

# 3GPP TR 23.870 V9.0.0 (2009-06)

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*Technical Report*

## **3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; SR VCC Support for IMS Emergency Calls (Release 9)**



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Keywords

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LTE, UMTS, Emergency, IMS, Voice

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## 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.

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# 1 Scope

SRVCC as specified in TS 23.216 [3], provides handover of voice calls from E-UTRAN/HSPA to UTRAN/GERAN or from E-UTRAN to CDMA2000 1x. SRVCC of IMS emergency calls is not supported in TS 23.216 [3], and thus handover of such calls will have unpredictable effects, in the worst case causing the call to fail. This is a serious concern for operators and their subscribers, and may cause regulatory violations in some parts of the world.

Therefore, the objective of this document is to study both the EPS and IMS aspects of how to best support the handover of ongoing emergency calls for the following scenarios:

- E-UTRAN to UTRAN/GERAN CS.
- HSPA to UTRAN/GERAN CS.
- E-UTRAN to CDMA2000 1x CS.

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# 2 References

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

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

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TR 23.869: "Support for IMS Emergency Calls over GPRS and EPS".
- [3] 3GPP TS 23.216: "Single Radio Voice Call Continuity (SRVCC); stage 2".
- [4] 3GPP TS 23.237: "IP Multimedia Subsystem (IMS) Service Continuity; Stage 2".
- [5] 3GPP TS 23.167: "IP Multimedia Subsystem (IMS) emergency sessions".
- [6] 3GPP TR 23.891: "Evaluation of LCS Control Plane Solutions for EPS".
- [7] 3GPP TS 24.229: "IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3".

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# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] 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].

**Single Radio Voice Call Continuity (SRVCC):** see TS 23.216 [3].

**Emergency Session Transfer Number for SRVCC:** A number used in the session transfer procedure for emergency calls, pointing toward the serving (visited if roaming) IMS E-SCC AS which handles the IMS emergency session transfer from PS to CS access.

## 3.2 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].

E-STN-SR	Emergency Session Transfer Number for SR VCC
E-SCC AS	Emergency Service Centralization and Continuity Application Server

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## 4 Overall Requirements

### 4.1 Service Characteristics

### 4.2 Architectural Requirements

1. The transport layer aspects of the solution shall be based on SRVCC procedures specified in Re1-8 TS 23.216 [3] - Single Radio Voice Call Continuity (SR VCC).
2. The IMS aspects of the solution shall be aligned with the conclusions of the study in TR 23.868 Extended Support of IP Multimedia Subsystem (IMS) Emergency Sessions where appropriate.
3. The solution should be able to provide continuity of location support following SR VCC of emergency calls by providing the PSAP with an accurate initial and updated location estimate, according to applicable regional requirements and subject to the constraints of the PSAP interface.
4. The solution shall provide a mechanism to perform session transfer for UEs in limited service mode and prohibit when necessary, according to local regulations.

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## 5 Scenarios

### 5.1 SR VCC from E-UTRAN (or HSPA) to 3GPP 2/3G

#### 5.1.1 Use case #1

1. UE initiate IMS emergency session over EPS or UTRAN (HSPA). This solution will be defined as according to the outcome of TR 23.869 [2] and TR 23.891 [6].
2. Visited IMS network is used for routing the session to PSAP. The SIP session is anchored in E-SCC AS.
3. UE is moving out of E-UTRAN (or HSPA) coverage into 2/3G.
4. SR VCC is performed and the UE is connected to 2/3G CS.
5. Handover back to E-UTRAN (or HSPA) is not supported.

**Editor's note: It is FFS which details of the solution on location continuity in case of SRVCC for emergency calls will be documented in TR 23.891 [6] and TR 23.870, respectively.**

## 5.2 SR VCC from E-UTRAN to CDMA2000 1x

### 5.2.1 Use case #1

1. The UE initiates IMS emergency session over EPS. This solution will be defined as according to the outcome of TR 23.869 [2].
2. Visited IMS network is used for routing the session to PSAP. The SIP session is anchored in E-SCC AS similar to anchoring of session transfer in SCC AS, as specified in TS 23.237 [4].
3. The UE is moving out of E-UTRAN coverage to CDMA2000 1x network.
4. SRVCC is performed and the UE is connected to CDMA 2000 1x network.
5. Handover back to E-UTRAN is not supported.

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## 6 Architecture Alternatives

### 6.1 Alternative 1 – SRVCC from E-UTRAN (or HSPA) to 3GPP 2/3G

#### 6.1.1 General

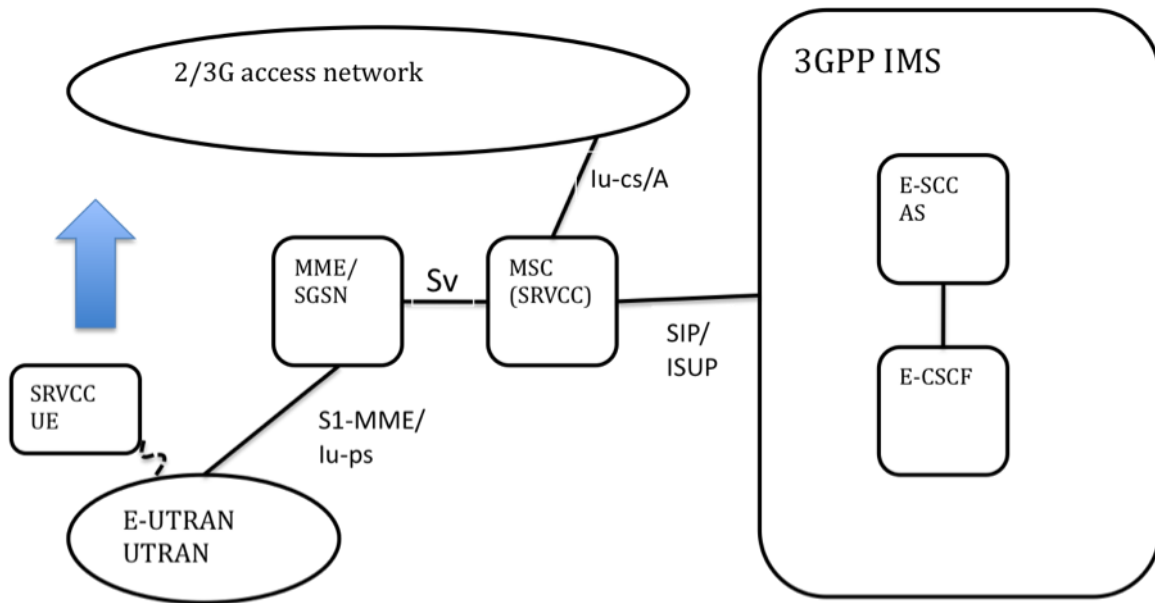
This clause presents an Architecture alternative to allow SR VCC for IMS emergency session from E-UTRAN to 2/3G CS. It uses E-STN-SR for session transfer procedure. E-STN-SR is an Emergency Session Transfer Number for SR VCC. MSC Server is enhanced for SR VCC (aka SR VCC MSC). SR VCC MSC initiates the session transfer with E-STN-SR, using the same procedure as defined for regular SR VCC with STN-SR in TS 23.216 [3].

E-STN-SR points toward the serving (visited if roaming) IMS network which handles the IMS emergency session. The E-SCC AS performs the session continuity when the INVITE (E-STN-SR) is received. This procedure for executing session transfer is similar to the one being defined in TS 23.237 [4] for regular SR VCC procedure, in clause 6.3.2.1.4.

For emergency session over E-UTRAN or HSPA, this functionality will be covered by TR 23.869 [2]. The MME or SGSN has to be aware that the UE is having an emergency session.

Other SR VCC related functionality follows what is being defined in TS 23.216 [3].

The following figure shows a general architecture to support SR VCC IMS emergency with E-STN-SR.



**Figure 6.1.1-1: Architecture to support SR VCC for IMS emergency session with E-STN-SR**

NOTE: The MSC server enhanced with SR VCC may not be the final target MSC which connects to the target cell.

*Editor's note: Architecture enhancements for Location Reporting/Continuity are FFS.*

## 6.1.2 Functional Entities

### 6.1.2.1 MSC Server enhanced for SRVCC

MSC Server enhanced for SRVCC provides the same functions as specified in TS 23.216 [3] plus:

- Support of location continuity as defined in TR 23.891 [6].
- Support of Limited Service Mode.

### 6.1.2.2 MME/SGSN

MME/SGSN provides the same functions as specified in TS 23.216 [3] plus:

- Identifies the UE and indicates emergency call as part of handover request.
- May send location information to support location continuity as defined in TR 23.891 [6]
- Shall send equipment identifier to the MSC server during the handover procedure for the case of UEs operating in limited service mode.

NOTE: How MME/SGSN know this session is emergency session will be studied as part for TR 23.869 [2].

*Editor's note: Additional enhancements (e.g., location aspect) are FFS.*

### 6.1.2.3 E-CSCF

E-CSCF shall provide the procedures for the insertion of the E-SCC-AS into the signalling path of an IMS emergency call.



### 6.1.2.4 E-SCC AS

E-SCC-AS shall provide the procedures for IMS session anchoring and PS to CS session transfer. The E-SCC-AS acts as a routing B2BUA which invokes third party call control (3pcc) for enablement of Session Transfers as specified in TS 23.237 [4]

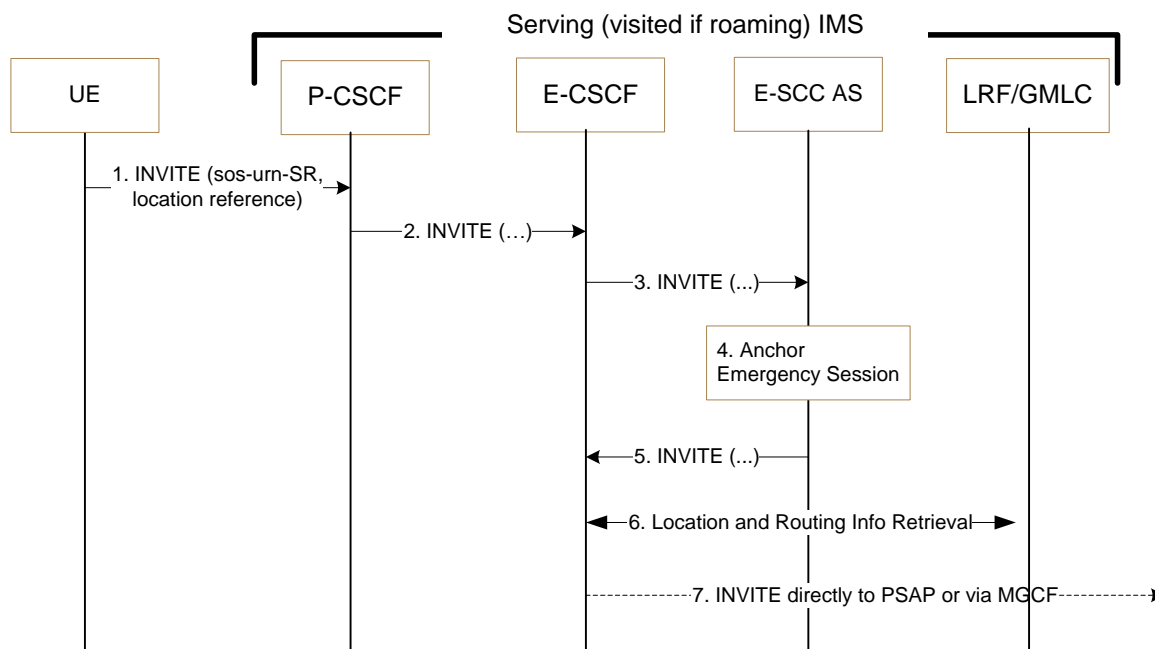
### 6.1.2.5 SRVCC UE

The SRVCC UE has IMS emergency call capabilities as defined in TS 23.167 [5] and TR 23.869 [2].

## 6.1.3 Call flows

### 6.1.3.1 IMS Emergency Origination

Figure 6.1.3.1-1 provides an example flow for an emergency session established in IMS, illustrating how the emergency session is anchored.

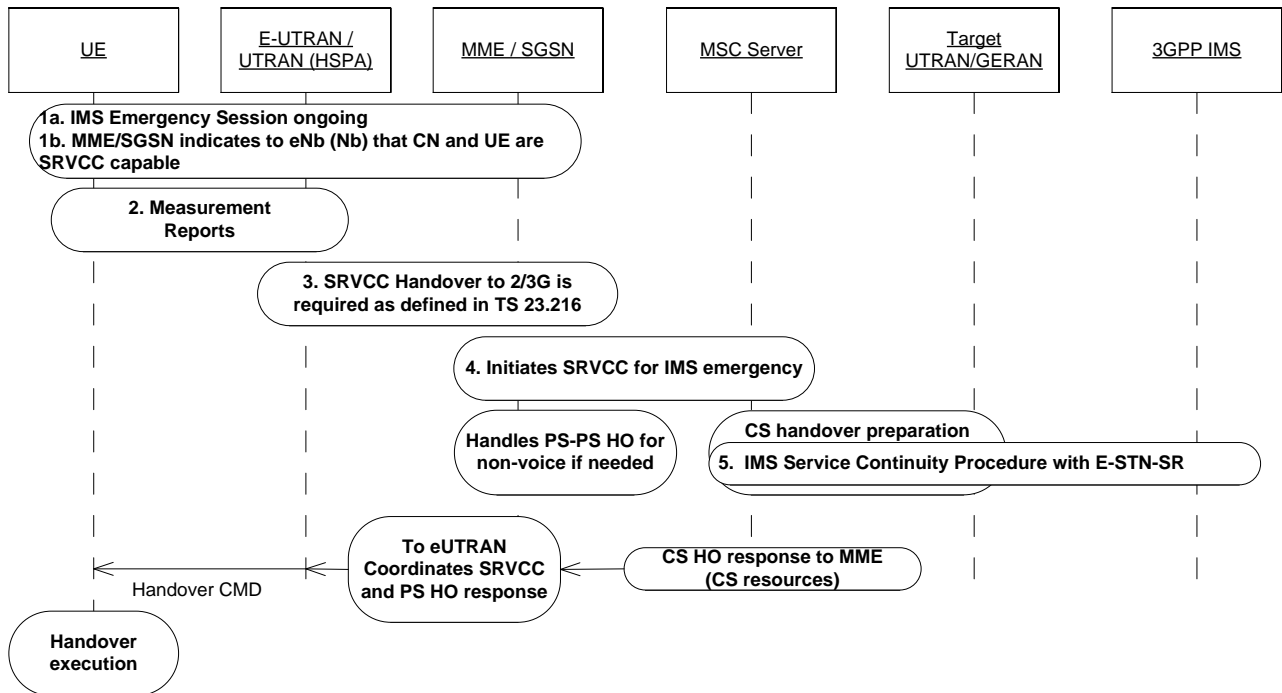


**Figure 6.1.3.1-1: UE initiating an emergency session in IMS**

1. The UE initiates an IMS emergency session over EPS or HSPA (according to the agreed solution defined in TR 23.869 [2]) and the procedures defined in TS 23.167 [5]. This involves the UE generating a SIP INVITE containing the UE's location information.
2. The P-CSCF selects an E-CSCF and forwards the INVITE to the E-CSCF.
3. The E-CSCF sends the INVITE to the E-SCC-AS.
4. The E-SCC-AS (acting as a routing B2BUA) anchors the emergency session, i.e. the E-SCC-AS is inserted in the signalling path which invokes a 3pcc for enablement of Domain Transfers for the call as specified in TS 23.237 [4].
5. The E-SCC AS creates a new INVITE and sends it back to E-CSCF.
6. The E-CSCF sends a request to the LRF to obtain UE location information (if not provided in the INVITE), selects the most appropriate PSAP based on the UE's location and allocates the necessary correlation information and routing information for the call.
7. The E-CSCF uses the routing information to format the INVITE message, and it sends it directly to the PSAP, or to the PSAP via the MGCF.

### 6.1.3.2 SRVCC Procedures

The call flow in Figure 6.1.3.2-1 illustrates the bearer level for SR VCC procedure for IMS emergency session.



**Figure 6.1.3.2-1: bearer level Call flow for SR VCC for IMS emergency session with E-STN-SR**

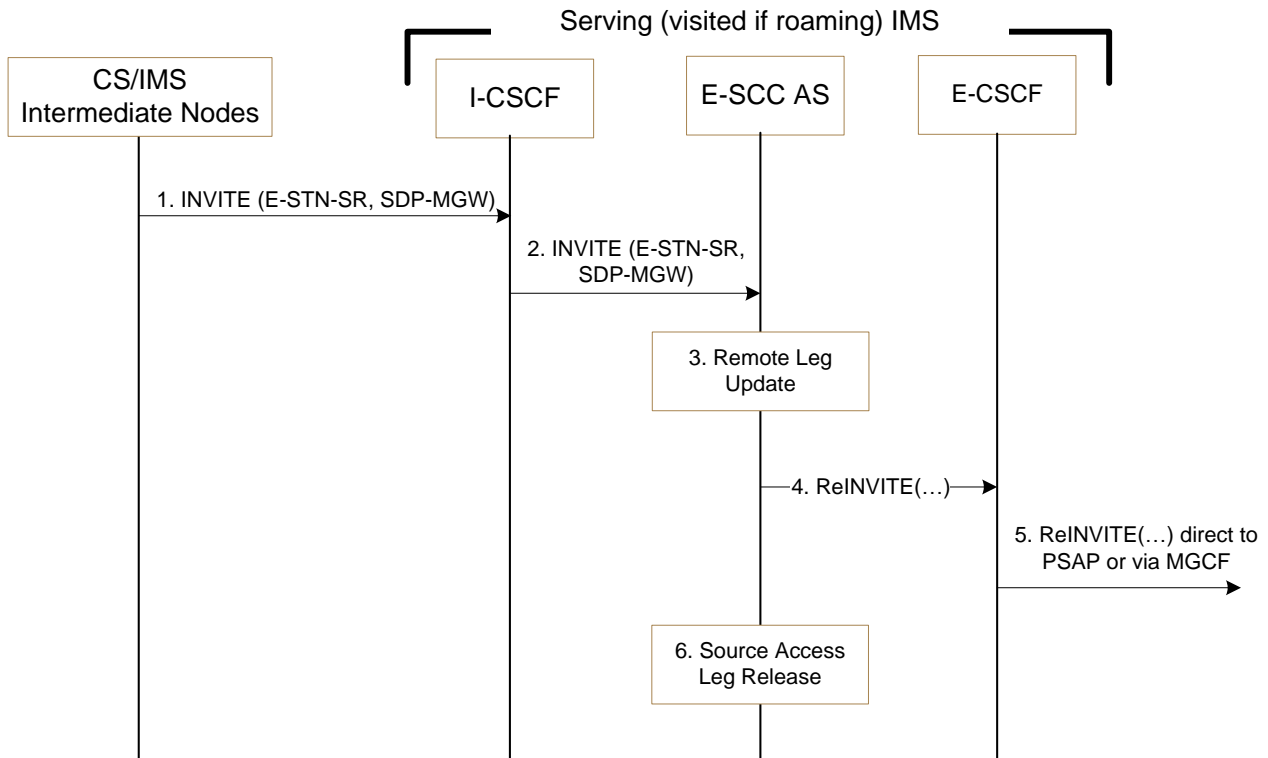
1a, 1b UE has initiated IMS Emergency session. E-UTRAN/UTRAN is aware that both the UE and CN support SR VCC as defined in TS 23.216 [3]. MME/SGSN is aware that IMS Emergency session is ongoing.

2,3 EUTRAN (UTRAN) determines that SR VCC is needed based on same mechanism defined in TS 23.216 [3].

4. MME/SGSN invokes SR VCC via Sv interface to MSC enhanced with SR VCC. MME/SGSN knows this is related to SR VCC IMS emergency. Either E-STN-SR is configured locally in MME and transferred to MSC or MME sends an Emergency indication to MSC and lets MSC to utilize its local configured E-STN-SR. MME may also send location related information to MSC to support location continuity as defined in TR 23.891 [6]. For the case of UEs operating in Limited Service Mode the MME/SGSN includes the equipment identifier in this message.

5. MSC initiates the session transfer with E-STN-SR. The IMS procedure is illustrate in Figure 6.1.3.2-2. The rest of the SR VCC procedures follow TS 23.216 [3]. MSC needs to support location continuity as defined in TR 23.891 [6].

The call flow in figure 6.1.3.2-2 illustrates the IMS level for SR VCC procedure for IMS emergency session for the authenticated case.



**Figure 6.1.3.2-2: IMS level Call flow for SR VCC for IMS emergency session with E-STN-SR**

1. MSC server initiates the session transfer with the E-STN-SR.
2. The I-CSCF routes the INVITE directly to the E-SCC AS by using similar procedures to that defined in TS 23.228, clause 5.7.5 "PSI based Application Server termination – direct".
- 3-4. The E-SCC AS uses the E-STN-SR to determine that Access Transfer is requested. The E-SCC AS proceeds with the Access Transfer of the active session with bi-directional speech for the UE by updating the Remote Leg with the media description and other information using the Remote Leg Update procedure as specified in clause 6.3.1.5 of TS 23.237 [4] (i.e. by sending a Re-INVITE to update the Remote Leg).
5. The E-CSCF forwards the Re-INVITE to the MGCF associated with the PSAP if the PSAP is located in the PSTN or CS Domain (the u-plane path is switched between the UE and the MGW) or the Re-INVITE is sent directly to an IP-capable PSAP (the u-plane path between the UE and the PSAP is switched end-to-end).
6. When session modification procedures complete, the source access leg (i.e. the access leg previously established over IMS) is released as specified in clause 6.3.1.6 of TS 23.237 [4].

**Editor's note: Additional enhancements (e.g., location aspect) are FFS.**

## 6.1.4 Support for UEs in Limited Service Mode

In order to support SRVCC emergency session domain transfer for UEs in Limited Service Mode (e.g. UICC-less) using equipment identifier, the MME shall support Limited Service Mode UE emergency attach defined in TR 23.869 [2] using unauthenticated IMSI or equipment identifier.

When EUTRAN (UTRAN) determines that SR VCC is needed, MME/SGSN invokes SR VCC via Sv interface to MSC enhanced for SR VCC including in any case the UE's equipment identifier. The MSC enhanced for SR VCC will setup the call leg towards the E-SCC AS with the UE's equipment identifier.

If the MSC enhanced for SR VCC has a SIP interface, it shall use the mechanism specified in TS 24.229 [7] to carry equipment identifier as a SIP URI to the E-SCC AS.

If the MSC enhanced for SRVCC does not have a SIP interface, it may convey the equipment identifier by using the IAM message to the MGCF. The MGCF then sends this with an INVITE to E-SCC AS, as part of the IMS procedure.

The E-SCC AS can then correlate the call legs according to the equipment identifier.

The method for correlation of the call legs at the E-SCC AS if SIP or ISUP does not provide this information is implementation dependant.

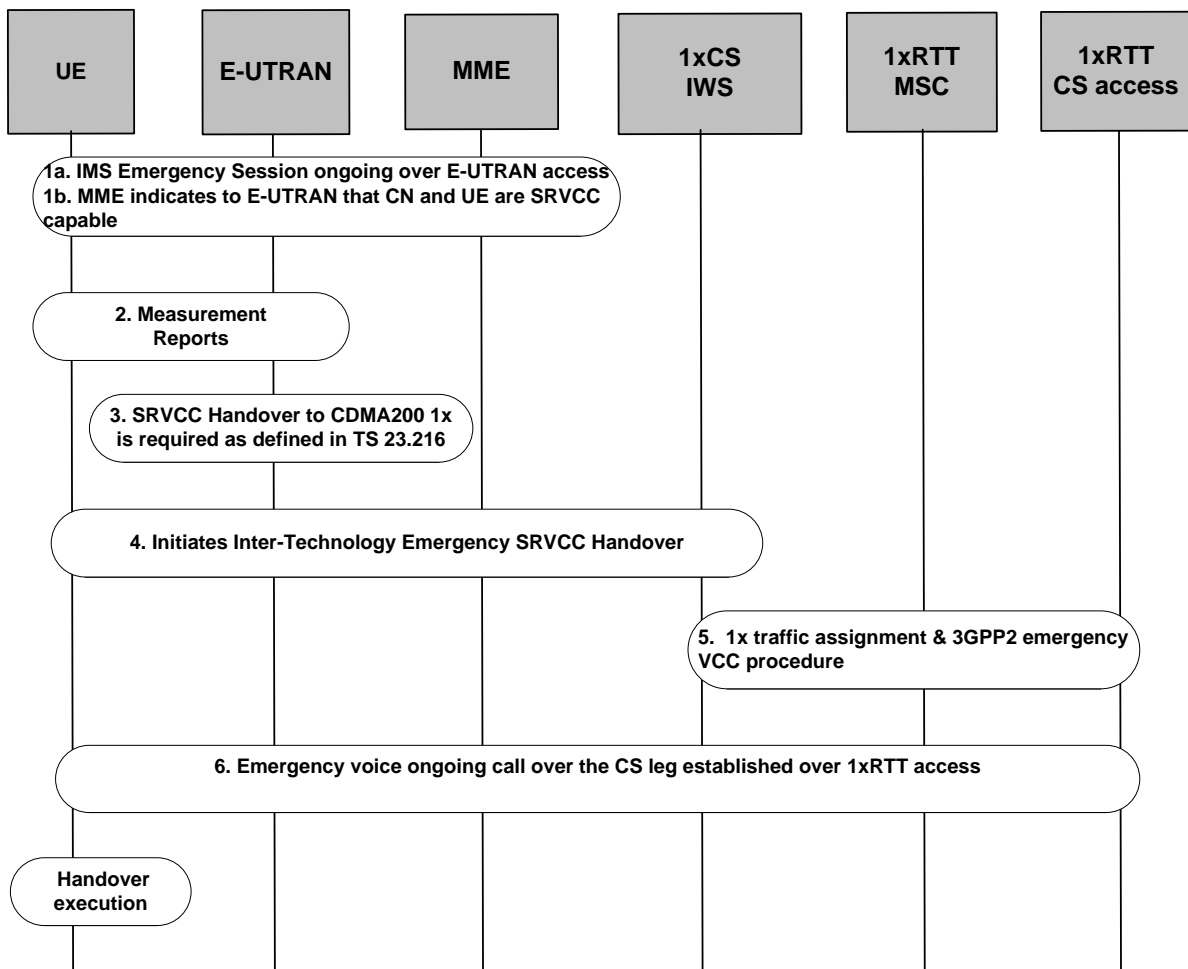
## 6.2 Alternative 2 – SRVCC from E-UTRAN to CDMA2000 1x

### 6.2.1 General

This clause describes an architecture alternative to enable SRVCC for IMS emergency session from E-UTRAN to CDMA2000 1x Circuit Switch. It is similar to the clause 6.1.3 in TS 23.216 [3] where the voice session is handover from E-UTRAN to CDMA2000 1.x. To support handover of emergency session the network is aware that the UE and core network support SRVCC and has information to identify Emergency session.

### 6.2.2 Call Flow

The following call flow illustrates the general bearer level call flow on handing over the emergency session from E-UTRAN to CDMA2000 1x.



**Figure 6.2.2-1: Bearer level call flow for LTE VoIP-to-1x CS emergency voice service continuity**

1a, 1b The UE has initiated an IMS Emergency session. The E-UTRAN is aware that both the UE and CN support SRVCC as defined in TS 23.216 [3]. MME is aware that IMS Emergency session is ongoing.

**Editor’s Note:** Considerations need to be made for the return of the E-STN-SR from the IMS network is to the UE for the purpose of session transfer initiation in step 4.

2,3 The E-UTRAN determines that SRVCC handover to CDMA2000 1x is needed based on same mechanism defined in TS 23.216 [3].

4. The E-UTRAN invokes the procedure for SRVCC handover to CDMA2000 1x.

5. An inter-technology handover procedure is initiated to the CDMA2000 1x network, similar to the SRVCC procedures in TS 23.216 [3]. Traffic resources are assigned in the 1x access network and the 3GPP2 emergency SRVCC procedure is invoked.

NOTE 1: the emergency SRVCC procedure is to be defined in 3GPP2.

NOTE 2: Location continuity on the 1xRTT side will be specified by 3GPP2.

6. The CS access leg is established over 1xRTT access. The E-UTRAN/EPS context may be released based on the normal E-UTRAN/EPS procedure.

### 6.2.3 Limited Service Mode Call Flow

The principles of section 6.1.4 related to the support of UEs in limited service mode also apply to the case of 3GPP2 1xRTT.

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## 7 Assessment

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## 8 Conclusion

### 8.1 Architecture

There is only one architecture alternative, this one should be specified.

### 8.2 Procedure

There is only one procedure/information flow alternative for SRVCC emergency with 3GPP 2/3G CS networks, Likewise, there is only one procedure/information flow alternative for SRVCC emergency with cdma2000 1x CS networks. Each of these should be specified.

### 8.3 Support for Limited Service Mode UEs

The equipment identifier is passed to MSC server via the MME. The equipment identifier is then communicated to the E-SCC AS to allow the E-SCC AS to correlate the session when updating the new leg.

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## Annex A: Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2009-03	SP#43	SP-090094	-	-	MCC Update for presentation to TSG SA	0.3.0	1.0.0
2009-05	SP-44	SP-090365	-	-	<a href="#">MCC update for presentation to TSG SA for approval</a>	1.2.0	2.0.0
2009-06	SP-44	-	-	-	MCC Update to version 9.0.0 after TSG SA Approval	2.0.0	9.0.0