



**Digital cellular telecommunications system (Phase 2+) (GSM);  
Universal Mobile Telecommunications System (UMTS);  
LTE;  
Priority service feasibility study  
(3GPP TR 22.950 version 15.0.0 Release 15)**



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**Reference**

RTR/TSGS-0122950vf00

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**Keywords**

GSM,LTE,UMTS

**ETSI**

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## Foreword

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## Introduction

This Technical Report (TR) presents the results of the Feasibility Study on Priority Service. The intent of this Feasibility Study is to assess the ability of 3GPP specifications to meet high-level requirements identified for Priority Service. This Feasibility Study consisted of a multi-step process, namely:

1. Identify high-level requirements for Priority Service.
2. Determine existing relevant 3GPP specifications for Priority Service.
3. Perform a Gap Analysis to assess the ability of existing 3GPP specifications to meet the high-level Priority Service requirements.

As defined in this document, Priority Service allows qualified and authorized users to obtain priority access to the next available radio (voice or data traffic) channels on a priority basis before other PLMN users during situations when PLMN congestion is blocking call attempts. In addition, Priority Service supports priority call progression and call completion to support an “end-to-end” priority call.

Priority Service is intended to be used by qualified and authorized users, i.e., emergency service personnel, only during times of emergency situations and network congestion. Access to Priority Service is limited to key personnel and those with leadership responsibilities and is not intended for use by all emergency service personnel. This is to ensure that non-emergency service personnel cannot “take over” the network and deny the other non-emergency service subscribers a reasonably level of service.

Priority Service providers should adhere to uniform, nationwide operating access procedures. Priority Service can provide significant benefits for public safety. There may be times during emergencies when non-Priority Service subscribers will be unable to obtain access to their wireless services (because Priority Service personnel are using the channels); nevertheless, the benefits of Priority Service outweigh any inconvenience to non-Priority Service subscribers.

Priority Service is to be available at all times in equipped markets in both the HPLMN and VPLMN within a country where the PLMN provider is offering the service. The capability for pre-emption should be supported, with the option to turn it on/off depending on regional requirements. Priority Service is applicable to both GERAN and UTRAN and is activated on a per call basis using Priority Service dialing procedures.

Priority Service, supported by the 3GPP system set of services and features, is one element in ability to deliver calls of a high priority nature from mobile to mobile networks, mobile to fixed networks, and fixed to mobile networks.

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# 1 Scope

This Technical Report (TR) presents the results of the Feasibility Study on Priority Service. The intent of this Feasibility Study is to assess the ability of 3GPP specifications to meet high-level requirements identified for Priority Service. This Feasibility Study consisted of a multi-step process, namely:

1. Identify high-level requirements for Priority Service.
2. Determine existing relevant 3GPP specifications for Priority Service.
3. Perform a Gap Analysis to assess the ability of existing 3GPP specifications to meet the high-level Priority Service requirements.

Additional functionalities not documented in this TR are considered outside the scope of this TR. Such additional functionality may be on a network-wide basis, nation-wide basis or particular to a group of users. Such additional functionality shall not compromise conformance to the requirements of the Priority Service defined in this specification.

The Priority Service is intended to be utilised for both Voice and Data and therefore both elements are considered within the scope of this document. While Priority Service is meant for both Voice and Data services, the initial set of requirements address Circuit Switched Services (Voice as well as Data). Multimedia and non-circuit switched aspects of Priority Service have not been addressed in this feasibility study and are for further study.

The Priority Service is intended to interwork with external networks to provide an end-to-end service. Therefore, service interactions with external networks are considered within the scope of this document, although the specification of these interactions may be in other standards. If this occurs, a reference to that specification shall be made.

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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.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 41.001: "GSM Release specifications".
- [2] TS 21.905: "Vocabulary for 3GPP Specifications"
- [3] ETSI TS 100 921 version 7.0.1 (1999-07), Digital cellular telecommunications system (Phase 2+); Service accessibility (GSM 02.11 version 7.0.1 Release 1998)
- [4] 3GPP TS 22.011 version 3.5.0 (2005-01), 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Service accessibility (Release 1999)
- [5] 3GPP TS 22.011 version 4.4.0 (2005-01), 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Service accessibility (Release 4)
- [6] ETSI EN 300 924 version 7.0.1 (2005-01), Digital cellular telecommunications system (Phase 2+); enhanced Multi-Level Precedence and Pre-emption (eMLPP) – Stage 1 (GSM 02.67 version 7.0.1 Release 1998)
- [7] 3GPP TS 03.67 version 7.2.0 (2005-01), 3rd Generation Partnership Project; Technical Specification Group Core Network; Digital cellular telecommunications system (Phase 2+); enhanced Multi-Level Precedence and Pre-emption (eMLPP) – Stage 2 (Release 1998)
- [8] ETSI EN 300 927 version 7.0.1 (2005-01), Digital cellular telecommunications system (Phase 2+); enhanced Multi-Level Precedence and Pre-emption (eMLPP) – Stage 3 (GSM 04.67 version 7.0.1 Release 1998)

- [9] 3G TS 22.067 version 3.0.1 (1999-10), 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; enhanced Multi-Level Precedence and Pre-emption (eMLPP) – Stage 1 (Release 1999)
- [10] 3GPP TS 23.067 version 3.3.0 (2005-01), 3rd Generation Partnership Project; Technical Specification Group Core Network; enhanced Multi-Level Precedence and Pre-emption (eMLPP) – Stage 2 (Release 1999)
- [11] 3GPP TS 24.067 version 3.3.0 (2005-01), 3rd Generation Partnership Project; Technical Specification Group Core Network; enhanced Multi-Level Precedence and Pre-emption (eMLPP) – Stage 3 (Release 1999)
- [12] 3G TS 22.067 version 4.0.0 (2005-01), 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; enhanced Multi-Level Precedence and Pre-emption (eMLPP) – Stage 1 (Release 4)
- [13] 3GPP TS 23.067 version 4.1.0 (2005-01), 3rd Generation Partnership Project; Technical Specification Group Core Network; enhanced Multi-Level Precedence and Pre-emption (eMLPP) – Stage 2 (Release 4)
- [14] 3GPP TS 24.067 version 4.1.0 (2005-01), 3rd Generation Partnership Project; Technical Specification Group Core Network; enhanced Multi-Level Precedence and Pre-emption (eMLPP) – Stage 3 (Release 4)
- [15] GSM 11.11 v7.6.1, Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface; Release 1998
- [16] GSM 04.08 v7.13.0, Mobile Radio Interface Layer 3 Specification; Release 1998
- [17] 3GPP TS 11.11 v8.5.0, Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface; Release 1999
- [18] 3GPP TS 51.011 v4.1.0, Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface; Release 4
- [19] 3GPP TS 08.08 v. 7.7.0, Mobile-services Switching Centre- Base Station System (MSC - BSS) interface Layer 3 specification; Release 1998
- [20] 3GPP TS 08.08 v. 8.12.0, Mobile-services Switching Centre- Base Station System (MSC - BSS) interface Layer 3 specification; Release 1999
- [21] 3GPP TS 08.08 v. 9.0.0, Mobile-services Switching Centre- Base Station System (MSC - BSS) interface Layer 3 specification; Release 4
- [22] 3GPP TS 25.413 v. 3.9.0, UTRAN Iu interface RANAP signalling; Release 1999
- [23] 3GPP TS 25.413 v. 4.2.0, UTRAN Iu interface RANAP signalling; Release 4
- [24] 3GPP TS 24.008 v. 3.11.0, Mobile radio interface layer 3 specification; Core Network Protocols - Stage 3; Release 1999
- [25] 3GPP TS 24.008 v. 4.4.0, Mobile radio interface layer 3 specification; Core Network Protocols - Stage 3; Release 4
- [26] ITU Recommendation I.255.3, Multi-Level Precedence and Preemption Service (MLPP), 1990
- [27] ITU Recommendation Q.85, Stage 2 Description for Community of Interest Supplementary Services, Section 3 – Multi-Level Precedence and Preemption (MLPP) (rev. 1), 1992
- [28] ITU Recommendation Q.735, Stage 3 Description for Community of Interest Supplementary Services using SS No. 7, Section 3 – Multi-Level Precedence and Preemption (MLPP), 1993
- [29] GSM 11.14, Specification of the SIM Application Toolkit for the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface
- [30] 3GPP TS 31.102, Characteristics of the USIM Application

- [31] 3GPP TS 31.111, USIM Application Toolkit (USAT)
- [32] 3GPP TS 25.321, Medium Access Control (MAC) protocol specification

## 3 Definitions and abbreviations

### 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

**Priority Service:** A service that allows qualified and authorized users to obtain priority access to the next available radio (voice or data traffic) channels during situations when PLMN congestion is blocking call attempts. In addition, Priority Service supports priority call progression and call completion to support an “end-to-end” priority call.

**Service User:** A user subscribed to Priority Service.

### 3.2 Abbreviations

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

CDR	Charging Data Record
eMLPP	Enhanced Multi-Level Precedence and Pre-emption
ISDN	Integrated Services Digital Network
MLPP	Multi-Level Precedence and Pre-emption
PIN	Personal Identification Number
PIE	Priority Information Element
PSTN	Public Switched Telephone Network
SC	Service Code
UE	User Equipment

## 4 High Level requirements

The following sections describe the high-level requirements to support Priority Service. These high-level requirements are used as a basis for the gap analysis described in Section 6.

### 4.1 Priority Call Origination

A call shall receive priority treatment (priority access to voice or traffic channels) on the originating side, when the call is setup by a Service User using the priority service dialling procedure described in section 4.9.

### 4.2 Priority Call Termination

A call shall receive priority treatment (priority access to voice or traffic channels) on the terminating side, when the call is setup by a Service User using the priority service dialling procedure described in section 4.9.

### 4.3 Priority Call Progression

The Priority Service user shall receive priority call treatment/progression through the mobile network(s). A priority call should be given higher priority over normal calls in the originating mobile network, to interconnected networks (including the PSTN) and in the terminating network. Note: The ISDN MLPP feature may be used for signalling of priority level in the core network.

### 4.4 Priority Radio Resource Queuing

Priority Service assumes a signalling channel is always available.

When a Priority Service call encounters a “no radio available” condition in the call path involving an access or egress air-interface, or both, and,



- at call origination, and upon recognition of the Priority Service dialing pattern, the Priority Service call is queued in the cell serving the calling party and processed for the next available radio channel in that cell in accordance with the caller's priority level and call initiation time.
- at call termination upon recognition of a priority call indication in an incoming call, the Priority Service call is queued in the cell serving the called party and processed for the next available radio channel in that cell in accordance with the call's priority level and arrival time.

## 4.5 Priority Levels

The Priority Service subscriber shall be assigned one of  $n$  priority levels. Priority levels are defined as 1, 2, 3, ...,  $n$ , with 1 being the highest priority level and  $n$  being the lowest priority level. Refer to Annex A for Regional requirements for priority levels.

## 4.6 Invocation on Demand

Priority Service is invoked only when requested and an idle voice or traffic channel required for an origination request is not available.

If an idle voice or traffic channel is available when Priority Service is requested, the origination request is allowed to proceed normally without delay.

Invocation of Priority Service at access (origination), during call progression (end-to-end), or egress (termination) is considered complete when one of the following occurs:

- A radio (voice or traffic) channel is assigned to the call (at origination or termination),
- The loss of radio contact or roaming to another PLMN provider's system (at origination only),
- The subscriber cancels the request by pressing the [END] key,
- Expiration of the maximum allowed time to hold for the next available radio (voice or traffic) channel (at origination or termination), or
- Deletion of the Priority Service request due to arrival of a higher priority request coupled with lack of queue capacity (at origination or termination).

## 4.7 Applicability to Telecommunications Services

Priority Service shall be applicable to voice and data telecommunications services that require a voice or traffic channel assignment.

## 4.8 Authorization

A subscriber invoking Priority Service on call origination is authorized based on the caller's subscription. It should also be possible for an additional second level of authentication (e.g., by the use of PIN) to identify that the user is authorized to make a priority call. In this case, authorization of the subscriber may be realized by the usage of a PIN. The PIN solution is for further study and needs to be standardized. The user priority levels (1- $n$ ) and the associated PINs are assigned by the appropriate national authority and are fixed, i.e., a subscriber may not be allowed to change the PIN or the priority level. Note: There are some concerns related to security for "PIN Authorization".

## 4.9 Priority Service Service Code

Priority Service is manually requested by adding on the Priority Service service code (SC) to the origination request, as in:

**SC**+ termination address + **SEND**

**Figure 1: Priority Service manual request**

## 4.10 Roaming

Priority Service shall be able to be supported during roaming when the roaming network supports Priority Service.

## 4.11 Handover

Priority Service shall be able to be supported during handover.

## 4.12 Charging Data Record

The system should record the following Priority Service charging data record (CDR) information, in addition to non-Priority Service CDR information:

- a Priority Service invocation attempts.
- b Call legs (origination and/or termination) on which Priority Service was used to gain access to the radio channel.
- c Recording of appropriate Priority Service information (e.g., Priority Level, PIN usage indication). Note: The value of recording this information in CDRs is for further study.

## 4.13 Priority Trunk Queuing

Priority Service shall be able to support queuing of Priority Service calls for trunk resources. Trunk queuing provides the capability to place a Priority Service call that has experienced a congestion condition for trunk resources (e.g., no circuit available) into a queue associated with a trunk group until a trunk becomes available or until a maximum trunk queuing time has expired. Priority Trunk Queuing applies to ISDN User Part (ISUP) and Multi-Frequency (MF) trunks.

## 4.14 Coexistence with eMLPP

As a service provider option, it shall be possible to offer Priority Service and eMLPP within the same network, but not to the same user.

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# 5 Additional Description of Priority Service

## 5.1 At call origination

If a user invokes and is authorized for Priority Service and a radio (voice or traffic) channel is available, then the call is allowed to proceed in the originating system. The call is given priority treatment during progression through the network.

If a user invokes and is authorized for Priority Service but a radio (voice or traffic) channel is not available, the call is queued for the next available radio channel in the cell in accordance with the user's priority level and call initiation time. The user should be given an indication that the call is progressing. The network treats the user as busy while a priority call request for the user is queued.

If a user invokes and is authorized for Priority Service and a radio (voice or traffic) channel is not available, if the queue for the cell is full, and if the user's Priority Service priority is higher than one or more Priority Service calls already in the queue, then the lowest, most recent call in the queue is dropped from the queue. The user's call is placed in the queue in accordance with the user's priority level and call initiation time. The user should be given an indication that the call is progressing. The network treats the user as busy while a priority call request for the user is queued.

It is desirable that if the system changes the resources allocated to a Service User (e.g., cell handover), the call set-up should proceed, as if the resources had remained the same (e.g., queue status). Note: The handling of queue status during handover is for further study.

The following indications should be provided to the subscriber:

- i Acceptance of a Priority Service request.
- ii Rejection of a Priority Service request.
- iii Loss of a pending request (including loss of radio contact and possibly roaming to another system).

A priority call request may be removed from the queue by the Service User pressing the **END** key. The request shall also be removed by the system, if radio contact is not maintained with the requesting UE.

## 5.2 During call progression

The Priority Service call receives priority treatment for call routing to interconnected networks supporting priority.

## 5.3 At call termination

If a terminating radio (voice or traffic) channel is available, the call is terminated to the called party.

If a terminating radio (voice or traffic) channel is not available, the call is queued for the next available radio channel in the cell serving the called party in accordance with the call's priority level. When a terminating radio channel becomes available and is assigned to the call, the call is terminated to the called party.

If a terminating radio (voice or traffic) channel is not available, the queue for the cell serving the called party is full, and the call's priority level is higher than one or more Priority Service calls in the queue, then the lowest, most recent call in the queue is dropped from the queue. The user's call is entered in the queue in accordance with the call's priority level. When a terminating radio channel becomes available and is assigned to the call, the call is terminated to the called party.

It is desirable that if the system changes the resources allocated to the called party (e.g., cell handover), the call set-up should proceed, as if the resources had remained the same (e.g., queue status).

## 5.4 Exception Procedures or Unsuccessful Outcome

At call origination, the following exceptions or unsuccessful outcomes can occur:

- 1 If the user invokes but is not subscribed to Priority Service, call setup is not allowed to proceed and the call is dropped.
- 2 If the user invokes and is subscribed to Priority Service but the user's mobile set times out while the call is undergoing Priority Service call queue processing, the user's mobile returns to the null state and the call is dropped.
- 3 If a user invokes and is subscribed to Priority Service, a radio channel is not available, and the queue for the cell is full, and the user's Priority Service priority is lower than all of the Priority Service calls in the queue, the call is dropped.
- 4 If a user invokes and is subscribed to Priority Service, and is queued for a radio channel, but the user loses coverage, the call is removed from the queue and is dropped.
- 5 If a user invokes and is subscribed to Priority Service, and is queued for a radio channel, but the maximum allowed call time in queue expires before a radio channel becomes available in the cell, the call is removed from the queue and is dropped.
- 6 If a user invokes and is subscribed to Priority Service, and is queued for a trunk resource, but the user loses coverage, the call is removed from the trunk queue and is dropped.
- 7 If a user invokes and is subscribed to Priority Service, and is queued for a trunk resource, but the maximum allowed call time in queue expires before a trunk resource becomes available in the cell, the call is removed from the trunk queue and is dropped.

At call termination the following exceptions or unsuccessful outcomes can occur:

- 1 If a radio channel is not available and the queue for the cell is full, but the calling party's priority is lower than all of the Priority Service calls in the queue, the call is not completed and the Service User is given an appropriate indication.
- 2 If the call is queued for a radio channel but the called party's mobile loses coverage, the call is removed from the queue and the Service User is given an appropriate indication.
- 3 If the call is queued for a radio channel but the maximum allowed call time in queue expires before a radio channel becomes available in the designated terminating cell, the call is removed from the queue and the Service User is given an appropriate indication.

## 5.5 Features Interactions

### Call Waiting

Priority Service call users will not receive an incoming call indication while the call is being queued.

### Call forwarding and call re-direction

Service users will not be allowed to invoke Priority Service calls through call forwarding or re-direction.

(E.g., "\*SC + termination address" as a forwarded-to number, or Priority Service invocation through other re-direction services, such as IN DP12 Redirection etc.)

### Call Origination Restrictions

Priority Service shall override Call origination Restrictions for Barring of Outgoing Calls (BAOC), Barring of outgoing International Calls (BOIC) and Barring of Outgoing International Calls except to Home PLMN Country (BOIC-exHC), as a network option. Note: This may be necessary only for the PIN-based solution.

### eMLPP (USA regional requirement)

Priority Service call attempt shall override any eMLPP priority levels that may be received from eMLPP capable mobile phones. That is Priority Service users shall be able to only invoke their assigned priority level. If a Priority Service user has an eMLPP capable phone and attempts to use an eMLPP priority level in addition to Priority Service \*SC dialing, the eMLPP priority level request will be ignored by the network.

### Prepaid service

Priority Service applies only to post-paid calls. Users shall not be allowed to subscribe to Priority Service and Prepaid.

### Emergency Calls (USA regional requirement)

There is no interaction between Priority Service and emergency calls. If a service user dials \*SC + [emergency call number], the call either receives radio traffic channel priority access treatment based on the service user's priority level or the call is denied. If a non-service user dials \*SC + [emergency call number], the call is denied.