b>	<b>Open Points on Inter-Operator Handover .....</b>	<b>18</b>
B.2	Selection of Target Cells for Handover.....	18
B.3	Network Information Exchange .....	18
B.4	Service Requirements.....	18
B.5	Billing, Accounting and Charging Requirements .....	18
<b>Annex C (informative):</b>	<b>Change history .....</b>	<b>19</b>
History .....		21

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# Foreword

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# 1 Scope

The scope of this document includes service requirements for handover maintaining continuity of service to a wireless terminal as it moves between the radio coverage area, or "cells", associated with different base station sites. This functionality is called "handover". Handover can also occur due to change of radio resource providing a service without necessarily any change of the base stations involved. In particular, when the radio resources providing a service change from one of the UTRA radio access modes to the other (UTRA-FDD and UTRA-TDD), this is regarded as handover. Particular emphasis has been placed on the description of requirements for service continuity within UTRAN and between UTRAN and GERAN.

It is a key requirement to allow for dual or multi-mode terminals to handover traffic from UTRAN to GERAN and vice versa. This document describes the service requirements for intra- and inter- system handover.

The following subject areas are within the scope of these service requirements:

- User perceived performance that may be influenced by handover;
- Operational requirements relating to handover;
- Security requirements.

The requirements set forth in this document are service requirements, in that they fulfil the following:

- The requirements are independent of the implementation of the UTRAN;
- The extent to which the requirements are met are in principle verifiable using observables that are not internal to the UTRAN.

## 1.1 Situations in which Service Requirements apply

The service requirements in this document are as far as possible independent of the implementation. They therefore apply to situations where handover would occur regardless of how the radio access network is implemented. Situations envisaged are:

- Handover within UTRAN due to change of radio resource caused by UE movement between areas covered by different transmitters;
- Handover within UTRAN due to change of UTRA radio access mode;
- Handover due to change of radio system.

It is possible that handover (i.e. change of radio resource) will occur in other situations, for example the technical implementation of the UTRAN may necessitate it or O&M procedures initiated by the operator may force it. Requirements for these situations are not within the scope of this document, with the exception of two remarks:

- Where the technical implementation of the UTRAN necessitates handover as a matter of normal operation (i.e. not related to the above situations), then services shall in no way be degraded or adversely affected;
- The service requirements for handover occurring in situations such as O&M activity are outside the scope of this document.

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## 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
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[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications "

[2] 3GPP TS 22.278: "Service requirements for the Evolved Packet System (EPS)"

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## 3 Definitions and Abbreviations

### 3.1 Definitions

In addition to the following, abbreviations used in the present document are listed in TR 21.905 [1].

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

**Connection mode (for a bearer service):** characterises the type of association between two endpoints as required by the bearer service for the transfer of information. A bearer service is either connection-oriented or connectionless. In a connection oriented mode, a logical association called *connection* needs to be established between the source and the destination entities before information can be exchanged between them. Connection oriented bearer services lifetime is the period of time between the establishment and the release of the connection.

**Connectionless (for a bearer service):** In a connectionless bearer, no connection is established beforehand between the source and the destination entities; the source and destination network addresses need to be specified in each message. Transferred information cannot be guaranteed of ordered delivery. Connectionless bearer services lifetime is reduced to the transport of one message.

**GERAN coverage:** an area where mobile cellular services are provided by a GERAN in accordance with GERAN specifications.

**UTRAN coverage:** an area where mobile cellular services are provided by a UTRAN in accordance with UTRAN specifications.

**Multi mode terminal:** UE that can obtain service from at least one UTRA radio access mode, and one or more different systems such as GERAN bands or possibly other radio systems such as IMT-2000 family members.

**Handover:** The process in which the radio access network changes the radio transmitters or radio access mode or radio system used to provide the bearer services, while maintaining a defined bearer service QoS.

**Intra PLMN handover:** Handover within the same network, i.e. having the same MCC-MNC regardless of radio access system. Note: this includes the case of UTRAN <>GERAN handover where MCC-MNC are the same in both cases.

**Inter PLMN handover:** Handover between different PLMNs, i.e. having different MCC-MNC.

**Inter system handover:** Handover between networks using different radio systems , e.g. UTRAN – GERAN.

**UTRA Radio access mode:** the selected UTRA radio access mode i.e. UTRA-FDD; UTRA-TDD.

**Radio system:** the selected 2<sup>nd</sup> or 3<sup>rd</sup> generation radio access technology.



**Service Continuity:** The means for maintaining active services during changes in the coverage areas or their characteristics without, as far as possible, the user noticing. Note that Service Continuity can be achieved by handover, cell re-selection or other mechanisms.

## 3.2 Abbreviations

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

UE                      User equipment

# 4 General Principles governing service continuity

## 4.0 General Principles for service continuity

The general principles for service continuity described in this specification refer to service continuity within the UTRAN, within the GERAN and between the UTRAN and GERAN. As a principle, the requirements on service continuity characteristics should be according to the target network on which the service is maintained.

Service requirements for seamless mobility between multiple heterogeneous access systems beyond only UTRAN and GERAN are contained within TS 22.278 [2].

## 4.1 Service Continuity Scenarios

Service continuity shall support the following scenarios:

1. Continuity of active CS services when moving within UTRAN, within GERAN and between UTRAN and GERAN coverage areas.
2. Continuity of active GPRS sessions when moving within UTRAN, within GERAN and between UTRAN and GERAN coverage areas.
3. Continuity of active IM Services when moving within UTRAN, within GERAN and between UTRAN and GERAN coverage areas (that support those IM services).

Service continuity is not applicable for any call or session using resources specific to the source domain that cannot be maintained using resources in the target domain.

## 4.2 Service Continuity requirements

For all scenarios, the specifications shall cover both service continuity within the same PLMN (intra-PLMN) and between PLMNs (inter-PLMN), including the case where the PLMNs involved are operated by different network operators.

It shall be possible for a user to roam between the different parts of a shared network without requiring any user intervention. The user experience while roaming in a shared network shall be comparable to the user experience while roaming in a non-shared network.

### 4.2.1 Service continuity for CS

The scenario numbers in this table refer to the scenarios in section 4.1.

		To CS services	
		UTRAN	GERAN
From CS services	UTRAN	Yes - Scenario 1	Yes - Scenario 1
	GERAN	Yes – Scenario 1	Yes – Scenario 1

## 4.2.2 Service continuity for GPRS

Service continuity of GPRS sessions (conversation, streaming, interactive and background) is required within the GERAN, within the UTRAN, and between the UTRAN and GERAN (scenario 2 in section 4.1 above).

Note: Service continuity for conversational, streaming and interactive GPRS sessions is not applicable to and from GERAN Release 4 or earlier, due to the lack of support for the conversational, streaming and interactive GPRS within GERAN Release 4 or earlier. In these cases, although the QoS required may not be available in the target, the bearer shall be maintained as long as possible. If the QoS supported by GERAN is not acceptable, the user/application may terminate the session.

## 4.2.3 Service continuity for IM Services

Service continuity of IM services is required within the GERAN, within the UTRAN, and between the UTRAN and GERAN (scenario 3 in section 4.1 above).

Note: Service continuity of IM Services is not applicable to and from GERAN Release 4 or earlier as the IM Services service classes are not supported by GERAN Release 4 or earlier. In these cases, although the QoS required may not be available in the target, the bearer shall be maintained as long as possible. If the QoS supported by GERAN is not acceptable, the user/application may terminate the session.

## 4.3 General Operational Considerations

### 4.3.1 Coverage environment

Mechanisms defined to support service continuity between different radio systems or radio access modes should effectively cope with a number of coverage scenarios:

- Limited coverage in a 'sea' of coverage provided by another radio system or radio access mode, or vice versa;
- Selective operation at a geographical boundary, with extensive UTRAN coverage on one side and extensive coverage from another radio system on the other side;
- Geographically co-located areas of UTRAN coverage and another radio system.

However the specifications should impose no restrictions or assumptions on how an operator might deploy or operate the network in both GERAN and UTRAN.

### 4.3.2 Inter PLMN Handover Issues

Handovers to support service continuity between PLMNs should remain an optional feature to implement. It is envisaged that handover would take place due to changing radio conditions caused e.g. by movement of the terminal causing it to leave the coverage area of a PLMN.

The following networks may be involved with an inter-PLMN handover procedure. These concepts are illustrated in Annex A:

- The user's *home network*, i.e. the operator where the user's subscription may be found;
- The user's *visited network* where the subscriber user is currently registered, i.e. the network where the subscriber user has performed the last successful update location procedure. As long as the subscriber user is roaming within the home network, home and visited network are identical;
- The user's *serving network* covering the cell that serves the subscriber. After successful completion of the update location update procedure, the serving network is identical with the visited network. After an inter-PLMN handover, the visited network is different from the serving network until a location update procedure has been successfully completed (excepted the case that the subscriber returns into the visited network);
- The *target network* covering candidate target cell(s) for inter-PLMN handover. The target network has overlapping radio coverage with the serving network but not necessarily with the visited network.