ETSI TR 122 950 V11.0.0 (2012-10)

Technical Report

**Digital cellular telecommunications system (Phase 2+);
Universal Mobile Telecommunications System (UMTS);
LTE;
Priority service feasibility study
(3GPP TR 22.950 version 11.0.0 Release 11)**

Reference

RTR/TSGS-0122950vb00

Keywords

GSM,LTE,UMTS

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00   Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

Individual copies of the present document can be downloaded from:
http://www.etsi.org

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at
http://portal.etsi.org/tb/status/status.asp

If you find errors in the present document, please send your comment to one of the following services:
http://portal.etsi.org/chaircor/ETSI_support.asp

Copyright Notification

ETSI

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://ipr.etsi.org).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Technical Report (TR) has been produced by ETSI 3rd Generation Partnership Project (3GPP).

The present document may refer to technical specifications or reports using their 3GPP identities, UMTS identities or GSM identities. These should be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between GSM, UMTS, 3GPP and ETSI identities can be found under http://webapp.etsi.org/key/queryform.asp.

Contents

Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x   the first digit:

1   presented to TSG for information;

2   presented to TSG for approval;

3   or greater indicates TSG approved document under change control.

y   the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z   the third digit is incremented when editorial only changes have been incorporated in the document.

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.

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.

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, <u>and,</u>

- <u>at call origination,</u> 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.

- <u>at call termination</u> 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 $\boxed{\text{END}}$ 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⌐

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.

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 $\boxed{\text{END}}$ 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.

6 Priority Service Gap Analysis

6.1 Service Accessibility

Service Accessibility is specified in:

Release 1998:

- 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);

Release 1999:

- 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); and

Release 4:

- 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).

Service Accessibility supports an Access Control capability that is pertinent to Priority Service.

6.1.1 Summary of Service Accessibility Capabilities

The Access Control capability prevents mobile users from initiating call origination attempts and from responding to pages in specific areas (e.g., in emergency situations where resource shortages exist). Access control is intended to allow network operators to prevent overload of radio access channels under critical conditions.

The basic mechanism is administered as follows: All SIMs are randomly assigned to one of ten access classes (0 – 9). In addition, SIMs may also be members of one or more of five special categories (access classes 11 to 15). These special classes are designated for specific purposes as summarized in the following table:

Table 1: Service Accessibility Access Classes

Access Class	Usage	Applicability
15	PLMN Staff	Home PLMN Only
14	Emergency Services	Home and Visited PLMNs of home country only
13	Public Utilities	
12	Security Services	
11	For PLMN Use	Home PLMN Only
0 - 9	General Use	Home and Visited PLMNs

In an emergency situation, broadcast messages are used (on an individual cell basis) to indicate the 'Access Classes' of subscribers that are barred from network access. Any number of classes may be barred at any one time. For example, to reduce approximately 20 percent of the basic mobile traffic in a given cell, broadcast messages might indicate that two of the basic access classes should be barred from access. Upon receiving an emergency broadcast message, those mobiles belonging to the barred access classes (and not also being members of any of the special classes) should not initiate a call attempt or respond to a page[1]. In addition, broadcast messages use 'access class 10' to indicate whether network access is allowed for emergency calls.

Access Control is designed to suppress not only the ability of non-priority end users to seize traffic channels, but also the ability of those end users to use signaling channels for call attempts. Service Accessibility, as specified, cannot be turned on and off by the end user.

---

[1] If a mobile is a member of at least one permitted Access Class, as signaled over the air interface, and the Access Class is applicable in the serving network, access attempts are allowed. Otherwise access attempts are not allowed.

6.1.2 Support for Priority Service

The following table identifies Service Accessibility support for Priority Service.

Table 2: Service Accessibility Gap Analysis

Priority Service Requirement Item	Description	Service Accessibility Support	Comments
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.	Supported	Using appropriate Access Class(es) to prevent access attempts
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.	Supported	Using appropriate Access Class(es) to prevent response to pages
3 Priority Progression	The user should 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 supporting priority (including the PSTN) and in the terminating network.	Not supported	
4 Priority Radio Resource Queuing	When a Priority Service call encounters a 'no radio available' condition in the call path involving an access or egress air-interface, or both, <u>and</u>, <u>at call origination</u>, 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. <u>at call termination</u> 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.	Not supported	
5 Priority Level	The subscriber should 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..	Partially supported	Ten (0-9) randomly allocated Access Classes. Five (11-15) special classes. Enumeration of special classes is not meant as a priority sequence. Priority Service priority levels could map to special Access Classes.
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.	Not supported	
7 Applicability to Telecommunications Services	Priority Service shall be applicable to voice and data telecommunications services that require a voice or traffic channel assignment.	Supported	
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	Supported	Access Classes stored in the SIM.

	(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.		
9 Priority Service service code	Priority Service is manually requested by adding on the Priority Service service code to the origination request.	Not supported	
10 Roaming	Priority Service shall be supported during roaming when the roaming network supports Priority Service.	Partially supported	Access classes 0-9 pertain to **Home and Visited PLMNs**. Access classes 11 and 15 pertain to **Home PLMN only**. Access classes 12, 13, and 14 pertain to **Home and Visited PLMNs <u>of home country only</u>**.
11 Handover	Priority Service shall be supported during handover.	Not supported	
12 Priority Service charging data record	The system should record the following Priority Service charging data information, in addition to non-Priority Service CDR information: Priority Service invocation attempts, Call legs (origination and/or termination) on which Priority Service was used to gain access to the radio channel. Recording of appropriate Priority Service information.	Not supported	
13 Priority Trunk Queuing	Priority Service shall be able to support queuing of Priority Service calls for trunk resources.	Not supported	
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.	Not supported	

6.2 Enhanced Multi-Level Precedence and Pre-emption (eMLPP)

eMLPP is specified in:

Release 1998:

- 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);

- 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);

- 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);

Release 1999:

- 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);

- 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);

- 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);

Release 4:

- 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 2000);

- 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);

- 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).

6.2.1 Summary of eMLPP Capabilities

The eMLPP service is provided as a network operator"s option to a domain of a network. The domain can be the whole network or a subset of the network. The eMLPP service applies to all network resources in the domain, and eMLPP is provided to a subscriber for all basic services subscribed to and for which eMLPP applies.

The eMLPP service supports two capabilities: precedence and pre-emption.

Precedence involves the assignment of a priority level to a call. eMLPP supports a maximum of seven priority levels. The two highest levels (A and B) are reserved for network internal use (e.g., for emergency calls). These are only used locally (i.e., in the domain of one MSC)[1]. The other five priority levels are offered for subscription and can be applied globally (presuming the priority level is successfully passed from the originating end and processed at the terminating end).

For each of the seven priority levels, the network operator can administer parameters that control the treatment of that priority within its domain. This treatment includes the selection of a target set-up time and whether or not pre-emption is allowed for each priority level. For example, a network operator might administer priority levels as follows:

---

[1] Levels A and B are mapped to priority level 0 for priority treatment outside of the MSC area in which they are applied.

Table 3: Example eMLPP Priority Levels

Priority Level	Set-Up Time	Pre-emption
A	Class 1	no
B	Class 2	no
0	Class 2	no
1	Class 3	no
2	Class 3	no
3	Class 3	no
4	Class 3	no

In the example above, three classes of set-up time performance are supported. In the above example, the network operator has assigned class 1 (fast set-up, nominally 1-2 seconds[2]) to Priority Level A traffic, has assigned class 2 (normal set-up, nominally less than 5 seconds) to traffic at Priority Levels B and 0, and has assigned class 3 (slow set-up, nominally less than 10 seconds) to the lower Priority Level traffic. 3GPP specifications do not define specific mechanisms (which may include specific technical capabilities and/or network engineering decisions) to achieve the target set-up times as defined by the service provider[3].

If idle resources are not available, pre-emption involves the seizure of resources (currently in use by a lower-priority call) for use by a call that is of higher priority. The network releases the lowest-priority call and seizes the necessary resources that are required to set up the higher-priority call. At handover to a congested cell, higher-priority calls replace existing calls of the lowest priority.

In the above example, the network operator has chosen not to allow pre-emption. Thus, priority levels will use different queuing priorities rather than pre-emption capabilities.

The eMLPP priority level for a given call depends on the calling subscriber. The maximum precedence level for each subscriber is set at subscription time (and is stored on the SIM).

The default priority level is established via normal registration procedures. If the user does not explicitly select a precedence level at call set-up, the network applies the subscriber-specific default precedence level.

The priority level can be selected by the user on a per-call basis (up to and including their maximum authorized precedence level).

The eMLPP service is invoked automatically by the network at call set-up, with the priority level established as above for mobile-originated calls. For mobile-terminated calls, the priority level is established based on the priority of the calling party, and is applied at the terminating end (presuming the call"s priority is passed via signaling between the originating and terminating networks). Interworking with ISDN MLPP is required.

The eMLPP service applies to roaming scenarios, if eMLPP is supported by the related networks.

The HLR maintains the logical state for eMLPP (provisioned or not provisioned), the maximum priority level, and the default priority level for each user.

The MSC stores service configuration information for each priority level (i.e., set up time [class] and pre-emption indicators, as illustrated in the previous section).

---

[2] Calls with a high priority requiring class 1 set-up may not require authentication at call set-up nor confidentiality on the radio link.

[3] Set-up times are defined for operation under normal circumstances (no congestion) and include the time from pressing the "send" button to the time the called party can receive information (excluding user reaction times).

The SIM stores data that influences UE actions, as noted in the following table:

Table 4: Example SIM data

Priority Level	Subscription Available	Automatic answering	Fast set-up actions
A	yes / no	yes / no	yes / no
B	yes / no	yes / no	yes / no
0	yes / no	yes / no	yes / no
1	yes / no	yes / no	yes / no
2	yes / no	yes / no	yes / no
3	yes / no	yes / no	yes / no
4	yes / no	yes / no	yes / no

The maximum authorized precedence level is stored on the SIM, allowing the mobile station to check that only an authorized level is used for set-up. (In addition, the network may verify the level used at set-up against the maximum authorized level.)

In the case of automatic answering of an incoming call with a sufficient priority level, the alerting indication to the calling party may not be provided in order to shorten the set-up time. If the called mobile subscriber is busy and automatic answering applies, the existing call may be released (if pre-emption applies) or may be placed on hold in order to accept an incoming call of higher priority.

6.2.2   Support for Priority Service

The following table identifies eMLPP support for Priority Service.

Table 5: eMLPP Gap Analysis

Priority Service Requirement Item	Description	eMLPP Support	Comments
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.	Supported	Based on subscribed priority level
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.	Supported	Based on priority level of calling party
3 Priority Progression	The user should 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 supporting priority (including the PSTN) and in the terminating network.	Supported depending on inter-operator agreements	Requires interworking with priority services supported within the interconnected networks (e.g. ISDN MLPP.) Requires special agreements between network operators to achieve transparent progression of priority level between networks.
4 Priority Radio Resource Queuing	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.	Partially Supported	Priority levels with no pre-emption capability allocated shall only have queuing priority 22.067, ch 4. Note: BSS implementations should have internal functionality to handle signaling channels overload, however in case of complete congestion there may not be way to guarantee priority access to network, however due to large capacity of paging and random access channels the complete overload of signaling channels very rare and thus is not likely to be the bottle neck.
5 Priority Level	The subscriber should 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..	Partially supported	Seven priority levels (with five available for subscription). Priority Service priority levels could map to eMLPP priority levels.
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.	Supported	If the user has an eMLPP subscription, the call shall have the priority level selected by the user at set-up or the priority level predefined by the subscriber as default priority level by registration.
7 Applicability to Telecommunications Services	Priority Service shall be applicable to voice and data telecommunications services that require a voice or traffic channel assignment.	Supported	eMLPP is a supplementary service and shall be provided to a subscriber for all basic services subscribed to and for which eMLPP applies.
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	Supported	Priority level stored in the SIM.

	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.		
9 Priority Service service code	Priority Service is manually requested by adding on the Priority Service service code to the origination request.	Partially supported	The exact MMI proposed is not supported. The MMI supported by eMLPP is specified in 22.030. The service code is 75.
10 Roaming	Priority Service shall be supported during roaming when the roaming network supports Priority Service.	Supported	eMLPP is applicable in case of roaming, if supported by the related networks.
11 Handover	Priority Service shall be supported during handover.	Partially supported	When pre-emption applies, at handover to a congested cell, higher priority calls shall replace those of the lowest priority. The pre-empted user shall receive an indication for congestion as defined in GSM 02.40.
12 Priority Service charging data record	The system should record the following Priority Service charging data information, in addition to non-Priority Service CDR information: Priority Service invocation attempts, Call legs (origination and/or termination) on which Priority Service was used to gain access to the radio channel. Recording of appropriate Priority Service information.	Supported	TS 22.067 ch 5.11.The utilized precedence level shall be able to be extracted from the event records if different from the default precedence level.
13 Priority Trunk Queuing	Priority Service shall be able to support queuing of Priority Service calls for trunk resources.	Not supported	eMLPP Stage 2, TS 23.067 ch 4, items c. and d. refer to 'contention in gaining terrestrial resources,' which may be interpreted as referring to Trunk Queuing. However, neither the Stage 1 (TS 22.067) nor the Stage 3 (TS 24.067) has any additional specification associated with trunk queuing.
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.	Not supported	

6.3 Subscriber Identity Module (SIM) Specifications

Release 1998:

- GSM 11.11 v7.6.1, Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface; Release 1998;

- GSM 04.08 v7.13.0, Mobile Radio Interface Layer 3 Specification; Release 1998;

- GSM 11.14, Specification of the SIM Application Toolkit for the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface

Release 1999:

- 3GPP TS 11.11 v8.5.0, Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface; Release 1999;

- 3GPP TS 24.008 v. 3.11.0, Mobile radio interface layer 3 specification; Core Network Protocols - Stage 3; Release 1999;

- GSM 11.14, Specification of the SIM Application Toolkit for the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface

Release 4:

- 3GPP TS 51.011 v4.1.0, Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface; Release 4;

- 3GPP TS 24.008 v. 4.4.0, Mobile radio interface layer 3 specification; Core Network Protocols - Stage 3; Release 4;

- 3GPP TS 31.102, Characteristics of the USIM Application;

- 3GPP TS 31.111, USIM Application Toolkit (USAT)

6.3.1 Summary of SIM-based Capabilities

The SIM specifications address the allocation and administration of *Access Control Classes* for control of Service Accessibility.

All mobile stations with an inserted SIM are members of one out of 10 access classes numbered 0 to 9. In addition, mobile stations may be members of one or more out of 5 special access classes (access classes 11 to 15). Both the regular as well as the special access class number are stored in the SIM. The access control class is a parameter to control the RACH utilization. The first 10 Access Control Classes (0-9) are randomly allocated to normal subscribers; and the top 5 classes (11-15) are allocated to specific high priority users.

The system information messages on the BCCH broadcast the list of authorized access classes and authorized special access classes in the system information messages, and whether emergency calls are allowed in the cell to all mobile stations or only to the members of authorized special access classes.

If the establishment cause for the request of the MM sub-layer is not "emergency call", access to the network is allowed if and only if the mobile station is a member of at least one authorized:

- access class; or

- special access class.

If the establishment cause for the request of the MM sub-layer is "emergency call", access to the network is allowed if and only if:

- emergency calls are allowed to all mobile stations in the cell; or

- the mobile station is a member of at least one authorized special access class.

Access Control is designed to suppress not only the ability of non-priority end users to seize traffic channels, but also the ability of those end users to use signaling channels for call attempts. Access Control class cannot be updated by the end-user, but by the operator and/or another authorized body. The information i.e., the access class field can be updated either over the air (with caution) or via SIM Toolkit. Security and authentication mechanism for the update of access control class need to be further investigated.

6.3.2   Support for Priority Service

The following table identifies SIM based support for Priority Service.

Table 6: SIM Gap Analysis

Priority Service Requirement Item	Description	SIM Support	Comments
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.	Supported	
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.	Supported	
3 Priority Progression	The user should 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 supporting priority (including the PSTN) and in the terminating network.	Not supported	
4 Priority Radio Resource Queuing	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.	Not supported	
5 Priority Level	The subscriber should 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..	Partially supported	Ten (0-9) randomly allocated Access Classes. Five (11-15) special classes. Enumeration of special classes is not meant as a priority sequence. PS priority levels could map to special Access Classes.
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.	Partially Supported	The user can insert a special SIM when he/she needs to make a priority call.
7 Applicability to Telecommunications Services	Priority Service shall be applicable to voice and data telecommunications services that require a voice or traffic channel assignment.	Supported	
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	Supported	Access Classes stored in the SIM.

	authentication (e.g., by the use of PIN) to identify that the user is authorized to make a priority call UE. In this case, authorization of the subscriber may be realized by the usage of a PIN.		
9 Priority Service service code	Priority Service is manually requested by adding on the Priority Service service code to the origination request.	Not supported	
10 Roaming	Priority Service shall be supported during roaming when the roaming network supports Priority Service.	Partially supported	Access classes 0-9 pertain to **Home and Visited PLMNs**. Access classes 11 and 15 pertain to **Home PLMN only**. Access classes 12, 13, and 14 pertain to **Home and Visited PLMNs <u>of home country only</u>**.
11 Handover	Priority Service shall be supported during handover.	Not supported	
12 Priority Service charging data record	The system should record the following Priority Service charging data information, in addition to non-Priority Service CDR information: Priority Service invocation attempts, Call legs (origination and/or termination) on which Priority Service was used to gain access to the radio channel. Recording of appropriate Priority Service information.	Not supported	
13 Priority Trunk Queuing	Priority Service shall be able to support queuing of Priority Service calls for trunk resources.	Not supported	
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.	Not supported	

6.4 Assignment request Priority Information Element

Priority Information Element (PIE) is specified in 3GPP TS 08.08 [19], [20], [21] and 3GPP TS 25.413 [22], [23]. The term used for the *Assignment request Priority Information Element* in Release 4 is *Allocation/Retention Priority*.

6.4.1 Summary and coding of Priority Information Element Capabilities

This element indicates the priority of the assignment request in A and Iu interface. Following information may be included in IE:

- priority level of the request (levels 1-14),

- if the request can be queued,

- if the request may pre-empt an existing connection and

- if the request can be pre-empted by another request.

The management of priority levels is implementation dependent, under operator control.

Priority information IE is also used if the Network supports eMLPP: 'The priority level of a call shall be determined by the MSC. Accordingly, the MSC shall request channel assignment with an indication of the priority level and the pre-emption capability of that call. For this the MSC shall use the priority message element as defined in GSM 08.08. Mapping of the priority information in this message element on the network specific eMLPP configuration shall be performed in the MSC. Queuing and resource pre-emption shall be performed accordingly if necessary.' (23.067 [10])

It is coded as follows [19]:

8	7	6	5	4	3	2	1	
Element identifier								octet 1
Length								octet 2
Priority								octet 3

Octet 2 is a binary indication of the length of the rest of the element.

Octet 3 is coded as follows:

8	7	6	5	4	3	2	1	
spare	pci	priority level				qa	pvi	octet 3

Bit 8 is spare, set to 0

pci = Pre-emption Capability indicator (see note)

0	this allocation request shall not pre-empt an existing connection
1	this allocation request may pre-empt an existing connection

priority level:

6 5 4 3	
0 0 0 0	spare
0 0 0 1	priority level 1 = highest priority
0 0 1 0	priority level 2 = second highest priority
: : : :	
1 1 1 0	priority level 14 = lowest priority
1 1 1 1	priority not used

qa = queuing allowed indicator

0	queuing not allowed
1	queuing allowed

pvi = Pre-emption Vulnerability indicator (see note)

0	this connection shall not be pre-empted by another allocation request
1	this connection might be pre-empted by another allocation request

NOTE: Pre-emption Capability indicator applies to the allocation of resources for an event and as such it provides the trigger to the pre-emption procedures/processes of the BSS. Pre-emption Vulnerability indicator applies for the entire duration of a connection and as such indicates whether the connection is a target of the pre-emption procedures/processes of the BSS.

6.4.2 Support for Priority Service

The following table identifies Priority Information Element support for Priority Service.

Note that the 3GPP specifications do not explicitly define the use of Priority IE, e.g. the data that the setting of the Information Element fields could/should be based on. Since this information element was introduced quite early in the standards, Network Element vendors may have taken this IE into other than eMLPP uses, too. Therefore, mandating usage of these fields in 3GPP specifications in this regard could cause problems.

The table indicates issues that may be achieved with using Priority Information Element, requirements that can be fulfilled with MSC internal or other additional vendor specific functionality have been also identified. Note that vendor specific information or functionality is not needed over open interfaces, where only standardized information is used.

Table 7: Priority Information Element Gap Analysis

Priority Service Requirement Item	Description	PIE support	Comments
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. \	Supported	
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.	Supported	
3 Priority Progression	The user should 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 supporting priority (including the PSTN) and in the terminating network.	Not supported/vendor specific	Vendor specific functionality is needed to set priorities for each leg. This may not be supported in all interfaces or some nodes on path may not have needed functionality.
4 Priority Radio Resource Queuing	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.	Supported	
5 Priority Level	The subscriber should 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..	Vendor specific	MMI used needs to be recognized by number analysis.
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.	Vendor specific	MMI used needs to be recognized by number analysis.
7 Applicability to Telecommunications Services	Priority Service shall be applicable to voice and data telecommunications services that require a voice or traffic channel assignment.	Supported	
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	Vendor specific	MSC has various information from HLR like Subscriber category, IMSI, etc. that can be used to identify subscription.

ETSI

	user is authorized to make a priority call. In this case, authorization of the subscriber may be realized by the usage of a PIN.		
9 Priority Service service code	Priority Service is manually requested by adding on the Priority Service service code to the origination request.	Vendor specific	MMI used needs to be recognized by number analysis.
10 Roaming	Priority Service shall be supported during roaming when the roaming network supports Priority Service.	Not supported / Vendor specific	
11 Handover	Priority Service shall be supported during handover.	Supported	
12 Priority Service charging data record	The system should record the following Priority Service charging data information, in addition to non-Priority Service CDR information: Priority Service invocation attempts, Call legs (origination and/or termination) on which Priority Service was used to gain access to the radio channel. Recording of appropriate Priority Service information.	Vendor specific	
13 Priority Trunk Queuing	Priority Service shall be able to support queuing of Priority Service calls for trunk resources.	Not supported	
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.	Not supported	

7 Conclusions

The objectives of this Feasibility Study for Priority Service were to:

1. outline the high-level technical requirements for Priority Service,

2. identify existing 3GPP capabilities related to Priority Service,

3. perform a gap analysis to determine the extent existing 3GPP specifications can support these Priority Services requirements.

The following high-level requirements were identified to support Priority Service:

1 Priority Call Origination,

2 Priority Call Termination,

3 Priority Progression,

4 Priority Radio Resource Queuing,

5 Priority Level,

6 Invocation on Demand,

7 Applicability to Telecommunications Services,

8 Authorization,

9 Priority Service service code,

10 Priority Service supported during roaming,

11 Priority Service supported during handover,

12 Priority Service charging data record,

13 Priority Trunk Queuing,

14 Coexistence with eMLPP.

The following primary 3GPP capabilities were identified to support Priority Service:

1 Service Accessibility,

2 Enhanced Multi-Level Precedence and Pre-emption (eMLPP),

3 Subscriber Identity Module (SIM) Specifications,

4 Priority Information Element.

The following table summarizes the mapping of the high-level requirements to 3GPP Specifications:

Table 8: Mapping of High-level Priority Service Requirements to 3GPP Specifications

High-level Requirement	Specification			
	3G TS 22.011, Service Accessibility	3G TS 22.067, 23.067, 24.067, eMLPP	3G TS 11.11, SIM	3G TS 08.08, 25.413, PIE
R.1 – Priority Call Origination	√ (= Supported)	√	√	√
R.2 – Priority Call Termination	√	√	√	√
R.3 – Priority Progression	NS (=Not Supported)	√	NS	NS or VS (=vendor specific)
R.4 – Priority Radio Resource Queuing	NS	PS (= Partially Supported)	NS	√
R.5 – Priority Level	PS	PS	PS	VS
R.6 – Invocation on Demand	NS	√	PS	VS
R.7 – Applicability to Telecommunications Services	√	√	√	√
R.8 – Authorization	√	√	√	VS
R.9 – Priority Service service code	NS	PS	NS	VS
R.10 – Roaming	PS	√	PS	NS/VS
R.11 – Handover	NS	PS	NS	√
R.12 – Priority Service charging data record	NS	√	NS	VS
R.13 – Priority Trunk Queuing	NS	NS	NS	NS
R.14 – Coexistence with eMLPP	NS	NS	NS	NS

Based on the analysis in this Feasibility Study, most of the high-level requirements for Priority Service can be supported through the use of Access Control, eMLPP, A/Iu Priority element, and SIM-based capabilities. The 'authorization by PIN' requirement could be supported by a handset-based solution and not a network-based solution.

Annex A (Informative): Regional Priority Service Requirements

Annexes are labeled A, B, C, etc. and are 'informative' (3G TRs are informative documents by nature).

United States Regional Requirements

For the United States, the top 5 priority levels are described in table 1.

Table A-1: Priorities for NS/EP Users

Priority Level	Responsibility	Qualifying Criteria
1	Executive Leadership and Policy Makers	Users who qualify for the Executive Leadership and Policy Makers priority will be assigned Priority 1. A limited number of PLMN technicians who are essential to restoring the PLMN networks shall also receive this highest priority treatment. Wireless carrier may assign Priority 1 to its technicians with operational responsibilities.
2	Disaster Response / Military Command and Control	Users who qualify for the Disaster Response/Military Command and Control priority will be assigned Priority 2. Individuals eligible for Priority 2 include personnel key to managing the initial response to an emergency at the local, State, regional and Federal levels. Personnel selected for this priority should be responsible for ensuring the viability or reconstruction of the basic infrastructure in an emergency area. In addition, personnel essential to the continuity of government and national security functions (e.g., conducting international affairs and intelligence activities) are included.
3	Public Health, Safety, and Law Enforcement Command	Users who qualify for the Public Health, Safety, and Law Enforcement Command priority will be assigned Priority 3. Eligible for this priority are individuals who direct operations critical to life, property, and maintenance of law and order immediately following an event.
4	Public Services/ Utilities and Public Welfare	Users who qualify for the Public Services/Utilities and Public Welfare priority will be assigned Priority 4. Eligible for this priority are those users whose responsibilities include managing public works and utility infrastructure damage assessment and restoration efforts and transportation to accomplish emergency response activities.
5	Disaster Recovery	Users who qualify for the Disaster Recovery priority will be assigned Priority 5. Eligible for this priority are those individuals responsible for managing a variety of recovery operations after the initial response has been accomplished.

Note: For US networks, these 5 priority levels are assigned by Office of the Manager, National Communications System (OMNCS) to key National Security and Emergency Preparedness (NS/EP) personnel in leadership positions.

In addition, the following Use Cases have been identified:

1. Priority Service should be ubiquitous. This requirement means that any authorized user should be able to make a priority call using any UE and that the authorization is 'tied' to the user and not the UE.

    a. If, in the short term, having a special UE expedites the fielding of this service, this is an acceptable approach for initial service. However, if the device contains the authorization, there must be a user-involved authentication (e.g., PIN) to prevent misuse or abuse by an un-authorized person.

    b. Initial service might have technology dependent implementations that include differing invocation sequences and man-machine interfaces (MMI). While this might be acceptable in the short-term, a migration needs to be planned to achieve a uniform invocation sequence and a single MMI that supports the ability for any authorized user to invoke priority service on any UE, regardless of technology.

   c.   The priority service user should authenticate once for each session. Authentication should be user friendly and will be used for accountability purposes. Authentication might be used for billing purposes. Methods of authentication might include a PIN, a credit-card-like 'swipe', or voice recognition.

   d.   The concept of using a credit card-like dialing sequence (Dial a specific prefix, enter a credit card and the destination number) for service authentication and billing is acceptable.

2.   The user should not have multiple telephone numbers, but rather the ability from one UE with which he/she is able to make priority and non-priority calls on a call-by-call basis. The user should have a user-friendly MMI and/or invocation mechanism to initiate and authenticate a priority call.

   a.   The MMI could offer the ability to place the UE into a 'Priority Service' mode or profile. During this timeframe, all calls placed from that UE are provided priority treatment. The user would then have to change 'profiles' from priority to normal subscription.

   b.   The MMI could also easily allow the user to invoke priority service on a call-by-call basis. Prompts might be required to get the user to enter a PIN, authentication, or destination number, if necessary.

3.   The user needs to make a voice call in a congested area (due to either increased call volume or infrastructure damage). The user invokes priority service and authenticates.

   a.   If end-to-end resources are available, the call proceeds as normal.

   b.   As the user attempts to place the call, the network recognizes the user as a priority service subscriber that has requested priority service and allocates network resources to this special user first before servicing other non-priority subscribers. If priority service users of different priority levels attempt to place a call simultaneous, then the user with the higher priority is serviced first by the network, followed by lower priority users, then non-priority subscribers.

   c.   If network resources are not immediately available, the network places the priority service subscriber in queue for the next available resource. The queue is managed by priority level and (within each level) time of entry into the queue.

   d.   The network provides feedback to the priority service subscriber (either tones or short messages) on the status of their call (e.g., authenticating, queuing, dropped from queue, completing).

   e.   The user needs the ability to call with priority other mobile (3G and non-3G) subscribers, PSTN subscribers, and in the future, IP voice subscribers, regardless of their priority status. (Mobile to mobile, mobile to PSTN, and mobile to IP-device).

   f.   If, in the case of the US, users need the ability to interwork with GETS, a PSTN service. Since GETS has only one priority level, priority levels need to be mapped and supported so that a GETS call gets priority origination, treatment, and termination across the wireless networks (i.e., across the air interface) and WPS calls gets mapped and supported into the PSTN.

   g.   With the current architecture, dissimilar wireless networks connect via the PSTN and not directly with each other. The PSTN is therefore responsible for 'translating' priority service indicator(s) for all types of wireless networks.

4.   The user needs data services in a congested area (due to either increased call volume or infrastructure damage).

   a.   The user needs to send priority and receive priority short messages. The user should have the ability to reject or accept the message. Again, the initiator sets the priority level of the session.

   b.   The user sends/receives e-mails, voice-mails, fax etc.

   c.   The user needs to query on-line databases and make a transaction (e.g., buy blankets, cots, water, etc).

      d.   The user needs to make a secure telephone circuit-switched data call (using COTS secure handsets, e.g., Motorola Sectera GSM phones).

5.   Charging Data Records and Billing Issues

      a.   In the service provider"s billing statement, the user should be able to see/verify each priority call attempt and result (duration if successful, and a reason for termination if unsuccessful).

6.   A Service Code of '272' has been identified to invoke Priority Service.

7.   Use Cases for PIN authentication are for further study.

8.   International roamers should not have access to Priority Service.

9.   The ability to distinguish Priority Users from eMLPP Users needs consideration.

Annex B (Informative): Change history

	SA Doc.	SA1 Doc	Spec	CR	Rev	Rel	Cat	Subject/Comment	Old	New	WI
								Change history			
Oct 12, 2001			22.950					First draft from document S1-PS-010006		0.0.0	Priority Services
Oct 26, 2001			22.950					Draft from document S1-PS-010010	0.0.0	0.0.1	Priority Services
November 2001		S1-011094	22.950					Draft from document S1-011094	0.0.1	0.0.2	Priority Services
December 2001			22.950					Draft from document S1-Priority-010016	0.0.2	0.0.3	Priority Services
January 2002		S1-020214	22.950					Draft from document S1-020214. Update of S1-Priority-010016 and S1-Priority-010017	0.0.3	0.0.4	Priority Services
February 2002		S1-020218	22.950					Update of S1-020214, incorporating S1-020215, S1-020216, and S1-020217	0.0.4	0.0.5	Priority Services
February 2002		S1-020592	22.950					Update of S1-020218 incorporating S1-020354, S1-020394 and other comments raised during the February 2002 meeting 3GPP SA1	0.0.5	0.0.6	Priority Services
February 2002		S1-020641	22.950					Update of S1-020592 using assigned TR number	0.0.6	1.0.0	Priority Services
SP-15			22.950					Presented for information to SA	1.0.0	1.0.0	Priority Services
May 2002		S1-020896	22.950					Editorial update of S1-020641 based on S1-020593 meeting results	1.0.0	1.0.1	Priority Services
May 2002		S1-021090	22.950					Editorial update of S1-020896 based on S1-021089 meeting results	1.0.1	1.1.0	Priority Services
SP-16	SP-020229	S1-021090	22.950					Presented to SA for approval	2.0.0	6.0.0	Priority Services
SP-18	SP-020667	S1-022099	22.950	001		Rel-6	D	CR to 22.950 on RAN-T changes	6.0.0	6.1.0	PRIOR-FS
SP-18	SP-020667	S1-022282	22.950	002		Rel-6	B	CR to 22.950 on Priority Trunk Queuing High Level Requirement	6.0.0	6.1.0	PRIOR-FS
SP-18	SP-020667	S1-022283	22.950	003		Rel-6	F	Changes to Emergency Calls Interactions	6.0.0	6.1.0	Prior-FS
SP-18	SP-020667	S1-022284	22.950	004		Rel-6	B	Coexistence of Priority Service and eMLPP in the same network	6.0.0	6.1.0	PRIOR-FS
SP-18	SP-020667	S1-022285	22.950	005		Rel-6	D	Priority Call Origination and Termination High Level Requirements Clarification	6.0.0	6.1.0	PRIOR-FS
SP-19	SP-030033	S1-030185	22.950	006	-	Rel-6	C	CR to TS 22.950 addressing progression of priority level when interworking with external networks	6.1.0	6.2.0	PRIOR-FS
SP-24	SP-040296	S1-040521	22.950	007	-	Rel-6	F	Deletion of Annex C (Informative) from draft ITU-T Recommendation F.706	6.2.0	6.3.0	PRIOR
SP-24	SP-040296	S1-040520	22.950	008	-	Rel-6	F	Deletion of Annex B (Informative) from ITU-T Recommendation E.106	6.2.0	6.3.0	PRIOR
SP-26	SP-040732	S1-040979	22.950	009	-	Rel-6	F	Priority Service optional support for Emergency Service	6.3.0	6.4.0	PRIOR
SP-36			22.950			Rel-7		Updated from Rel-6 to Rel-7	6.4.0	7.0.0	
SP-42			22.950			Rel-8		Updated from Rel-7 to Rel-8	7.0.0	8.0.0	
SP-46	-	-	-	-	-	-	-	Updated to Rel-9 by MCC	8.0.0	9.0.0	
2011-03	-	-	-	-	-	-	-	Update to Rel-10 version (MCC)	9.0.0	10.0.0	

| 2012-09 | - | - | - | - | - | - | - | Updated to Rel-11 by MCC | 10.0.0 | 11.0.0 | |

History

Document history		
V11.0.0	October 2012	Publication