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*Technical Specification*

**3rd Generation Partnership Project;  
Technical Specification Group Services and System Aspects;  
Telecommunication management;  
Automatic Neighbour Relation (ANR) management;  
Concepts and requirements  
(Release 11)**

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Keywords

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## Foreword

This Technical Specification has been produced by the 3<sup>rd</sup> 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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## Introduction

The present document is part of a TS-family covering the 3<sup>rd</sup> Generation Partnership Project Technical Specification Group Services and System Aspects, Telecommunication management; as identified below:

**32.511: "Automatic Neighbour Relation (ANR) management; Concepts and requirements".**

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# 1 Scope

The present document describes the concepts and requirements for the management of Automatic Neighbour Relation (ANR) in UTRAN and E-UTRAN across the Itf-N. The ANR management is a key feature of Self Organizing Networks (SON) [4].

The NR concept and background information are described in clause 4.  
The requirements for management of NR are defined in clause 5.

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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 TS 32.101: "Telecommunication management; Principles and high level requirements".
  - [3] 3GPP TS 32.102: "Telecommunication management; Architecture".
  - [4] 3GPP TR 32.816: "Telecommunication management; Study on Management of Evolved Universal Terrestrial Radio Access Network (E-UTRAN) and Evolved Packet Core (EPC)".
  - [5] 3GPP TS 32.501 "Telecommunication management; Self-Configuration of Network Elements; Concepts and requirements".
  - [6] 3GPP TS 36.300 "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".
  - [7] 3GPP TS 32.301 "Telecommunication management; Configuration Management (CM); Notification Integration Reference Point (IRP); Requirements".
  - [8] 3GPP TS 25.484 "Automatic Neighbour Relation (ANR) for UTRAN; Stage 2".
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# 3 Definitions and abbreviations

For the purposes of the present document, the terms and definitions given in TS 32.101 [2], TS 32.102 [3] and TS 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 TS 32.101 [2], TS 32.102 [3] and TS 21.905 [1], in that order.

## 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].

**ANR function:** The ANR function in E-UTRAN is described in TS 36.300 [6], section 22.3.2a. The ANR function in UTRAN is described in TS 25.484 [8].

**Neighbour cell Relation:** The Neighbour cell Relation (NR) in E-UTRAN is defined in TS 36.300 [6] section 22.3.2a. The Neighbour cell Relation in UTRAN is defined in TS 25.484 [8].

**Searchlist:** List of frequencies and supporting information to be used for neighbour cell measurements. The Searchlist contains entries for E-UTRAN and supported IRATs.

## 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].

ANR	Automatic Neighbour Relation
eNB	eNodeB or evolved NodeB
NR	Neighbour cell Relation
NRT	Neighbour cell Relation Table
UC	Use Case

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## 4 Concepts and background

For E-UTRAN, the ANR function in the eNB relates to the Use Cases **Establishment of new eNB in network** and **Optimisation of the neighbourhood list** in [4].

- For **Establishment of new eNB in network**. If the operator so chooses, the OAM system adds and configures NRs before the eNB goes into operation.
- For **Optimisation of the neighbourhood list**, the ANR function deals with automatic NR additions and removals. It minimizes the need for planning and configuring NRs. If the operator so chooses, the OAM system adds and configures NRs or removes NRs after the eNB goes into operation.

For UTRAN, the ANR function concept and overall description is documented in TS 25.484 [8].

- The ANR function in RNC allows OAM system to manage the NRT. OAM system can add and delete NRs and also change the attributes of the NRs. The OAM system is informed about changes in the NRT made by ANR function.

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## 5 Requirements

### 5.1 Business level requirements

**REQ-ANR-CON-001** NRs shall be set up and optimized with no or minimal human intervention.

**REQ-ANR-CON-002** For E-UTRAN, initial status of the newly created NR by ANR function shall be such that HO is allowed, X2 connection setup is allowed, and the NR is allowed to be removed by ANR function in eNB.

**REQ-ANR-CON-003** E-UTRAN ANR supports management of NRs from E-UTRAN to E-UTRAN, from E-UTRAN to UTRAN, from E-UTRAN to CDMA2000 and from E-UTRAN to GERAN.

**REQ-ANR-CON-004** For UTRAN, initial status of the newly created NR by ANR function shall be such that HO is allowed and the NR is allowed to be removed by ANR function in RNC.

**REQ-ANR-CON-005** UTRAN ANR supports management of NRs from UTRAN to UTRAN, from UTRAN to E-UTRAN and from UTRAN to GERAN.

## 5.1.1 Void

## 5.1.1.1 Void

## 5.1.1.2 Void

## 5.1.1.3 Void

## 5.2 Specification level requirements

## 5.2.1 Void

## 5.2.2 Void

## 5.2.3 Void

## 5.2.4 Use cases

## 5.2.4.1 Management of fully automatic ANR function

Use Case Stage	Evolution / Specification	<<Uses>> Related use
<b>Goal (*)</b>	The goal is that the IRPManager may add and remove NRs and that it may change attributes of the NRs	
<b>Actors and Roles (*)</b>	<ul style="list-style-type: none"> <li>IRPManager as user</li> </ul>	
<b>Telecom resources</b>	<ul style="list-style-type: none"> <li>ANR function</li> <li>eNB or RNC</li> </ul>	
<b>Assumptions</b>		
<b>Pre conditions</b>	<ul style="list-style-type: none"> <li>The ANR function in eNB or RNC is active;</li> <li>The cell may or may not have Neighbour Relations configured by O&amp;M;</li> <li>For E-UTRAN, the eNB has finished Use Case <i>Self-configuration of a new eNodeB</i> [5];</li> <li>For UTRAN, the RNC is properly installed and running.</li> </ul>	
<b>Begins when</b>	This Use Case begins when all pre conditions have been met.	
<b>Step 1 (*) (M)</b>	<ul style="list-style-type: none"> <li>If the IRPManager finds out that an unsuitable Neighbour Relation has been added by ANR, the IRPManager may “Blacklist” that particular Neighbour Relation.</li> <li>If the IRPManager finds out that a desired Neighbour Relation has not been added by ANR, the IRPManager may “Whitelist” that particular Neighbour Relation.</li> <li>The IRPManager may uncheck the noRemove attribute from any present Neighbour Relation.</li> </ul>	
<b>Ends when (*)</b>	This Use Case ends when the eNB or RNC is taken out of service or when the ANR function is stopped.	
<b>Exceptions</b>	One of the steps identified above fails and retry is unsuccessful.	
<b>Post Conditions</b>		
<b>Traceability (*)</b>	REQ-ANR-CON-001	

### 5.2.4.2 Manual start of the ANR function by operator

Use Case Stage	Evolution / Specification	<<Uses>> Related use
<b>Goal (*)</b>	The ANR function in eNB or RNC can be enabled by IRPManager.	
<b>Actors and Roles (*)</b>	<ul style="list-style-type: none"> <li>IRPManager as user</li> </ul>	
<b>Telecom resources</b>	<ul style="list-style-type: none"> <li>ANR function</li> <li>eNB or RNC</li> </ul>	
<b>Assumptions</b>		
<b>Pre conditions</b>	<ul style="list-style-type: none"> <li>The ANR function is not active;</li> <li>The eNB or RNC may have Neighbour Relations. The NRs may be configured by O&amp;M or be may have been added by ANR function if ANR function has been active previously.</li> </ul>	
<b>Begins when</b>	The Use Case begins when the IRP Manager starts the ANR function.	
<b>Step 1 (*) (M)</b>	The IRPManager enables the ANR function in eNB or RNC.	
<b>Ends when (*)</b>	Ends when all steps identified above are completed or when an exception occurs	
<b>Exceptions</b>	One of the steps identified above fails and retry is unsuccessful.	
<b>Post Conditions</b>	The ANR function in eNB or RNC is enabled by IRPManager successfully or unsuccessfully.	
<b>Traceability (*)</b>	REQ-ANR-FUN-10, REQ-ANR-FUN-26	

### 5.2.4.3 Handling of noX2 attribute

#### Use Case 1

IRPManager needs to be able to forbid and allow the establishment of X2 interfaces from the source macro eNBs to a target eNB. IRPManager is aware that the target eNB cannot support X2 connections. This UC on how noX2 is used relates to node level rather than cell level.

#### Use Case 2

IRPManager needs to be able to allow and forbid the establishment of X2 interfaces from the source HeNBs to a target macro eNB. This UC supports the case when a potentially large number of HeNBs in the vicinity of a macro eNB, X2 establishment requests from HeNB might saturate the physical ports of the macro eNB (not in terms of bandwidth saturation but rather the saturation in terms of the number of simultaneous establishment requests supported). This UC on how noX2 is used relates to node level rather than Cell level.

#### Use Case 3

IRPManager needs to be able to forbid the establishment of the X2 interface from (IRPManager's) operator's eNB to another operator's eNB or to an eNB that belongs to another unwanted PLMN. This UC supports the case when the IP address of the target eNB cannot be obtained or the X2 handovers to another unwanted PLMN are not allowed. This UC on how noX2 is used relates to node level rather than cell level.

#### Use Case 4

IRPManager needs to be able to ask for the release of the X2 interface improperly established by eNB. This UC supports the case when the serving eNB has established an X2 interface (e.g., by ANR) before IRPManager had a chance to forbid the establishment of that X2 interface. The IRPManager needs to be able to ask the serving eNB to release the X2 interface to the target eNB. This UC on how noX2 is used relates to node level rather than cell level.



## 5.2.4.4 Manual stop of the ANR function by operator

Use Case Stage	Evolution / Specification	<<Uses>> Related use
<b>Goal (*)</b>	The ANR function in eNB or RNC can be disabled by IRPManager.	
<b>Actors and Roles (*)</b>	<ul style="list-style-type: none"> <li>• IRPManager as user</li> </ul>	
<b>Telecom resources</b>	<ul style="list-style-type: none"> <li>• ANR function</li> <li>• eNB or RNC</li> </ul>	
<b>Assumptions</b>		
<b>Pre conditions</b>	<ul style="list-style-type: none"> <li>• The ANR function is active</li> </ul>	
<b>Begins when</b>	The Use Case begins when the IRPManager makes a decision to disable the ANR function.	
<b>Step 1 (*) (M)</b>	The IRPManager disables the ANR function in eNB or RNC.	
<b>Ends when (*)</b>	Ends when all steps identified above are completed or when an exception occurs.	
<b>Exceptions</b>	One of the steps identified above fails and retry is unsuccessful.	
<b>Post Conditions</b>	The ANR function in eNB or RNC is disabled by IRPManager successfully or unsuccessfully. All existing NRs, whether created by ANR or otherwise are unaltered.	
<b>Traceability (*)</b>	REQ-ANR-FUN-10, REQ-ANR-FUN-26	

## 5.2.5 Requirements

### 5.2.5.1 ANR function management in E-UTRAN

The business level requirements in section 5.1 are decomposed into the following specification level requirements , applicable for E-UTRAN:

- REQ-ANR-FUN-01** An IRPManager shall be able to request that HO be allowed from source cell to target cell.
- REQ-ANR-FUN-02** An IRPManager shall be able to request that HO be prohibited from source cell to target cell.
- REQ-ANR-FUN-03** An IRPManager shall be able to request that HO be allowed from source cell to target cell and that no other entity than an IRPManager can remove that request. This is termed as HO white-listing.
- REQ-ANR-FUN-04** An IRPManager shall be able to request that HO be prohibited from source cell to target cell and that no other entity than an IRPManager can remove that request. This is termed as HO black-listing.
- REQ-ANR-FUN-05** An IRPManager shall inform the IRPManager about success or failure of IRPManager operations to allow HO, prohibit HO, HO white-list and HO black-list.
- REQ-ANR-FUN-06** An IRPManager shall be able to request establishment of an X2 connection from one eNB to another eNB.
- REQ-ANR-FUN-07** An IRPManager shall be able to request the release of an X2 connection between two eNBs.
- REQ-ANR-FUN-08** An IRPManager shall be able to request that X2 interface from one eNB to another eNB be established if the X2 interface is not established and that the release of X2 interface be prohibited. No other entity than an IRPManager can remove that request. This is termed as X2 white-listing.
- REQ-ANR-FUN-09** An IRPManager shall be able to request that X2 interface from one eNB to another eNB be released if the X2 interface is established and that the establishment of the X2 interface be prohibited. No other entity than an IRPManager can remove that request. This is termed as X2 black-listing.
- REQ-ANR-FUN-10** Operator shall be able to disable/enable one eNB or multiple eNB's ANR function when needed.
- REQ-ANR-FUN-11** void
- REQ-ANR-FUN-12** An IRPManager shall be able to add and configure new NRs in the eNB.
- REQ-ANR-FUN-13** An IRPManager shall be able to remove NRs in the eNB
- REQ-ANR-FUN-14** An IRPManager shall inform the IRPManager about changes to the NR according to TS 32.301 [7].
- REQ-ANR-FUN-15** A Searchlist is needed for each cell. The IRPManager should be able to configure the Searchlist.
- REQ-ANR-FUN-16** An IRPManager shall inform the IRPManager about the newly added and removed NRs according to TS 32.301 [7].
- REQ-ANR-FUN-17** An IRPManager shall be able to retrieve ANR related attribute values on cell level, identifying:
- Source cell & target cell
  - NR status (locked, unlocked)
  - HO status (allowed, prohibited)

Editor's note:

The 'locked' NR status indicates that the NR shall not be removed by the ANR function.  
The 'unlocked' NR status indicates that the NR may be removed by the ANR function.

The 'allowed' HO status indicates that handovers are allowed for this NR.  
The 'prohibited' HO status indicates that handovers are prohibited for this NR.

The combination of 'locked' NR status and 'allowed' HO status is a 'whitelisted' relation.  
The combination of 'locked' NR status and 'prohibited' HO status is a 'blacklisted' relation

- REQ-ANR-FUN-18** The IRPAgent shall support a capability allowing the IRPManager to determine whether the X2 interface between two eNodeBs is established or not established.
- REQ-ANR-FUN-19** IRPManager shall be able to request that the source eNB be prohibited to use X2 interface for HOs to a target eNB even if the X2 interface exists between the eNBs. No other entity than an IRPManager can remove that request. This is termed as X2HO black-listing.
- REQ-ANR-FUN-20** The IRPAgent shall support a capability allowing the IRPManager to retrieve the X2 whitelisted and blacklisted eNBs.

### 5.2.5.2 ANR function management in UTRAN

The business level requirements in section 5.1 are decomposed into the following specification level requirements, applicable for UTRAN:

- REQ-ANR -FUN-21** The IRPAgent shall support a capability allowing the IRPManager to request that HO be allowed from source cell to target cell.
- REQ-ANR-FUN-22** The IRPAgent shall support a capability allowing the IRPManager to request that HO be prohibited from source cell to target cell.
- REQ-ANR-FUN-23** The IRPAgent shall support a capability allowing the IRPManager to request that HO be allowed from source cell to target cell and that no other entity than an IRPManager can remove that request. This is termed as HO white-listing.
- REQ-ANR-FUN-24** The IRPAgent shall support a capability allowing the IRPManager to request that HO be prohibited from source cell to target cell and that no other entity than an IRPManager can remove that request. This is termed as HO black-listing.
- REQ-ANR-FUN-25** The IRPAgent shall inform the IRPManager about success or failure of IRPManager operations to allow HO, prohibit HO, HO white-list and HO black-list.
- REQ-ANR-FUN-26** The IRPAgent shall support a capability allowing the IRPManager to disable/enable ANR function in RNC when needed.
- REQ-ANR-FUN-27** The IRPAgent shall support a capability allowing the IRPManager to add and configure new NRs in the RNC.
- REQ-ANR-FUN-28** The IRPAgent shall support a capability allowing the IRPManager to remove NRs in the RNC.
- REQ-ANR-FUN-29** The IRPAgent shall inform the IRPManager about changes to the NR according to TS 32.301 [7].
- REQ-ANR-FUN-30** The IRPAgent shall inform the IRPManager about the newly added and removed NRs according to TS 32.301 [7].
- REQ-ANR-FUN-31** The IRPAgent shall support a capability allowing the IRPManager to retrieve ANR related attribute values on cell level, identifying:

- Source cell & target cell
- NR status (locked, unlocked)
- HO status (allowed, prohibited)

Note:

The 'locked' NR status indicates that the NR shall not be removed by the ANR function.

The 'unlocked' NR status indicates that the NR may be removed by the ANR function.  
The 'allowed' HO status indicates that handovers are allowed for this NR.  
The 'prohibited' HO status indicates that handovers are prohibited for this NR.

The combination of 'locked' NR status and 'allowed' HO status is a 'whitelisted' relation.  
The combination of 'locked' NR status and 'prohibited' HO status is a 'blacklisted' relation.

## Annex A (informative): Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2008-12					Submitted to SA#42 for information and approval	1.0.0	8.0.0
2009-03	SP-43	SP-090213	001	1	Remove solution related terms and inconsistencies in Requirement specification and add clarifications	8.0.0	8.1.0
2009-06	SP-44	SP-090290	002	--	Clarify requirement REQ-ANR-FUN-18	8.1.0	8.2.0
2009-12	-	-	-	-	Update to Rel-9 version (MCC)	8.2.0	9.0.0
2011-03	-	-	-	-	Update to Rel-10 version (MCC)	9.0.0	10.0.0
2011-06	SP-52	SP-110293	009	1	Introducing ANR use cases for UTRAN	10.0.0	11.0.0
2011-09	SP-53	SP-110540	010	--	Introducing ANR concepts and requirements for UTRAN	11.0.0	11.1.0
2012-09	SP-57	SP-120574	011	--	Clean-up changes for ANR management concepts and requirements	11.1.0	11.2.0