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Technical Specification

3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Support for Internet Protocol (IP) based IP Multimedia Subsystem (IMS) Emergency calls over General Packet Radio Service (GPRS) and Evolved Packet Service (EPS) (Release 9)



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Keywords

IMS, emergency, PS, GPRS, UTRAN, E-UTRAN, EPS

3GPP

Postal address

3GPP support office address

650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet

<http://www.3gpp.org>

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Foreword

This Technical Specification 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:

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Introduction

This Technical Report documents functionality being specified to support IMS Emergency Calls over GPRS and EPS. Because IMS emergency call support is expected to impact several functional areas, this TR will describe the functionality as it is being developed. Once a functional component is complete the appropriate Technical Specifications will be updated accordingly.

1 Scope

1.1 Objective

This TR has been created for the purpose of having a single source for documenting the GPRS and EPS enhancements to support emergency calls. As solutions to particular aspects are agreed, CRs will be created for the associated TSs. This TR is not a study. The IMS Emergency Services study is available in TR 23.867 [5].

The present document includes the following:

- Functionality needed to meet the requirements as defined in TS 22.101 [2] and TS 23.167 [3] for handling IMS emergency calls over the GPRS using GERAN and UTRAN access both in the case where the UE is in normal service mode (e.g., UE has sufficient credentials and is authorized to receive the service) and where the UE is in limited service mode (e.g. the UE does not have sufficient credentials or is not authorized to receive GPRS service).
- Functionality needed to meet the requirements as defined in TS 22.101 [2] and TS 23.167 [3] for handling IMS emergency calls over the EPS using E-UTRAN access both in the case where the UE is in normal service mode (e.g., UE has sufficient credentials and is authorized to receive the service) and where the UE is in limited service mode (e.g. the UE does not have sufficient credentials or is not authorized to receive EPS service).
- EPS functionality needed to support IMS emergency call handovers between 3GPP accesses and between 3GPP and non-3GPP accesses.

NOTE: Access network specific impacts for a UE to attach to the non-3GPP access network for emergency calling are out of scope of 3GPP.

- EPS functionality to support of IMS emergency calls that complies with applicable requirements for provision of location information as defined in TS 23.167 [3].

2 Background

GPRS Emergency Services procedures were partially complete in Release 7. A decision was made at SA#36 to remove GPRS Emergency Services support from Release 7 so that a complete solution could be developed in Release 9 (see clause 9.17 of the SA#36 meeting report [4]). The functionality provided support for valid subscribers initiating an IMS Emergency Call over UTRAN while in their home network or while roaming. The GPRS enhancements included:

- a) **Definition of an Emergency APN:** A UE that needs to do IMS emergency registration (for example always in VPLMN) shall start by requesting a PDP context with the emergency APN in GPRS. The emergency APN is the basic part of the Rel-7 solution, because it enables IMS emergency services with local break-out for roaming UEs in VPLMN. In a home network, a PDP context to an emergency APN also provides a way for GPRS to identify a session for emergency services so that special GPRS handling, that may override subscription, can be allowed.(e.g., QoS and ARP). This capability is critical for the most basic solution that could be supported and should be the highest priority functionality to be specified.
- b) **UE QoS indication of emergency:** The UE shall include an emergency indication in the UMTS bearer QoS IE when establishing or modifying the PDP context used for the emergency service. It has been determined that this is not needed. QoS can be provided by either establishment of the emergency PDP context or through PCC.
- c) **QoS Negotiation:** SGSN handling of the ARP is modified to not re-verify the value received from the GGSN against the subscription. This allows the GGSN to change the ARP for emergency services to a high priority so the call will not be pre-empted. This is functionality is important for overriding subscription in order to override ARP subscription limits.
- d) **Network support indication:** The SGSN shall indicate in the Attach Accept and RAU Accept messages whether GPRS emergency functions are supported in the network. This indicator improves functional efficiency.

3 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 22.101: "Service aspects; Service principles".
- [3] 3GPP TS 23.167: "IP Multimedia Subsystem (IMS) emergency sessions".
- [4] 3GPPTSG SA#36 meeting report: http://www.3gpp.org/ftp/tsg_sa/TSG_SA/TSGS_36/Report.
- [5] 3GPP TR 23.867: "Internet Protocol (IP) based IP Multimedia Subsystem (IMS) emergency sessions".
- [6] 3GPP TSG SA#36 TD SP-070427 by Nokia/NSN: "IMS emergency services using GPRS access in Rel-7".
- [7] 3GPP TS 23.167 v7.4.0, 2007-03-20: "IP Multimedia Subsystem (IMS) emergency sessions".
- [8] 3GPP TSG SA#37 meeting report: http://www.3gpp.org/ftp/tsg_sa/TSG_SA/TSGS_37/Report.
- [9] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".
- [10] 3GPP TS 23.107: "Quality of Service (QoS) concept and architecture".
- [11] 3GPP TS 23.221: "Architectural requirements".
- [12] 3GPP TS 23.228: "IP Multimedia Subsystem (IMS); Stage 2".
- [13] 3GPP TS 23.203: "Policy and charging control architecture".
- [14] 3GPP TS 23.401: "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access".
- [15] 3GPP TS 23.122: "Non-Access-Stratum (NAS) functions related to Mobile Station (MS) in idle mode".
- [16] OMA AD SUPL: "Secure User Plane Location Architecture", <http://www.openmobilealliance.org>.
- [17] 3GPP TR 23.891: "Evaluation of LCS Control Plane Solutions for EPS".
- [18] 3GPP TS 25.413: "UTRAN Iu interface Radio Access Network Application Part (RANAP) signalling".
- [19] 3GPP TS 36.413: "Evolved Universal Terrestrial Radio Access (E-UTRA); S1 Application Protocol (S1AP)".
- [20] 3GPP TS 23.402: "Architecture enhancements for non-3GPP accesses".
- [21] 3GPP2 X.S0060, "HRPD Support for Emergency Services", <http://www.3gpp2.org>.

4 Definitions and abbreviations

4.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1], TS 23.167 [3] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1] or TS 23.167 [3].

Limited Service Mode: The UE state that only allows emergency calls. This state is entered when a UE is unable to find a suitable cell to camp on, or the SIM is not inserted, or if it receives certain responses to a Location Registration request (e.g., "illegal UE"), it attempts to camp on a cell irrespective of the PLMN identity. See TS 23.122[15].

Invalid UICC: A UE that does not have a UICC or a UE with an IMSI that does not have corresponding subscription information in the HLR.

Local regulation categories:

- (1) **Normal Mode:** Only subscribers are supported. Meaning, an emergency call is treated by the network as any other call regarding subscription. The UE must be authenticated and authorized for service in their current location in order to gain network access for emergency calling.
- (2) **Valid IMSI limited:** Only subscribers with a valid IMSI that can be authenticated are supported by the network. They may not be authorized for PS service in their current location but are allowed to over ride subscription restrictions to initiate an IMS emergency call.
- (3) **All Emergency Calls (All-EmCalls):** Regulation requires all UEs to be able to access the network to initiate an emergency call, regardless of authentication or authorization status. Therefore, even a UE without valid credentials should be served (e.g. UE's without an UICC, UE's that received "IMSI unknown in HLR" or "PLMN not allowed" rejects).

4.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

5 Overall Functionality to Support IMS Emergency Calls

5.1 IMS Functionality

5.1.1 Release 7 functionality to be considered for Release 9

As documented in clause 9.17 of the SA#37 meeting report [8], GPRS functionality removed from Release 7 can be reinserted with Release 9 CRs. The table in Annex A lists the CRs handled during SA#36, #37 and #38 regarding GPRS support of IMS emergency calls. The CRs in the table marked as "open" indicates they need to be considered in Release 9.

- 1) IP Multimedia Subsystem (IMS) emergency sessions; TS 23.167 [3]: For the most part the IMS specification is access network agnostic. However references and examples referring to GPRS were removed from the TS and these need to be added back. If only valid subscribers are addressed initially, then GPRS would be added to the applicable clauses and another CR would be needed later to add GPRS to the clauses addressing limited mode. Refer to SA#37 CR0069R3.

5.1.2 Release 9 Functionality

- 1) IP Multimedia Subsystem (IMS) emergency sessions; TS 23.167 [3]:
 - The E-UTRAN specification TS 23.401 [14] needs to be added to the references clause and referenced throughout the document where appropriate where other IP-CAN specifications are referenced.
 - Annex E "Emergency support in different IP-CANs" needs to have GPRS updated.

5.2 GPRS Functionality

5.2.1 UTRAN Functionality overview

The minimum UTRAN functionality needed to support IMS emergency calling for UEs in normal service mode, while in their home network or while roaming, is the ability to establish an emergency PDP context (i.e., the emergency APN). This allows QoS and ARP rules to be established for sessions associated with the emergency PDP context to meet local regulatory requirements. An emergency PDP context also allows the knowledge of the emergency session to be supported during handovers that cause a new SGSN to be assigned because the emergency PDP context is included in the mobility messages (Forward Relocation Request and Routing Area Update). The QoS negotiation capability and network indication of emergency support are also efficient handling of emergency calls.

5.2.2 UTRAN Normal Service Mode Functionality

TR 23.867 [5] is the study for IMS emergency calls and associated IP-CAN impacts.

IP-CAN requirements to support IMS emergency calls are specified in clause 4.4 of TS 23.167 [3]. Additionally, TS 23.167 v7.4.0 [7] Annex A contains further analysis of GPRS impacts related to the IP-CAN requirements.

A synopsis of UTRAN functionality needed to support IMS emergency calls for UEs operating in normal service mode is provided in Annex B.

5.2.2.1 Release 7 functionality to be considered for Release 9

The table in Annex A lists the CRs handled during SA#36, #37 and #38 regarding GPRS support of IMS emergency calls. The CRs in the table marked as "open" indicates the functionality needs to be considered for Release 9.

NOTE: QoS may be changing in Release 8 and also needs to be considered.

5.2.2.1.1 General emergency services support descriptions:

- 1) *Architecture requirements* TS 23.221[11]: Based on SA#37 CR0054R3 the following is considered:
 - Clause 8 "Support of IM CN Subsystem services" – Provide a description of GPRS emergency call handling for UE recognized emergency calls including emergency attach, emergency PDP context, QoS, CS/IM domain selection. (Note: Do not include UICC-less handling from CR0054R3 as that will be done separately under UTRAN Limited Service Mode).
- 2) *General Packet Radio Service (GPRS); Service description; Stage 2* TS 23.060 [9]: Based on SA#36 CR594R2 the following is considered:
 - Add a new clause 5x "Functionality for IMS emergency services support. Provide an overview of PS domain emergency call support functionality including: emergency attach, emergency PDP context, QoS, PCC, emergency services network support indicator, allocation/retention priority handling for emergency services.

5.2.2.1.2 Emergency APN:

- 1) *General Packet Radio Service (GPRS); Service description; Stage 2* TS 23.060 [9]: Based on SA#37 CR0598 and SA#36 CR0596, the following is considered to support establishing a PDP context to an Emergency APN:
 - Reference section: Add TS 23.167 IP Multimedia Subsystem (IMS) emergency sessions;

- Clause 3.2 Abbreviations: Add Em-APN Emergency Access Point Name;
- Clause 6.5.3 Combined GPRS/IMSI Attach procedure;
- Clause 9.2.2.1 PDP Context Activation Procedure:
 - Step 1 – Include procedure for requesting the Emergency Context in the Activate PDP Context Request
 - Step 4 – Include GGSN handling of Em-APN (GGSN filtering and that subscription is not required)
 - Annex A – A.1 Definitions: State the Em-APN PDP context is linked with a dynamic PDP address.
 - Annex A – A.2 Selection Rules: Include Em-APN in SDL for establishing PDP context.

5.2.2.1.3 QoS Negotiation

- 1) *General Packet Radio Service (GPRS); Service description; Stage 2* TS 23.060 [9]: Based on SA#36 CR0594R2, QoS interworking per TS 23.107 [10] needs to be considered:
 - Clause 6.9.1.2.2 Inter SGSN Routing Area Update (A/Gb-mode) - 3rd paragraph following step 12: Enhance the description of prioritization to include consideration of highest QoS per TS 23.107 [10].
 - Clause 6.9.1.3.2 Combined Inter SGSN RA/LA Update (A/Gb-mode) - 3rd paragraph following step 16: Enhance the description of prioritization to include consideration of highest QoS per TS 23.107 [10].
 - Clause 6.9.2.1 Routing Area Update (Iu-mode) - 3rd paragraph following Note 4: Enhance the description of prioritization to include consideration of highest QoS per TS 23.107 [10].
 - Clause 6.9.2.2.1 Serving RNS Relocation Procedure (Iu-mode),
 - Clause 6.9.2.2.2 Combined Hard Handover and SRNS Relocation Procedure, and
 - Clause 6.9.2.2.3 Combined Cell/URA Update and SRNS Relocation Procedure: following the text for the figure, insert a new paragraph that describes sending the PDP Contexts in a prioritized order to the new SGSN in the Forward Relocation Request message and that prioritization is implementation dependent but should be based on current activity and the highest QoS per TS 23.107 [10].
 - Clause 6.13.2.1 Inter-SGSN Inter-system Change: Iu mode to A/Gb mode Inter-SGSN Change, and
 - Clause 6.13.2.2 A/Gb mode to Iu mode Inter-SGSN Change: 2nd paragraph following step 21: Enhance the description of prioritization to include consideration of highest QoS per TS 23.107 [10].
- 2) *General Packet Radio Service (GPRS); Service description; Stage 2* TS 23.060 [9]: Based on SA#36 CR0595R2, SGSN QoS negotiation is modified so that the ARP IE value is not re-verified by the SGSN or GGSN after the GGSN sets it. This allows the GGSN/PCC to modify the ARP to a value higher than the subscription allows so that the session will not be pre-empted.
 - Clause 9.2.2.1 PDP Context Activation Procedure - Step 4 last paragraph,
 - Clause 9.2.2.1.1 Secondary PDP Context Activation Procedure – Step 3 last paragraph,
 - Clause 9.2.3.1 SGSN-Initiated PDP Context Modification Procedure – Step 2 last paragraph,
 - Clause 9.2.3.3 MS-Initiated PDP Context Modification Procedure: add requirement that the ARP IE is not subject to re-verification.
 - Clause 9.2.3.2 GGSN-Initiate PDP Context Modification Procedure – Step 1: Add a statement that a disabled ARP restriction will not be enabled during context modification if an ARP subscription restriction was disabled during context activation.

5.2.2.1.4 PCC enhancement to support IMS emergency calls:

- 1) *Policy and charging control architecture*; TS 23.203 [13]: Based on SA#37 CR0051, in the GPRS specific clause add the ability for PCRF verification with IM CN that an Emergency APN is being used for an emergency call.

- 2) In addition, Release 8 PCC enhancements should be considered in TS 23.203 [13] to include a PCC based Admission and Priority parameter as described in clause 5.2.2.2.

5.2.2.1.5 Network support indication

- 1) *General Packet Radio Service (GPRS): Service description; Stage 2* TS 23.060 [9]: Based on SA#36 CR0594R2, an indicator for network support of PS emergency calls is sent to the UE in attach and routing update responses. The CR specified the indicator in successful response messages. In addition to the functionality in the CR, the indicator would also be needed in attach and routing update reject messages. This will allow restricted mode UEs to know if the network can be accessed for emergency services.
 - Clause 6.5.3: Combined GPRS/IMSI Attach procedure: add indicator to text of step 9 (attach accept),
 - Clause 6.9.2.1: Routing Area Update Procedure (Iu-mode): add indicator to text of step 17 (routing area update accept),
 - Clause 6.13.2.2 Inter-SGSN Inter-system Change: A/Gb mode to Iu mode Inter-SGSN Change: add indicator to text of step 16 (routing area update accept).

5.2.2.2 Key Issue 1: PCC rule for Allocation and Retention Priority

5.2.2.2.1 Description

Based on SA2#59 S2-073681, an Emergency ARP parameter in the PCC based rules is considered to allow PCC to override the subscription ARP. This allows PCC to assign an ARP value to a session that may not be allowed per subscription. This allows PCC to assign a higher priority to emergency sessions.

5.2.2.2.2 Solution

Policy and charging control architecture; TS 23.203 [13]: needs to consider defining a PCC based rule for Allocation and Retention Priority parameter for emergency sessions. The PCC rules can be got from the solution described on clause 5.3.4.

5.2.3 UTRAN Limited Service Mode Functionality

A synopsis of Limited Service Mode procedures is in Annex C.

5.2.3.1 Re-Introduction of Release 7 Functionality

5.2.3.2 Key Issue 1: Limited Mode UE Attaching to a GPRS network (UE with UICC)

5.2.3.2.1 Description

If a UE that has an HLR entry for its IMSI but is in a limited service mode, normal attach procedures would fail. However, a UE may be permitted limited access to the network for emergency services when required by local regulation.

5.2.3.2.2 Solution

When a limited mode UE detects an emergency services request, the UE includes an emergency indicator in the Attach Request. This will allow GPRS to override attach restrictions:

- 1) *General Packet Radio Service (GPRS): Service description; Stage 2* TS 23.060 [9]:
 - Clause 6.5.3 Combined GPRS / IMSI Attach procedure.

5.2.3.3 Key Issue 2: Network Support of Emergency Services

5.2.3.3.1 Description

For normal mode, a network indicator is sent from the SGSN to the UE in the Attach Accept and Routing Update Accept messages to the UE to indicate the network support of PS emergency services. If a UE's request had been rejected, no indicator had been defined. This would result in the UE inefficiently attempting Emergency Attaches in networks that may not support PS emergency services. Also, lack of PS emergency services advertisement shall cause the UE to use CS access to place emergency calls.

5.2.3.3.2 Solution

By including the indicator in Attach and Routing Update Reject messages, the UE would know if it could attempt an Emergency Attach when in limited service mode and the user attempts an emergency call.

1) *General Packet Radio Service (GPRS): Service description; Stage 2 TS 23.060 [9]:*

- Clause 6.5.3: Combined GPRS/IMSI Attach procedure: add indicator to text of step 9 (attach reject),
- Clause 6.9.2.1: Routing Area Update Procedure: add indicator to text of step 17 (routing area update reject),
- Clause 6.13.2.2.1 Inter-SGSN Inter-system Change: A/Gb mode to Iu mode Inter-SGSN Change using Gn/Gp: add indicator to text of step 16 (routing area update reject).

5.2.3.4 Key Issue 3: Limited Mode UE Attaching to a GPRS network (UICCless UE)

5.2.3.4.1 Description

If a UE is in limited service mode because it does not have a UICC or does not have an HLR entry for its IMSI, normal attach procedures would fail. However, a UE may be permitted limited access to the network for emergency services when required by local regulation.

5.2.3.4.2 Solution

When a limited mode UE detects an emergency services request, the UE includes an emergency indicator in the Attach Request and its IMEI. This will allow GPRS to override attach restrictions and skip authentication and location update procedures.

1) *General Packet Radio Service (GPRS): Service description; Stage 2 TS 23.060 [9]:*

Clause 6.5.3 Combined GPRS / IMSI Attach procedure.

5.2.4 GERAN Normal Service Mode Functionality

5.2.4.1 Key Issue 1: Emergency Calls over GERAN

5.2.4.1.1 Description

The number of GERAN (A/Gb mode) networks that will support voice over IMS real-time services will be limited. So voice over IMS is not likely to be supported.

5.2.4.1.2 Solution

If a UE is camped on a GERAN network, it is recommended that emergency calls should be initiated in CS mode. GERAN support for IMS emergency services will not be developed in this release.

5.2.5 GERAN Limited Service Mode Functionality

See clause 5.2.4.1. It is recommended that CS mode is used for UEs capable of A/Gb mode.

5.3 EPS Functionality

5.3.1 EPS Functionality overview

The solution for the EPS is aimed at supporting both normal mode and limited service mode. When the UE is in normal service mode the normal EMM procedures apply. As the UE enters limited service mode as specified in TS 23.122 [15] (e.g. Attach request is rejected), special EMM procedures for emergency service may be needed to access EPS. For release 9, the proposed solution uses the emergency APN. In all cases (e.g. home, roaming, normal mode, limited service mode), emergency connectivity to an emergency APN will be used. The UE initiates the emergency connectivity upon recognition of dialled emergency number. This connectivity is limited to using emergency services available at the PDN served by the emergency APN, via static rules (thus no impact on PCC).

The Allocation/Retention Priority (ARP) values set for the bearer used to provide connectivity to the Emergency APN shall be adequate to support emergency services and the QCI shall select a GBR service for conversational voice service. And the GBR set to the value necessary to support the selected codec for the emergency service.

5.3.2 E-UTRAN Normal Service Mode Functionality

A synopsis of E-UTRAN functionality needed to support IMS emergency calls for UEs operating in normal service mode is provided in Annex B.

5.3.2.1 Key Issue 1: Attach: shall it be a normal attach or an emergency attach?

5.3.2.1.1 Description

It has to be decided whether a UE that will start an emergency session and has not yet made an initial attach to the network needs to perform a normal attach or an emergency attach.

5.3.2.1.2 Solution

The emergency attach procedure should not be attempted until:

- the UE is in limited service mode and
- the UE is attempting to set up an emergency session

When a normal attach is used, a default bearer is set up based on subscription or operator policy. The APN associated to this default bearer is normally not supporting the features associates to an emergency access. So, subsequent to a normal attach, another (additional) default bearer to the emergency APN to be set up. This PDN connection shall have the QoS attributes suitable to support an emergency call.

The handling of the limited service state attach for the E-UTRAN is described in the relevant clause in this TR.

5.3.2.2 Key Issue 2:

5.3.2.2.1 Description

< description of key issue >

5.3.2.2.2 Solution

< there may be more than one solution >

< description of each solution for the key issue, include UE and network impact >

5.3.3 E-UTRAN Limited Service Mode Functionality

A synopsis of Limited Service Mode procedures is in Annex C.

5.3.3.1 Key Issue 1: Attach in limited service state

5.3.3.1.1 Description

If the attach procedure or the tracking area update procedures fail the UE enters a limited service mode allowing the UE to place only emergency calls – if the network allows for that - until another non blacklisted TAI is identified on the broadcast information, in which case a normal attach will be attempted. Before a UE can place an emergency call, it needs to be attached to the network.

5.3.3.1.2 Solution

If the user attempts to place an emergency call while in limited service mode, then an emergency attach is attempted with the IMSI or IMEI as a UE identifier. IMEI is included if the UE does not have a UICC. The IMEI is included to potentially blacklist malicious callers. The emergency attach will not directly cause a TAU to be performed and will override any service restriction that would otherwise forbid the UE from being attached in the specific TA.

The emergency attach procedure also caused the establishment of a default EPS bearer providing PDN connectivity to the emergency APN. This PDN connection shall have the QoS attributes suitable to support an emergency call. Over this connectivity it is possible to establish an IMS session for emergency services only, and static rules will prevent the usage of this APN for other purposes.

5.3.3.2 Key Issue 2: Mobility management during an emergency call

5.3.3.2.1 Description

An ongoing successful emergency call placed while the UE is in normal or limited service state may be interrupted by a failed TA update, handover to a restricted area, or any other service restriction implying the UE should be detached. A mechanism is needed to avoid this.

In order to support emergency call continuity, the UE can be permitted to handover to an access restriction area. A mechanism is needed to solve this.

5.3.3.2.2 Solution – special handling of TA updates for emergency services

Provide explicit context in the EPC so that the network is aware an emergency call is ongoing. This will avoid TA UPDATE failures (the TA updates always succeed during an emergency call). When the UE enters limited service mode, the network maintains bearer resources used for the emergency call.

5.3.3.2.3 Solution – special handling of Handover for emergency services

Provide explicit context in the EPC and E-UTRAN so that the network is aware an emergency call is ongoing. The MME can identify the bearer used for the emergency call based on the Emergency APN in EPS bearer context. In order to inform the E-UTRAN about the usage of the bearer for emergency purposes, the MME allocates an ARP value reserved for emergency services to the emergency bearer. In case a bearer with an emergency ARP values is established, the Mobility Restriction functionality shall not be executed in the radio network and the core network for emergency bearers, the UE can be handover to these areas included in the Handover Restriction List. If the source eNodeB finds the target eNodeB included in the Handover Restriction List and an emergency call is ongoing for the UE, the source eNodeB only sends bearer resources used for the emergency call to the target MME/eNodeB and requests the MME to release the non-emergency bearers by sending a Bearer Release Request. The target eNodeB also considers the emergency bearer ARP when evaluating bearers to be allowed to handover.

5.3.3.3 Key Issue 3: Additional PDN Connection during Limited Service Mode

5.3.3.3.1 Description

A UE in a limited Service mode after establishing an Emergency Attach should not have access to any additional PDN connection due to the nature of the mode the UE is operating on. Thus the system needs to ensure that no additional PDN access is possible.

5.3.3.3.2 Solution – Restricting Additional PDN connection after Emergency Attach

The UE Requested PDN Connectivity procedure is not applicable if the UE has performed an Emergency Attach. The reason is that only emergency call is allowed on such a connection, and this can be handled with a single PDN connection. So the UE shall not send additional PDN Connectivity requests in this mode, if a fraudulent UE does try to establish an additional PDN Connection, then the MME shall reject such request with appropriate reason.

NOTE: When GPRS procedures are specified in the appropriate specifications (i.e. when the CRs are written), the same Single PDN Connection for Emergency Attach/PDP Context shall be applied for limited service mode of operation.

5.3.3.4 Key Issue 4: When to Detach after an emergency call

5.3.3.4.1 Description

When a UE is emergency attached, it is not allowed on the network except for emergency calls. Once on the network for emergency calling, how long should the UE remain attached after the call terminates must be considered. The time needs to be long enough not to drop a very long emergency call. But the timer needs to be short enough to release unused resources (e.g., to permit the UE to reselect a cell in the HPLMN and return to normal service; or to limit the time during which the UE might reselect a GERAN cell). This may require some timer reset depending on service or other conditions. The timer supports cases, e.g. when the initial emergency call may have terminated abnormally and should be allowed to be re-established quickly. The emergency detach timer may need to be started also for UEs that change from normal to limited services conditions, e.g. when moving into restricted areas.

It can be noted that the MME is not aware of the SIP signalling that releases the emergency call. Additionally, it is not yet determined whether dedicated bearers will be established and released when the emergency call starts and ends.

5.3.3.4.2 Solution – Detach of UEs in limited service mode

The user may need to re-initiate the emergency call. MME initiated implicit detach procedures after inactivity timeout specific to emergency attach are used. This timer may be shorter than that used for non-emergency inactivity timeouts. The UE is also allowed to explicitly detach using normal UE detach procedures. The HSS-initiated detach procedure is not suitable for the detach of UEs that are emergency attached, because the emergency service is not a subscribed service and these UEs may not have an HSS entry.

5.3.4 QOS handling for emergency calls

5.3.4.1 Description

If an EPS Bearer is used for emergency service, the bearer should get special handling, e.g. special ARP should be set for the bearer in order to guarantee the bearer can be established in case of resource limitations. Special emergency PCC rules for the bearer can be used to solve this.

5.3.4.2 Emergency Call without an Emergency APN

When the AF receives emergency services, the AF provides Emergency indicator information to the PCRF. According to that indicator, the PCRF provides emergency services PCC rule to the PCEF. The PCRF instructs PCEF the bearer is used for emergency services by setting the ARPs of PCC rules to Emergency ARPs. This enables the relevant network elements to prioritize bearers with the ARPs when performing policy control. According to the Emergency ARPs, the PCEF initiates dedicated bearer activation procedure to establish emergency bearer.

Editor's note: It is expected that the current PCC procedures are sufficient to set an appropriate ARP for the emergency call.

5.3.4.3 Emergency Call with an Emergency APN

The emergency APN allows the UE to obtain local bearer and a local P-CSCF. The PCEF performs an IP-CAN Session Establishment procedure as defined in TS 23.203 [13]. The emergency APN is provided to the PCRF from the PCEF. The PCRF instructs PCEF the bearer is used for emergency services by setting the ARP of PCC rules to Emergency

ARPs. This enables the relevant network elements to prioritize bearers with the ARP when performing admission control.

If the AF does not provide an emergency indication but the emergency service information is associated with an UE IP address belonging to an emergency APN, it should be possible for the PCRF to reject the emergency service provided by the P-CSCF (and thus to trigger the release of the associated emergency session). This PCRF check will be added to the GPRS annex of TS 23.203 [13].

5.3.5 Load re-balancing between MMEs

5.3.5.1 Key Issue 1: Releasing connected UEs

5.3.5.1.1 Description

If the UE is in ECM_CONNECTED mode and the MME needs to be offloaded, the MME can initiate an S1 release procedure which forces the S1 and RRC connections to be released and the UE to perform TAU. This procedure may cause an emergency call to be released and it is possible that a failure during TAU procedures could prohibit the connection to be re-established to the same PSAP. UEs in an active emergency session should not be released.

5.3.5.1.2 Solution

When a UE is in ECM-CONNECTED mode with an active emergency session, the MME should not release the UE. The MME should wait until the UE initiates a TAU or becomes inactive.

5.4 EPS Emergency Location Functionality

Emergency location functionality may be based on a user plane solution specified by OMA in SUPL 2.0 [16] or based on a control plane solution for EPS [17]. See also TS 23.167 [3] for additional location functionality that may be supported for IMS emergency calls.

NOTE: Support for UICC-less is defined by OMA as of SUPL 2.0. Possible improvement of SUPL support for UICC-less EPS emergency calls is out of scope for 3GPP.

To support routing of calls to the correct PSAP, in some countries, use of the serving cell identity may be required. Mechanisms for the CN to obtain the serving cell identity are inherently supported by the S1 and Iu interfaces, and, Location Reporting procedures specified in TS 25.413 [18] for UTRAN and TS 36.413 [19] E-UTRAN.

5.5 EPS functionality for handovers between 3GPP and HRPD access

5.5.0 General

When both the 3GPP and HRPD accesses support emergency calls in the packet domain, support for handover of emergency calls between 3GPP access and HRPD access follows the architecture and flows in TS 23.402 [20] for handover between 3GPP and non-3GPP accesses.

- For the cases of non-optimized handover between 3GPP access and HRPD access and optimized handover from HRPD to 3GPP access, the emergency call is over a PDN connection that may not be in the same default PDN. As with the flows for these cases in 23.402, the UE establishes the PDN connection for the emergency call after the default PDN is handed over. In these cases when the target access is 3GPP access, the emergency requirements on the attach procedures in Annex B.2 for normal mode UEs and Annex C for limited service mode UEs apply.
- For the case of optimized handover from 3GPP to HRPD access, when an emergency call is established in LTE, the context for the emergency call is established in the HRPD access prior to handover using session maintenance procedures over the S101 interface.

5.5.1 Key Issue 1: Availability of APN and PDN GW address in limited service mode for network based handovers

5.5.1.1 Description

When a UE performs an attach with the EPS, the HSS stores an APN and PDN GW identity for the UE. However, when the UE is in limited service mode and does not have a validated IMSI, it will not have a record in the HSS. This information is needed for handover to HRPD access because the PDN GW identity is retrieved from the HSS/3GPP AAA Server when the UE attaches to the non-3GPP access.

5.5.1.2 Solution

When a UE which is in limited service mode and does not have a validated IMSI performs an emergency call handover from 3GPP access to HRPD access, besides emergency APN and PDN GW address in the direct transfer request message to HRPD on S101 as specified in TS 23.402 [20], the MME will also include IMEI as no IMSI is provided. This applies in the optimized handover case, and is not available in the non optimized case.

5.5.2 Key Issue 2: Identification of an emergency call at attach for HRPD access

5.5.2.1 Description

When a UE attaches to an HRPD access for handover of an emergency call, the HRPD access must have a means to indicate to the EPC that a PDN connection is for an emergency call.

5.5.2.2 Solution

As with 3GPP access, the HRPD access will provide to the PDN GW an Emergency APN.

NOTE: How Emergency APN is provided to the HRPD access is defined in specifications for the HRPD access technology and is outside the scope of 3GPP.

5.5.3 Key Issue 3: Emergency call handover from HRPD access to E-UTRAN in limited service mode

5.5.3.1 Description

When a UE performs handover from HRPD access to E-UTRAN, Attach procedure specified in TS 23.401 [14] is used. The Attach procedure is shared with several procedures including the initial attach, handover (especially from non-3GPP) and emergency attach. And it is expected that the emergency call handover procedure is different from emergency attach and the Attach procedure should be modified to support the emergency call handover. Therefore, it is needed to distinguish emergency handover from the existing procedures including the emergency attach for adding an appropriate emergency call handover flow into the Attach procedure. And also other relevant procedures should be considered in same way.

5.5.3.2 Solution

5.6 EPS functionality for HRPD access

5.6.1 Overview of EPS functionality

The solution for the EPS is aimed at supporting both normal mode and limited service mode. When the UE is in normal service mode the normal mobility management procedures for HRPD apply. As the UE enters limited service mode (e.g., Attach request is rejected), special mobility management procedures for emergency service may be needed to access EPS. For Release 9, the proposed solution uses the emergency APN. In all cases (e.g., home, roaming, normal

mode, limited service mode), emergency connectivity to an emergency APN will be used. The UE initiates the emergency connectivity upon recognition of dialled emergency number.

The ARP values set for the bearer used to provide connectivity to the Emergency APN shall be adequate to support emergency services (this is to be decided when the ARP definition is complete) and the QCI shall select a GBR service for conversational voice service. And the GBR set to the value necessary to support the selected codec for the emergency service.

As with 3GPP access, an emergency attach is used for HRPD access only when:

- the UE is in limited service mode and
- the UE is attempting to set up an emergency session

Support for emergency in specific HRPD access is documented in specifications for that technology, such as [21].

Annex A: Release 7 CRs for GPRS Emergency Services

The following table contains the Release 7 CRs addressed under the IMS Emergency Services agenda item in SA#36, SA#37 and SA#38. The CRs with the status "open" need to be considered for Release 9.

SA#	SP pkg	TS	CR#	Description	Action	Status
36	070263			LS from SA2 asking about GPRS in rel.7	None	closed
36	070427			Nokia/NSN summary of GPRS status	Use as guideline for Rel-9	open
36	070435			LS from CT regarding GPRS status in rel.7; CT CRs pending SA decision	Send LS to CT once SA2 accepts CRs to TSs	open
38	070910	22.101	0245	Limits IM CN support to IWLAN and FBI	approved at SA#38; N/A for SA2; verify Rel-9 did not also change	closed
36	070383	23.060	0594R2	- Adds clause 5.x describing what is/not supported for emer calls - Adds ref to QoS (TS 23.107) - Adds ntwk notification of SGSN support of PS emer calls.	rejected at SA#36; consider as separate parts in Rel-9/TR; clause 5.x should reflect Rel-9 functionality	open
36	070383	23.060	0595R2	To support priority of PS emer calls, the Allocation/Retention Priority Information Element is not re-verified	rejected at SA#36; consider for Rel-9/TR	open
36	070383	23.060	0596	Clarification of Emergency APN selection rules due to incomplete implementation of CR0586; Missing decision action APN(R) =Em-APN is added into Figure A.1:SDL Diagram 1	rejected at SA#36; consider for Rel-9/TR	open
37	070535	23.060	0598	All changes introduced by CR 0586rev1(S2-070565) are removed: - reference to TS23.167 - Em-APN abbreviation - Em-APN specific handling in PDP Context Activation procedure - Em-APN specific handling in APN selection rules	approved at SA#37; consider for Rel-9	open
36	070384	23.107	0162R3	Emergency Indication is added to the UMTS QoS attributes.	rejected at SA#36; not needed, PCC support of emergency services accomplishes this.	closed
36	070385	23.167	0065R1	Aligns CS/PS selection w/22.101	approved at SA#36; complete for Rel-9	closed
36	070385	23.167	0066	Removes Editor's note on access network reject of anonymous request	approved at SA#36; complete for Rel-9	closed
37	070535	23.167	0067R6	Require a UE to include IP-CAN identity information if available in the SIP INVITE to enable a P-CSCF to determine the general UE location – e.g. if the UE is roaming.	approved at SA#37; complete for Rel-9	closed
37	070535	23.167	0069R3	Removes GPRS references/text	approved at SA#37; consider parts for Rel-9 (Annex A information goes in the new TR)	open
38	070887	23.167	0071R1	Correction of Emergency Registration Required 380 Response	approved at SA#38; complete for Rel-9	closed
38	070887	23.167	0072R1	Cleanup of outstanding issues for IMS Emergency (removes several editor's notes)	approved at SA#38; complete for Rel-9	closed
38	070887	23.167	0075R1	380 response generation	approved at SA#38; complete for Rel-9	closed
38	070887	23.167	0077R4	P-CSCF procedure clarifications and Emergency Registration time	approved at SA#38; complete for Rel-9	closed

SA#	SP pkg	TS	CR#	Description	Action	Status
37	070549	23.203	0051	Removal of PCC verification that Emergency APN is used for IM CN emergency call	approved at SA#37; consider for Rel-9 but in the GPRS specific clause A.1.3.2.1	open
38	070887	23.221	0054R2	see CR0054R3	revised to 070897 at SA#38; N/A for SA2	closed
38	070897	23.221	0054R3	Removal of GPRS specific support for Emergency	approved at SA#38; consider for Rel-9 via 2 CRs; 1 for normal mode, 2nd for limited mode	open
37	070535	23.228	0700	Add TS 23.167 IMS emergency sessions as reference in TS 23.228 and correct clause 5.13 to indicate the support of IMS emergency session	approved at SA#37; complete for Rel-9	closed

Annex B: IMS Emergency Calls over UTRAN and E-UTRAN

B.1 IMS Emergency Calls over UTRAN

B.1.1 UTRAN Use Cases

B.1.1.1 Normal Mode – Initial Call

For a UTRAN based IMS Subscriber with valid GPRS and IMS subscriptions, the following procedures are needed to initiate an IMS Emergency Call over UTRAN.

	Home/ Roaming	Attached	IMS Registered?	Action
1a	Home	Yes	Yes	Case 1a: IMS Emergency Registration is required¹ a) Create PDP Context to Emergency APN (with appropriate QoS/priority/ARP/P-CSCF assignment) b) IMS Emergency Registration c) Initiate IMS Emergency Call d) GGSN/PGW static filters to ensure Em-APN limited use
1b	Home	Yes	Yes	Case 1b: No IMS Emergency Registration Required a) No GPRS action needed; b) Initiate IMS Emergency Call c) P-CSCF detects emergency session and informs GGSN/PGW via PCRF of Emergency Session (this may trigger network requested QoS procedure to have a secondary PDP context for the emergency call).
2	Home	Yes	No	a) Create PDP Context to Emergency APN (with appropriate QoS/priority/ARP/P-CSCF assignment) b) IMS Emergency Registration c) Initiate IMS Emergency Call d) GGSN/PGW static filters to ensure Em-APN limited use
3	Home	No	No	a) Normal Attach ² b) Create PDP Context to Emergency APN (with appropriate QoS/priority/ARP/P-CSCF assignment) c) IMS Emergency Registration d) Initiate IMS Emergency Call e) GGSN/PGW static filters to ensure EmAPN limited use
4	Roaming	Yes	Yes or No	a) Create PDP Context to Emergency APN (with appropriate QoS/priority/ARP/P-CSCF assignment) b) IMS Emergency Registration c) Initiate IMS Emergency Call d) Local GGSN/PGW static filters to ensure EmAPN limited use

¹ 3GPP TS 23.167 specifies two options when the UE is in its home network and already IMS registered, either (1a) always require the UE to perform an IMS Emergency Registration prior to making an emergency call, or (1b) initiate the emergency call using the existing IMS registration.

² FFS – When "restricted mode" is supported, it needs to be determined if a UE that has knowledge of the need to initiate an emergency call prior to the PDP connectivity, whether the UE should use a "normal attach" or "emergency attach".

	Home/ Roaming	Attached	IMS Registered?	Action
5	Roaming	No	No	a) Normal Attach (see footnote 2) b) Create PDP Context to Emergency APN (with appropriate QoS/ priority/ ARP/P-CSCF assignment) c) IMS Emergency Registration d) Initiate IMS Emergency Call e) Local GGSN/PGW static filters to ensure EmAPN limited use

B.1.1.2 Normal Mode – Handover

	Use Case	Solution
6	UTRAN based IMS capable UE that has no roaming restrictions	Only intra-PLMN handovers are considered in Rel-9. A UE in normal mode is allowed to perform handovers and are not restricted from entering a new area so no enhancements are needed.

B.1.2 GPRS Non-Emergency Procedures to Support Emergency Sessions

The following are based on CRs that were agreed in Release 7 for GPRS emergency call support and need to be reconsidered for Release 9:

B.1.2.1 Network Indicator

To inform the UE whether or not the network supports the Emergency APN, the SGSN will always include the "Emergency Support Indication" in the response to the UE on Attach and Routing Update (Attach Accept, Routing Update Accept, Attach Reject, Routing Update Reject).

B.2 IMS Emergency Calls over E-UTRAN

B.2.1 E-UTRAN Use Cases

B.2.1.1 Normal Mode – Initial Call

For a E-UTRAN based IMS Subscriber with valid EPS and IMS subscriptions, the following procedures are needed to initiate an IMS Emergency Call over E-UTRAN.

	Home/ Roaming	EMM- Registered	IMS Registered?	Action
1a	Home	Yes	Yes	Case 1a: IMS Emergency Registration is required³ a) UE requested PDN connectivity for an Emergency APN (with appropriate QoS/ priority/ ARP/P-CSCF assignment) b) IMS Emergency Registration c) Initiate IMS Emergency Call via E-CSCF d) PDN GW static filters to ensure EmAPN limited use
1b	Home	Yes	Yes	Case 1b: No IMS Emergency Registration Required a) No EPS action needed; b) Initiate IMS Emergency Call c) P-CSCF detects emergency session and informs PDN GW via PCRF of Emergency Session (this may trigger network requested QoS procedure to have dedicated GBR bearer for the emergency call).
2	Home	Yes	No	a) UE requested PDN connectivity for an Emergency APN (with appropriate QoS/ priority/ ARP/P-CSCF assignment) b) IMS Emergency Registration c) Initiate IMS Emergency Call d) PDN GW static filters to ensure EmAPN limited use
3	Home	No	No	a) Normal Attach ⁴ b) UE requested PDN connectivity for an Emergency APN (with appropriate QoS/ priority/ ARP/P-CSCF assignment) c) IMS Emergency Registration d) Initiate IMS Emergency Call e) PDN GW static filters to ensure EmAPN limited use
4	Roaming	Yes	Yes or No	a) UE requested PDN connectivity for an Emergency APN (with appropriate QoS/ priority/ ARP/P-CSCF assignment) b) IMS Emergency Registration c) Initiate IMS Emergency Call d) Local PDN GW static filters to ensure EmAPN limited use
5	Roaming	No	No	a) Normal Attach (see footnote 4) b) UE requested PDN connectivity for an Emergency APN (with appropriate QoS/ priority/ ARP/P-CSCF assignment) c) IMS Emergency Registration d) Initiate IMS Emergency Call e) Local PDN GW static filters to ensure EmAPN limited use

³ TS23.167 specifies two options when the UE is in its home network and already IMS registered, either (1a) always require the UE to perform an IMS Emergency Registration prior to making an emergency call, or (1b) initiate the emergency call using the existing IMS registration.

⁴ FFS – When "restricted mode" is supported, it needs to be determined if a UE that has knowledge of the need to initiate an emergency call prior to the PDP connectivity, whether the UE should use a "normal attach" or "emergency attach".

B.2.1.2 Normal Mode – Handover

	Use Case	Solution
6	E-UTRAN based IMS capable UE with no roaming restrictions.	Only intra-PLMN handovers are considered in Rel.9. A UE in normal mode is allowed to perform handovers and are not restricted from entering a new area so no enhancements are needed.

B.2.2 EPS Non-Emergency Procedures to Support Emergency Sessions

The following are based on CRs that were agreed in Release 7 for GPRS emergency call support and need to be considered for EPS:

B.2.2.1 Network Indicator

To inform the UE whether or not the network supports the Emergency APN, the MME will always include the "Emergency Support Indication" in the response to the UE on Attach and Tracking Area Update (Attach Accept, Tracking Area Update Accept, Attach Reject, Tracking Area Update Reject).

Annex C: Local regulation for emergency call

Local regulation for emergency calling sometimes requires a network to provide emergency call handling regardless of a caller's subscription.

Local regulation for emergency call support is grouped into the following categories: "Normal Mode", "Valid IMSI limited", and "All Emergency Calls (All-EmCalls)".

The following table summarizes the necessary procedures to support UEs in different service states for each of the categories of local regulation. The type of local regulation a network supports is in the "Local Regulation" column and the UE service states are in the "Valid IMSI", "Valid Location", and "Valid Service" columns.

	Local regulation (Note 1)	Valid IMSI	Valid Location (Note 2)	Valid Service (Note 3)	Action
1	Normal only	N	Y or N	Y or N	During network selection: a) Normal attach procedures b) Authentication fails c) No Emergency Service d) Attach Reject; emer = N Later if UE detects an emergency call, the UE will not be able to use the PS network.
2	Normal only	Y	N	Y or N	During network selection: a) Normal attach procedures b) Authentication succeeds c) Update Location failure d) No Emergency Service e) Attach Reject; emer = N Later if UE detects an emergency call, the UE will not be able to use the PS network.
3	Normal only	Y	Y or N	N	Same as Invalid Location (case 2)
4	Valid IMSI limited	N	Y or N	Y or N	During network selection: a) Normal attach procedures b) Authentication fails c) Attach reject; emer = N Later if UE detects an emergency call, the UE will not be able to use the PS network.
5	Valid IMSI limited	Y	N	Y or N	During network selection: a) Normal attach procedures b) Authentication succeeds c) Location Update fails d) Attach reject; emer = Y Later if UE detects an emergency call: e) Emergency Attach; include IMSI f) Authentication succeeds g) Skip Location update h) Attach Accept; emer=Y i) Create PDP Context (GPRS) or PDN Connection (EPS) to Emergency APN (with appropriate QoS/ priority/ ARP/P-CSCF assignment)
6	Valid IMSI limited	Y	Y or N	N	Same as Valid IMSI with Invalid Location (case 5)

	Local regulation (Note 1)	Valid IMSI	Valid Location (Note 2)	Valid Service (Note 3)	Action
7	All-EmCalls	N	Y or N	Y or N	During network selection: (Note 4) a) Normal attach procedures b) Authentication fails c) Attach reject; emer = Y Later if UE detects an emergency call: d) Emergency Attach; include IMEI e) Skip Authentication* f) Skip Location update g) Attach Accept; emer=Y h) Create PDP Context (GPRS) or PDN Connection (EPS) to Emergency APN (with P-TMSI, appropriate QoS/ priority/ ARP/P-CSCF assignment)
8	All-EmCalls	Y	N	Y or N	During network selection: a) Normal attach procedures b) Authentication succeeds c) Location Update fails d) Attach reject; emer = Y Later if UE detects an emergency call: e) Emergency Attach; include IMSI f) Authentication succeeds g) Skip Location update h) Attach Accept; emer=Y i) Create PDP Context (GPRS) or PDN Connection (EPS) to Emergency APN (with P-TMSI, appropriate QoS/ priority/ ARP/P-CSCF assignment)
9	All-EmCalls	Y	Y or N	N	Same as All-EmCalls with invalid Location (case 8)
NOTE 1: Local regulation – the entries in this column represent the minimal level of user subscription required for a network to provide emergency services.					
NOTE 2: Valid Location - the UE is being served in an area it is allowed to be attached.					
NOTE 3: Valid Service – the UE is allowed PS service (e.g., is not barred due to credit limit exhaustion)					
NOTE 4: UEs that are aware that an emergency attach with IMSI will be denied (e.g. UE's without an UICC, UE's that previously received "IMSI unknown in HLR" or "PLMN not allowed" reject), the UE may skip the normal attach attempt (steps a, b, c) and initiate an emergency attach with IMEI, starting at step d.					
* Authentication may not be performed. If authentication is performed and fails, access would still be allowed.					

C.1 GPRS/EPS enhancements to support Limited Service Mode UEs

From the table above, the following functionality is required:

- (1) Including the "Emergency Support Network Indicator" on Attach/Routing/Tracking Update Reject messages is used to inform the UE of the network's support of Emergency Services for "Limited Service Mode" UEs. If the indicator is set to "no" in a reject to the UE, then the UE will not attempt an Emergency Attach while in a limited service mode. If the indicator is set to "yes" in a reject to the UE, then the UE may perform an Emergency Attach while in limited service mode.
- (2) Where IMSI is used as the UE identifier for mobility management; for UEs that do not have a valid IMSI, the IMEI will be used as the UE identifier (e.g., Attach, Request PDP Context, Forward Relocation Request). Once attached, the SGSN/MME will generate a P-TMSI for the UE that can be used for UE – SGSN/MME signalling (include P-TMSI in Attach Accept).
- (3) When a UE performs an Emergency Attach with IMEI, authentication is skipped or if performed and fails, will continue with the Emergency Attach.
- (4) When a UE performs an Emergency Attach (IMSI or IMEI) the HLR Location Update is skipped.

- (5) Inter-SGSN/MME Relocation procedures (Forward Relocation Request) will need to include an indication that the UE is in limited service mode so that authentication and/or updating the HLR with the new location can either be skipped or if fails, the call can still be allowed to continue if required by local regulation.

Annex D: TS 23.401 Release 9 Changes

Key : **Green** highlight indicates new text for existing TS 23.401 clauses . TS 23.401 clause 5.9.2 is all new text for IMS emergency call support.

*****Start of Change 23.401 v830_S2-087299.1*****

**NOTICE: ALL TEXT UNDER TS 23.401 CLAUSE 5.9.2 IS
NEW**

5.9.2 IMS Emergency Call Support

5.9.2.1 Introduction

The bearer services for IMS emergency call support are functionalities provided by the serving network of the UE and do not require a subscription. However, subscription related restrictions such as roaming restrictions and bearer limits may apply to the emergency bearer services , depending on local regulation. To provide IMS emergency services, the MME is configured with Emergency Configuration Data that is applied to all emergency bearer services that are established on UE request. The Emergency Configuration Data contains the Emergency APN which is used to derive PDN GW .

5.9.2.2 EPC Capabilities to Support IMS Emergency Calls

5.9.2.2.1 Introduction

EPC functions and capabilities are provided per clause 4 except as specified in the following clauses .

5.9.2.2.2 Architecture Reference Model

Per clause 4.2, the non-roaming architectures (Figure 4.2.1-1 and Figure 4.2.1-2) and roaming architecture with the visited operator's application function (Figure 4.2.2-3) apply. The other roaming architectures with services provided by the home network do not apply.

5.9.2.2.3 Mobility Restrictions

When local regulation requires Emergency Calls to be provided regardless of mobility restrictions, the *Mobility Restrictions per clause 4.3.5.7*, should not be applied to emergency connections. When emergency bearers are created, the MME includes an indication to E-UTRAN. When in state ECM_CONNECTED, the source E-UTRAN considers this indication during handover evaluation. If only restricted target cells are available, E-UTRAN can handover the emergency bearers and include non-emergency bearers in the "Bearers to be Released" list.

5.9.2.2.4 PDN GW selection function (3GPP accesses)

When a PDN GW is selected for IMS emergency call support, the *PDN GW selection function* described in clause 4.3.8.1 for normal bearer services does not apply. The PDN GW selection does not depend on subscriber information in the HSS since emergency call support is a local, not subscribed service.

The PDN GW selection function shall derive a suitable PDN GW in the visited PLMN by using the Emergency APN. The PDN GW address is derived from the Emergency APN and the protocol type on S5 (PMIP or GTP) by using the Domain Name Service function.

If the Domain Name Service function provides a list of PDN GW addresses, one PDN GW address is selected from this list. If the selected PDN GW cannot be used, e.g. due to an error, then another PDN GW is selected from the list. The specific interaction between the MME and the Domain Name Service function may include functionality to allow for

the retrieval or provision of additional information regarding the PDN GW capabilities (e.g. whether the PDN GW supports PMIP-based or GTP-based S5/S8, or both).

If the PDN GW identity is statically configured in the MME, then it may be a FQDN or an IP Address[es].

5.9.2.2.5 QoS

The EPS Bearer description in clause 4.7.2.1 states "*The initial bearer level QoS parameter values of the default bearer are assigned by the network, based on subscription data (in case of E-UTRAN the MME sets those initial values based on subscription data retrieved from HSS). The PCEF may change those values based in interaction with the PCRF or based on local configuration.*" Where local regulation supports calls from an unauthorised caller, the MME may not have subscription data. Additionally, the local network may want to provide IMS emergency call support differently than what is allowed by a UE subscription. Therefore, the initial QoS values configured in the MME will be based on local configuration. The PDN GW can make the final decision on QoS parameters.

5.9.2.2.6 PCC

When connecting to a PDN GW for IMS emergency call support and dynamic policy is used, per clause 4.7.5, the PCRF provides the PDN GW with the QoS parameters, including ARP for the emergency bearers to prioritize the bearers when performing admission control. Per clause 4.7.5, local configuration of static policy functions is also allowed and not subject to standardization. The PDN GW can make the final decision on QoS parameters.

The PCRF also has the ability to ensure the emergency PDN GW connection is used only for IMS emergency sessions. The PCRF can reject an IMS session established via the emergency PDN GW connection if the AF (i.e., P-CSCF) does not provide an emergency indication to the PCRF.

5.9.2.2.7 IP Address Allocation

When an emergency session is established in the visited/serving network, and if the UE does not have an IP address, the UE is assigned a dynamic IP address in the visited/serving network. The PDN type value shall be according to UE capabilities and network preference (if preference is applicable for a UE).

5.9.2.2.8 Load re-balancing between MMEs

As per load re-balancing procedures in clause 4.3.7.3, the MME is allowed to off-load ECM-CONNECTED mode UEs by initiating S1 Release procedures. When a UE is in ECM-CONNECTED mode with an active emergency session, the MME should not release the UE. The MME should wait until the UE initiates a TAU or becomes inactive. The MME may release the UE under critical conditions such as the need to perform an MME node restart.

5.9.2.x1 Emergency Attach

An Emergency Attach procedure, based on the *Attach Procedure* in clause 5.3.2.1, is used when a UE is in a limited service mode and the UE needs a PDN connection for emergency services. The enhancements needed to support Emergency Attach are:

- a) The Attach Request indicates request type "emergency".
- b) If the UE has a valid IMSI it includes it otherwise the UE includes its IMEI in the emergency attach request.
- c) Where local regulation requires support for unauthenticated or unauthorized UEs, subscription and authorization procedures may be skipped or performed and failing is accepted.

The *Attach Procedure* Steps are modified as follows:

Step 1 (Attach Request): UE includes the emergency attach indication and IMSI or IMEI. If the UE has a valid IMSI then it includes the IMSI when initiating Attach with request type "emergency". Otherwise the IMEI is included.

Step 5a (Authentication): If the MME is configured to accept unauthenticated emergency services the MME skips the authentication procedure or accepts that authentication fails when the request type is "emergency".

Step 5b (Identity Request-ME Identity): The IMEI may have been included in Step 1. If not, it may be requested. If the MME is configured to accept unauthenticated emergency services the MME skips the IMEI check or accepts that it fails when the request type is "emergency".

Step 8 (Update Location Request): The location update is not performed for an unauthenticated UE and may not be performed for unauthorized UE.

Step 11 For UEs with valid IMSI MME does not reject emergency attach due to access restrictions, regional restrictions or subscription check failure and does not notify any reject to HSS.

Step 12 (Create Default Bearer): For request type “emergency” the MME applies the parameters from MME Emergency Configuration Data.

Step 14 (PCC): Where dynamic PCC is deployed, the PCRF, recognizing the emergency APN, instructs the PCEF that the bearer is used for emergency services by setting the ARP of the PCC rules so that bearers can be prioritized when performing admission control. If dynamic PCC is not deployed, static rules are configured in the PDN GW.

Step 17 (Initial Context Setup Request/Attach Accept): The MME determines the UE AMBR to be used by the eNB based on MME configured values. The MME includes an ARP value reserved for emergency service for the emergency bearers in the Session Management Request.

Step 25 (Notify Request): The Notify Request is not performed for an unauthenticated UE and may not be performed for unauthorized UE.

Editor's Note: It is FFS if handover to non-3PPP accesses is supported during an emergency call for UEs without a valid IMSI (i.e., no HSS entry).

5.9.2.x2 Emergency Tracking Area Update

This procedure is executed when the UE has an on-going emergency call when a tracking area update is triggered. If the MME changes, the emergency connection information must be conveyed to the MME so that the appropriate service level can be maintained.

Tracking area update during an emergency call is based on the procedures in clause 5.3.3. The enhancements needed to support IMS Emergency Calls are:

- a) If emergency calls are supported for UEs in a limited service mode, the tracking area update must succeed if the UE moves to a restricted area during the emergency call. This includes continuing the procedure if security procedures fail or the location update fails or indicates the UE is now in a restricted area.

The *Tracking Area Update procedure with Serving GW change* Steps in clause 5.3.3.1 are enhanced or used as follows:

Step 4, Step 6, Step 7 (Context Request/Authentication/Context Acknowledge): For emergency calls in limited service mode and where the network supports emergency calls in limited service mode, the validation procedures may be skipped. If performed and fails, the TAU may proceed where required by local regulation.

Step 5 (Context Response): Per clause 5.3.3.1, the APN is included in the MME context information, thereby conveying the emergency call context when the APN is the Emergency APN.

Step 12 (Update Location): For emergency calls in limited service mode and where the network supports emergency calls in limited service mode, the location update procedures may be skipped. If performed and fails, the TAU may proceed where required by local regulation.

Step 15 (Update Location Ack): The regional subscription restrictions and access restrictions are ignored where emergency access is required per local regulation.

The *Tracking Area Update procedure without Serving GW change* Steps in clause 5.3.3.2 are enhanced or used as follows:

Step 4, Step 6, Step 8, Step 9 (Context Request(oMME)/Context Request(oSGSN), Authentication/Context Acknowledge): For emergency calls in limited service mode and where the network supports emergency calls in limited service mode, the validation procedures may be skipped. If performed and fails, the TAU may proceed where required by local regulation.

Step 5 (Context Response): Per clause 5.3.3.1, the APN is included in the MME context information, thereby conveying the emergency call context when the APN is the Emergency APN.

Step 16 (Update Location): For emergency calls in limited service mode and where the network supports emergency calls in limited service mode, the location update procedures may be skipped. If performed and fails, the TAU may proceed where required by local regulation.

Step 21 (Update Location Ack): The regional subscription restrictions and access restrictions are ignored where emergency access is required per local regulation.

5.9.2.x3 Detach Procedures

The user that is emergency attached, may need to re-initiate the emergency call, for example, if the call dropped. Explicit UE initiated detach and MME initiated implicit detach procedures per clause 5.3.8 apply. MME initiated implicit detach procedures are based on an inactivity timeout specific to limited service mode. This timer may be shorter than that used for non-emergency inactivity timeouts.

The Detach procedures for UEs that are emergency attached are handled per normal detach procedures in clause 5.3.8. The enhancements needed to support IMS Emergency Calls are as follows:

The *UE-initiated Detach Procedure* in clause 5.3.8.2 Steps are enhanced as follows:

Step 1, Note 3: NAS security is not performed for an emergency attached UE.

5.9.2.x4 Emergency PDN Connection

This procedure is executed after the UE has successfully attached to the EPS. When the UE detects an emergency call, it establishes a PDN connection using the emergency APN so that emergency call handling can be provided by the local EPS per EPS configuration without subscription limitations.

A UE request for emergency PDN connectivity is based on the *UE request for PDN connectivity procedure* in clause 5.10.2. The enhancements needed to support IMS Emergency Calls are:

- a) The PDN Connectivity Request indicates request type "emergency". The APN included is the emergency APN.

Editors note: It is to be defined whether the APN from the MME Emergency Configuration Data or the APN signalled from UE takes precedence for the PDN GW selection.

- b) MME configured Emergency Configuration Data is used to establish the default bearer.

The *UE request for PDN connectivity procedure* Steps are enhanced as follows:

Step 1 (PDN Connectivity Request): Request type indicates "emergency". The APN included is the Emergency APN that the MME recognizes and therefore does not verify against the UE's subscription.

Step 2 (Create Default Bearer Request): Parameters derived from MME Emergency Configuration Data are used for establishing the default bearer.

Step 4 (PCC): Where dynamic PCC is deployed, the PCRF, recognizing the emergency APN, instructs the PCEF that the bearer is used for emergency services by setting the ARP of the PCC rules so that bearers can be prioritised when performing admission control. Otherwise, these rules are statically configured in the PDN GW. If dynamic PCC is not deployed, static rules are configured in the PDN GW.

Step 7 (Bearer Setup Request): The MME determines the UE AMBR to be used by the eNB. Either the existing UE AMBR value is reused or a new UE AMBR is determined based on MME configured values for the UE-AMBR and the updated set of APN-AMBRs in use. The MME includes an ARP value reserved for emergency service for the emergency bearers in the Session Management Request.

Step 15 (Notify Request): The Notify Request including the Emergency APN and PDN GW identity is sent to the HSS.

5.9.2.x5 UE requested PDN connectivity during Limited Service Mode

In a limited service mode of operation, the UE shall not request any additional PDN connectivity when already connected via Emergency Attach procedure, as specified in 5.9.2.x1. If a UE does make an attempt to initiate an additional PDN connection in this scenario, the MME shall reject this request.

5.9.2.x6 Handover

When the source eNodeB needs to handover the UE to a target eNodeB, under ordinary circumstances the source eNodeB will not select a target if it is on the Handover Restricted List. An exception is when there are no other targets and the eNodeB needs to handover emergency bearers. The source eNodeB may select a target eNodeB that is on the Handover Restricted List for emergency bearers and request the MME to release non-emergency bearers.

The target eNodeB is also allowed to reject bearers during handover. The target eNodeB needs to take into consideration the emergency bearer QoS indicator (e.g. the ARP) when determining which bearers to reject.

When the MME receives the list of bearers to be released, the MME will release according to the bearer deactivation procedures in clause 5.4.3.

This eNodeB check for emergency bearer QoS is applicable to the following handover procedures:

- Clause 5.5.1.1.2, X2-based handover without Serving GW relocation:
 - (Handover execution) – the source eNodeB would not include non-emergency bearers in the handover request to the target eNodeB if the target is on the Handover Restricted List. The source eNodeB sends a Bearer Release Request to the MME for the bearers that were not included in the Handover Request. If the target eNodeB was not restricted all bearers, were included in the Handover Request. If the target eNodeB can not accept all bearers, it needs to consider the emergency bearer QoS when selecting bearers to accept.
- Clause 5.5.1.1.3, X2-based handover with Serving GW relocation:
 - (Handover execution) – same eNodeB handling as described above.
- Clause 5.5.1.2 S1-based handover:
 - Step 2 (Handover Required) – if the target eNodeB is restricted, the source eNodeB only includes emergency bearers.
 - Step 5 (Handover Request Ack) – when considering which bearers to allow, the target eNodeB needs to consider the ARP value reserved for emergency bearer.
 - Step 9 (Handover Command) – if the Handover Command was received from a restricted target, the source eNodeB can request the MME to release the non-emergency bearers.

5.9.2.x7 Location Support

Emergency location functionality may be based on a user plane solution specified by OMA in SUPL 2.0 [x1] or based on a control plane solution for EPS [x2]. See also TS 23.167 [x3] for additional location functionality that may be supported for IMS emergency calls.

NOTE: Support for UICC-less is defined by OMA as of SUPL 2.0. Possible improvement of SUPL support for UICC-less EPS emergency calls is out of scope for 3GPP.

To support routing of calls to the correct PSAP, in some countries, use of the serving cell identity may be required. Mechanisms for the CN to obtain the serving cell identity are inherently supported by the S1 and Iu interfaces, and, Location Reporting procedures specified in TS 25.413 [22] for UTRAN and TS 36.413 [36] for E-UTRAN.

Editor's Note: When creating the TS 23.401 CR, add the above references: [x1] OMA AD SUPL: "Secure User Plane Location Architecture", <http://www.openmobilealliance.org>. [x2] 3GPP TR 23.891: "Evaluation of LCS Control Plane Solutions for EPS". [x3] 3GPP TS 23.167: "IP Multimedia Subsystem (IMS) emergency sessions"

5.9.2.x8 MME Emergency Configuration Data

Editor's Note: A new table to be added in 23.401 clause 5.7.2. Other parameters that need be included is FFS.

Table 5.7.2-x: MME Emergency Configuration Data

Field	Description
Emergency Access Point Name (em APN)	A label according to DNS naming conventions describing the access point used for Emergency PDN connection (wild card not allowed).
Emergency QoS profile	The bearer level QoS parameter values for Emergency APN's default bearer (QCI and ARP).
Emergency PDN GW identity	The statically configured identity of the PDN GW used for emergency APN. The PDN GW identity may be either an FQDN or an IP address.

Annex E: TS 23.060 Release 9 Changes

TS 23.060 clause 5.x is all new text for functionality for emergency call support.

**NOTICE: ALL TEXT UNDER TS 23.060 CLAUSE 5.x IS
NEW**

5.x Functionality for emergency call support

5.x.y APN Restriction handling for Emergency calls

During PDP Context Activation procedure or default bearer activation (for connectivity through S4) for emergency, GGSN or PGW shall ignore APN Restriction. During PDP Context Modification procedure (via the APN Restriction received from the GGSN or PGW) and inter SGSN changes, the SGSN shall not deactivate emergency related bearer to maintain valid APN combination. Same restriction also applies to procedures in TS 23.401.

Annex F: Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2009-03	SP#43	SP-090093	-	-	MCC Update for presentation to TSG SA	0.7.0	1.0.0
2009-03	-	-	-	-	Approved at TSG SA#43. Upgraded to Release 9	1.0.0	9.0.0