

ETSI TS 136 420 V13.0.0 (2016-01)



**LTE;
Evolved Universal Terrestrial Radio Access Network (E-UTRAN);
X2 general aspects and principles
(3GPP TS 36.420 version 13.0.0 Release 13)**



Reference

RTS/TSGR-0336420vd00

Keywords

LTE

ETSI

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

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

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

Important notice

The present document can be downloaded from:
<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

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

If you find errors in the present document, please send your comment to one of the following services:
<https://portal.etsi.org/People/CommitteeSupportStaff.aspx>

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2016.
All rights reserved.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members.
3GPP™ and **LTE™** are Trade Marks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.
GSM® and the GSM logo are Trade Marks registered and owned by the GSM Association.

Intellectual Property Rights

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

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

Foreword

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

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

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

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Contents

Intellectual Property Rights	2
Foreword.....	2
Modal verbs terminology.....	2
Foreword.....	5
1 Scope.....	6
2 References	6
3 Definitions, symbols and abbreviations	6
3.1 Definitions.....	6
3.2 Abbreviations	7
4 General aspects.....	7
4.1 Introduction	7
4.2 X2 interface general principles.....	7
4.3 X2 interface specification objectives.....	7
4.3.1 General.....	7
4.3.2 Addressing of eNBs over the X2 interface	7
4.4 X2 interface capabilities	7
4.4.1 Radio application related signalling.....	7
4.4.2 X2 tunnels.....	8
4.5 X2 interface characteristics	8
4.5.1 Uses of SCTP.....	8
4.5.1.1 General.....	8
5 Functions of the X2 interface	8
5.1 Function list.....	8
5.2 Function description	9
5.2.1 Intra LTE-Access-System mobility support for ECM-CONNECTED UE.....	9
5.2.1.1 Context transfer from source eNB to target eNB	9
5.2.1.2 Control of user plane transport bearers between source eNB and target eNB	9
5.2.1.3 Handover cancellation.....	9
5.2.1.4 UE context release in source eNB	9
5.2.1.5 Dual Connectivity	9
5.2.2 Load management.....	9
5.2.3 Inter-cell interference coordination.....	9
5.2.3.1 Uplink interference load management	9
5.2.3.2 Downlink interference avoidance.....	9
5.2.4 General X2 management and error handling functions	10
5.2.4.1 Error indication	10
5.2.4.2 Reset.....	10
5.2.5 Trace functions	10
5.2.6 Application level data exchange between eNBs	10
5.2.7 Data exchange for self-optimisation	10
6 X2 interface protocols and protocol structure	10
6.1 General	10
6.2 Radio signalling protocols.....	11
6.2.1 X2AP protocol.....	11
6.3 User plane protocol	11
6.3.1 Tunnelling protocol GTP-U.....	11
7 Other X2 interface specifications	11
7.1 E-UTRAN X2 interface: X2 layer 1 (TS 36.421).....	11
7.2 E-UTRAN X2 interface: X2 signaling transport (TS 36.422).....	12
7.3 E-UTRAN X2 interface: X2 application protocol (X2AP) (TS 36.423)	12
7.4 E-UTRAN X2 interface: X2 data transport (TS 36.424).....	12

7.5 Summary of E-UTRAN X2 interface Technical Specifications.....12

Annex A (informative): Change history13

History14

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:

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.

1 Scope.

The present document is an introduction to the TSG RAN TS 36.42x series of UMTS Technical Specifications that define the X2 interface. It is an interface for the interconnection of two E-UTRAN NodeB (eNB) components within the Evolved Universal Terrestrial Radio Access Network (E-UTRAN) architecture (TS 36.401 [2]).

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 TS 36.401: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Architecture description".
- [3] 3GPP TS 36.421: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 layer 1".
- [4] 3GPP TS 36.422: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 signaling transport".
- [5] 3GPP TS 36.423: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 application protocol (X2AP)".
- [6] 3GPP TS 36.424: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 data transport".
- [7] IETF RFC 4960 (2007-09): "Stream Control Transmission Protocol".
- [8] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA), Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".

3 Definitions, symbols 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].

Dual Connectivity: Defined in TS 36.300 [8].

E-RAB: Defined in TS 36.401 [2].

X2 GW: Defined in TS 36.300 [8].

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].

ECM	EPS Connection Management
E-RAB	E-UTRAN Radio Access Bearer
MeNB	Master eNB
SeNB	Secondary eNB
X2-C	X2 Control plane
X2 GW	X2 GateWay

4 General aspects

4.1 Introduction

The interface allowing to interconnect eNBs with each other is referred to as the X2 interface.

4.2 X2 interface general principles

The general principles for the specification of the X2 interface are as follows:

- the X2 interface should be open;
- the X2 interface shall support the exchange of signalling information between two eNBs, in addition the interface shall support the forwarding of PDUs to the respective tunnel endpoints;
- from a logical standpoint, the X2 is a point-to-point interface between two eNBs within the E-UTRAN. A point-to-point logical interface should be feasible even in the absence of a physical direct connection between the two eNBs.

4.3 X2 interface specification objectives

4.3.1 General

The X2 interface specifications shall facilitate the following:

- inter-connection of eNBs supplied by different manufacturers;
- support of continuation between eNBs of the E-UTRAN services offered via the S1 interface;
- separation of X2 interface Radio Network functionality and Transport Network functionality to facilitate introduction of future technology.

4.3.2 Addressing of eNBs over the X2 interface

-

4.4 X2 interface capabilities

4.4.1 Radio application related signalling

The X2 interface provides capability to support radio interface mobility and Dual Connectivity between eNBs, of UEs having a connection with E-UTRAN.

4.4.2 X2 tunnels

4.5 X2 interface characteristics

4.5.1 Uses of SCTP

4.5.1.1 General

The SCTP (IETF RFC 4960 [7]) is used to support the exchange of X2 Application Protocol (X2AP) signalling messages between two eNBs

A single SCTP association per X2-C interface instance shall be used, except when the X2 GW is used.

Only when the X2 GW is used to connect one eNB to one or more specific eNB(s), all X2-C interface instances from that eNB to the relevant eNB(s) are carried over the same SCTP association from that eNB to the X2 GW, and over separate SCTP association(s) from the X2 GW to the relevant eNB(s).

For X2-C interface instance(s) over one SCTP association one pair of stream identifiers shall be used for X2-C common procedures and only a few pairs of stream identifiers should be used for X2-C dedicated procedures.

Source-eNB communication context identifiers that are assigned by the source-eNB for X2-C dedicated procedures, and target-eNB communication context identifiers that are assigned by the target-eNB for X2-C dedicated procedures, shall be used to distinguish UE specific X2-C signalling transport bearers. The communication context identifiers are conveyed in the respective X2AP messages.

5 Functions of the X2 interface

5.1 Function list

The list of functions on the X2 interface is the following:

- Intra LTE-Access-System Mobility Support for ECM-CONNECTED UE:
 - Context transfer from source eNB to target eNB;
 - Control of user plane transport bearers between source eNB and target eNB;
 - Handover cancellation;
 - UE context release in source eNB;
 - Dual Connectivity.
- Load Management
- Inter-cell Interference Coordination
 - Uplink Interference Load Management;
 - Downlink interference avoidance.
- General X2 management and error handling functions:
 - Error indication;
 - Reset.
- Application level data exchange between eNBs
- Trace functions

- Data exchange for self-optimisation

5.2 Function description

5.2.1 Intra LTE-Access-System mobility support for ECM-CONNECTED UE

This function allows the eNB to handover the control of a certain UE to another eNB.

5.2.1.1 Context transfer from source eNB to target eNB

This function allows transferring information required to maintain the E-UTRAN services for an UE in ECM-CONNECTED from source to target eNB.

5.2.1.2 Control of user plane transport bearers between source eNB and target eNB

This function allows establishing and releasing transport bearers between source and target eNB to allow for data forwarding. At most one user plane transport bearer per E-RAB allocated to the UE may be established for relaying DL data received from the EPC from the source eNB to the target eNB. At most one user plane transport bearer per E-RAB allocated to the UE may be established for relaying the UL data received from the UE from the source eNB to the target eNB.

5.2.1.3 Handover cancellation

This function allows informing an already prepared target eNB that a prepared handover will not take place. It allows releasing the resources allocated during a preparation.

5.2.1.4 UE context release in source eNB

This function allows the target eNB to trigger the release of the resources allocated to the UE in the source eNB.

5.2.1.5 Dual Connectivity

This function allows MeNB and SeNB to support Dual Connectivity. MeNB and SeNB manage establishment, modification and release of UE context at the SeNB, and controls user plane tunnels over X2.

5.2.2 Load management

This function allows exchanging overload and traffic load information between eNBs, such that the eNBs can control the traffic load appropriately. This information may be spontaneously sent to selected neighbour eNBs, or reported as configured by a neighbour eNB.

5.2.3 Inter-cell interference coordination

This function allows keeping inter-cell interference under control. For this neighbouring eNBs exchange appropriate information allowing that eNBs make radio resource assignments such that interference is mitigated.

5.2.3.1 Uplink interference load management

This function allows indicating an uplink interference overload and resource blocks especially sensitive to inter-cell interference between neighbouring eNBs, such that neighbour eNBs can co-ordinate with each other such that the mutual interference caused by their uplink radio resource allocations is mitigated.

5.2.3.2 Downlink interference avoidance

This function allows an eNB to inform its neighbour eNBs about downlink power restrictions in its own cells, per resource block or per subframe for interference aware scheduling by the neighbour eNBs.

5.2.4 General X2 management and error handling functions

These functions allow for managing of signalling associations between eNBs, surveying X2 interface and recovering from errors.

5.2.4.1 Error indication

This function allows the reporting of general error situations on application level.

5.2.4.2 Reset

This function allows an eNB₁ to inform another eNB₂ that it has recovered from an abnormal failure and that all the contexts (except the application level data – see section 5.2.6) related to eNB₁ and stored in eNB₂ shall be deleted, and the associated resources released.

5.2.5 Trace functions

Trace recording sessions on E-UTRAN interfaces for a particular UE is initiated by the EPC. The trace initiation information is also propagated to the Target eNB during handover, attached to certain handover messages on X2.

5.2.6 Application level data exchange between eNBs

This function allows two eNBs to exchange application level data when an X2 connection is setup, and to update this information at any time.

5.2.7 Data exchange for self-optimisation

This function allows two eNBs to exchange information in order to support self-optimization functionality.

6 X2 interface protocols and protocol structure

6.1 General

There shall exist a clear separation between the Radio Network Layer and the Transport Layer. Therefore, the radio network signaling and X2 data streams are separated from the data transport resource and traffic handling as shown in Figure 6.1.1.

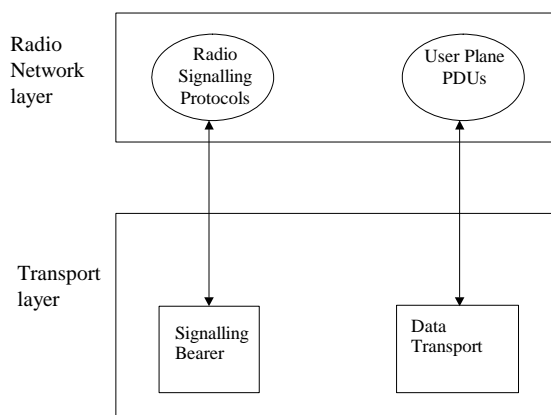


Figure 6.1.1: Separation of Radio Network Protocols and transport over X2

6.2 Radio signalling protocols

6.2.1 X2AP protocol

The protocol responsible for providing signalling information across the X2 interface is called the X2 Application Protocol (X2AP). The X2AP is terminated by the two eNBs inter-connected via the X2 interface X2AP Procedure Modules.

6.3 User plane protocol

6.3.1 Tunnelling protocol GTP-U

6.4 X2 interface protocol structure

The X2 interface protocol architecture consists of two functional layers:

- Radio Network Layer, defines the procedures related to the interaction between eNBs. The radio network layer consists of a Radio Network Control Plane and a Radio Network User Plane.
- The transport network layer provides services for user plane and signaling transport.

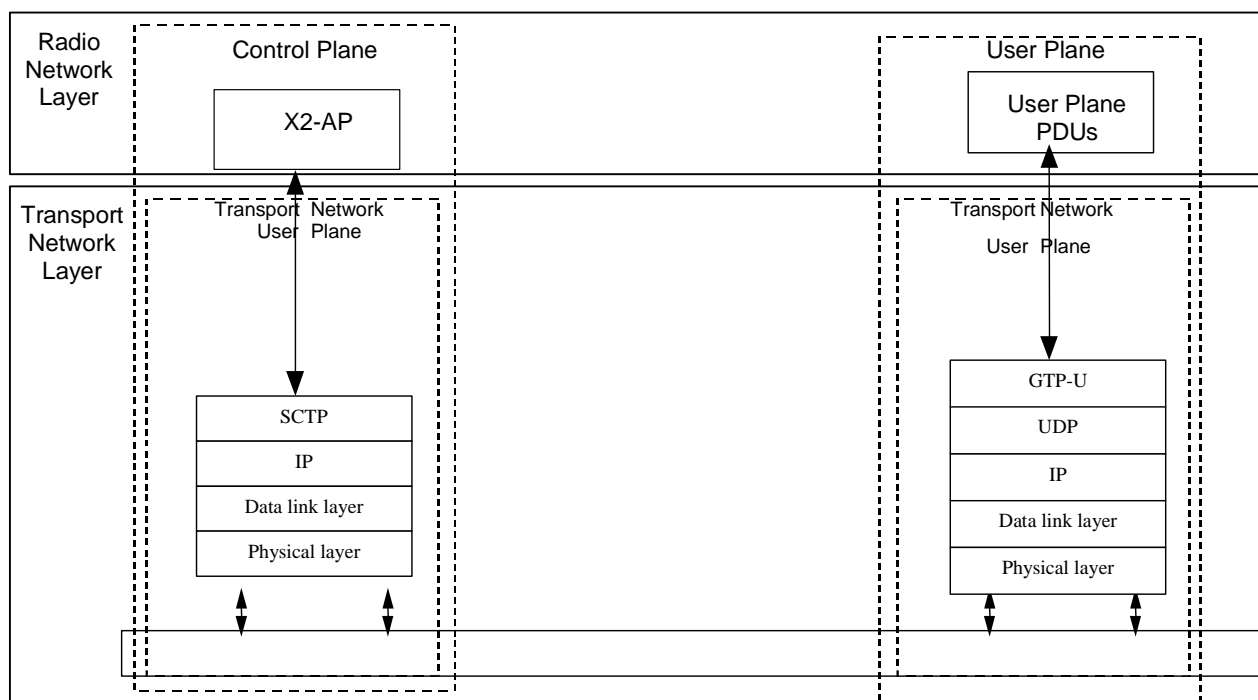


Figure 6.4.1: X2 Interface protocol structure

7 Other X2 interface specifications

7.1 E-UTRAN X2 interface: X2 layer 1 (TS 36.421)

TS 36.421 [3] specifies the range of physical layer technologies that may be used to support the X2 interface.

7.2 E-UTRAN X2 interface: X2 signaling transport (TS 36.422)

TS 36.422 [4] specifies how the X2AP signaling messages are transported over X2.

7.3 E-UTRAN X2 interface: X2 application protocol (X2AP) (TS 36.423)

TS 36.423 [5] specifies the radio network layer signaling procedures of the control plane between eNBs in E-UTRAN.

7.4 E-UTRAN X2 interface: X2 data transport (TS 36.424)

TS 36.424 [6] specifies the standards for user data transport protocols over the E-UTRAN X2 interface.

7.5 Summary of E-UTRAN X2 interface Technical Specifications

The relationship between the technical specifications that define the E-UTRAN X2 interface is shown in Figure 7.5.1.

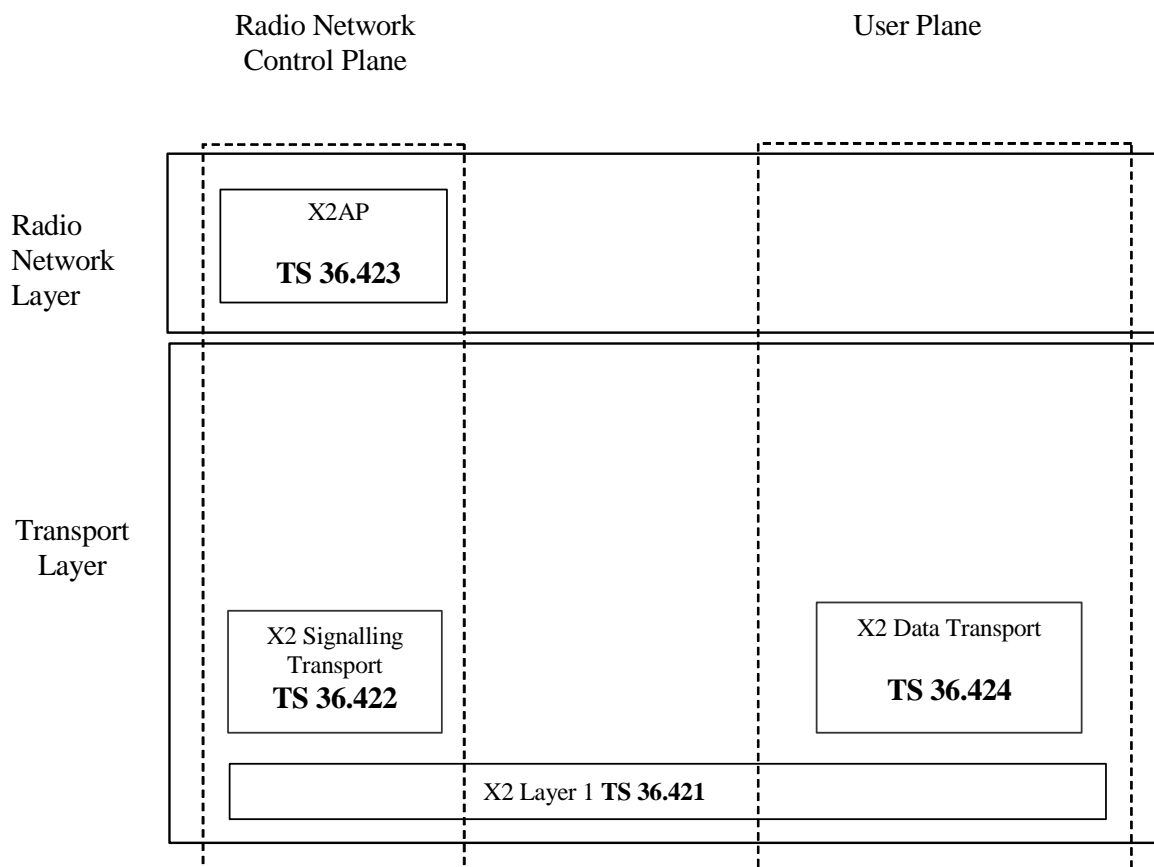


Figure 7.5.1: X2 Interface Technical Specifications

Annex A (informative): Change history

Change history						
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	New
2007-11	38	RP-070853			specification presented to TSG-RAN for information and approval	1.0.0
2007-12	38				specification approved at TSG-RAN and placed under change control	8.0.0
2008-12	42	RP-080845	0002	2	Correction of SAE Bearer and Update of the list of X2 functions	8.1.0
2009-12	-	-	-	-	Creation of Rel-9 version based on v.8.1.0	9.0.0
2010-12					Creation of Rel-10 version based on v. 9.0.0	10.0.0
2011-03	SP-49	SP-100629			Clarification on the use of References (TS 21.801 CR#0030)	10.0.1
2011-06	52	RP-110684	0003	1	Correction of References	10.1.0
2011-09	53	RP-111196	0005	2	Update of the list of X2 functions	10.2.0
2011-09	53	RP-111197	0009	1	Correction of SCTP description for X2 Control Plane protocol	10.2.0
2012-09					Update to Rel-11 version (MCC)	11.0.0
2014-06	64	RP-140897	0010	6	Introduction of the X2 GW	12.0.0
2014-12	66	RP-142089	0013	4	Introduction of dual connectivity	12.1.0
2015-12					Update to Rel-13 version (MCC)	13.0.0

History

Document history		
V13.0.0	January 2016	Publication