

# 3GPP TR 32.814 V7.0.0 (2007-03)

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*Technical Report*

## **3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication management; UTRAN and GERAN Key Performance Indicators (KPI) (Release 7)**



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Keywords

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## Foreword

This Technical Report 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:

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## Introduction

Cellular Networks are becoming more and more complex, with this complexity comes more services, and this in turn leads to a greater number of network parameters that have to be tuned, optimised and made compatible. Cellular Networks are also continuously evolving in terms of capacity and traffic patterns. To keep control of these very dynamic networks, Operators need to keep a constant watch on network performance. Performance measurements are collected by Network Elements throughout the network and 3GPP has defined many (hundreds) of standardized measurements in the 52.402 and 32.4xx series specifications.

Typically Network Operators and equipment vendors will aggregate and combines some of the key measurements and use them to compute some Key Performance Indicators (KPI). KPIs such as hand-off success rate, call drop-rate, hold time, and congestion are continuously monitored to provide indicators of areas that might require tuning.

To date KPIs have not been standardised across equipment vendors, this makes it difficult for operators with multiple vendors to easily calculate Network wide KPIs.

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# 1 Scope

The present document details a proposal to create Key Performance Indicators for UTRAN and GERAN networks, using performance measurements defined in the 32.4xx series specifications (any exceptions are noted in the KPI definitions).

The KPIs detailed in sections 4 & 5 are an output from the CO-OP initiative (A co-operative effort by eight network equipment providers) [8].

The KPIs detailed in section 6 are an example of an alternative high level KPI definition method that does not rely on standardised counter definitions. A draft KPI template is also described.

The KPI definitions in this Technical Report are intended as input to 3GPP for information and further study in the possible creation of a 3GPP Technical Specification.

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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 TS 32.405, Telecommunication management; Performance Management (PM); Performance measurements Universal Terrestrial Radio Access Network (UTRAN).
- [2] 3GPP TS 25.331, Technical Specification Group, Radio Access Network; Radio Resource Control (RRC); Protocol Specification (Release 6);
- [3] 3GPP TS 25.413, Technical Specification Group, UTRAN Iu interface RANAP signalling (Release 6);
- [4] ETSI TS 102.250-2V1.2.1, Speech Processing, Transmission and Quality Aspects (STQ); QoS aspects for popular services in GSM and 3G networks; Part 2: Definition of Quality of Service parameters and their computation
- [5] 3GPP TS 52.402, Telecommunication management; Performance Management (PM); Performance measurements – GSM (Release 6).
- [6] 3GPP TR 21.905 Technical Specification Group Services and System Aspects; Vocabulary for 3GPP Specifications, Version 7.0.0.
- [7] ITU-T Recommendation E.800; Terms and definitions related to quality of service and network performance including dependability
- [8] TMF 058 Supporting Document; 2G/3G Radio KPI Definitions, Release 2 version 2.0.1, March 2006.

## 3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

CO-OP	A co-operative effort by eight network equipment providers [8]
CS	Circuit Switched
EDGE	Enhanced Data rates for GSM Evolution
GERAN	GSM EDGE Radio Access Network
GSM	Global System for Mobile Communications
KPI	Key Performance Indicator
PS	Packet Switched
RAB	Radio Access Bearer
RAT	Radio Access Technology
RRC	Radio Resource Control
SDCCH	Stand-alone Dedicated Control Channel
TCH	Traffic Channel
UMTS	Universal Mobile Telecommunications System
UTRAN	UMTS Radio Access Network

## 4 CO-OP UTRAN KPI Definitions

The following clauses contain definitions of the UTRAN KPIs with an associated formula indicating how the KPI is calculated from a set of component raw measurements. The definitions of the raw measurements used are given in [1].

### 4.1 Overview of UTRAN KPIs and Categories

The UTRAN KPIs described in this clause are categorized as follows:

Category	KPI	
	Circuit Switched (CS)	Packet Switched (PS)
Accessibility	RAB Estab. Success Rate CS	RAB Estab. Success Rate PS
	RRC Connection Establishment Success Rate	
	Call Setup Success Rate	
Retainability	Connection Drop Rate CS	Connection Drop Rate PS
	Call Drop Rate CS	Call Drop Rate PS
Mobility	Outgoing Hard Handover success rate	
	Outgoing Inter System Handover success rate CS	Outgoing Inter System Handover success rate PS
	Soft Handover Success Rate	
Capacity	Throughput Measurements CS	Throughput Measurements PS

Some of the KPI categories (Accessibility & Retainability in the table above are service performance categories from ITU-T Recommendation E.800 [7].

Any future KPI specification work should consider close alignment with ITU-T Recommendation E.800 [7].

### 4.2 KPI Types

The KPIs defined in this document are made up of three different KPI Types, i.e. Ratio, Mean and Cumulative. These KPI types are indicated in the definitions by the keys **RATIO**, **MEAN** and **CUM**. The definitions of these KPI Types are:

**RATIO:** This KPI is produced to reflect the percentage of a specific case occurrence to all the cases.

**MEAN:** This KPI is produced to reflect a mean measurement value based on a number of sample results.

**CUM:** This KPI is produced to reflect a cumulative measurement which is always increasing.

### 4.3 RAB Establishment Success Rate

Long name	a) RAB establishment success rate CS b) RAB establishment success rate PS c) RAB establishment success rate
Short name	a) RabEstabSR.CS b) RabEstabSR.PS c) RabEstabSR
Description	This KPI describes the ratio of all successful RAB establishments related to the total number of RAB establishment attempts.
Formula	$RabEstabSR.CS = \frac{\sum_{type} RAB.SuccEstabCSNoQueuing.[type] + \sum_{type} RAB.SuccEstabCSQueuing.[type]}{\sum_{type} RAB.AttEstabCS.[type]}$ $RabEstabSR.PS = \frac{\sum_{type} RAB.SuccEstabPSNoQueuing.[type] + \sum_{type} RAB.SuccEstabPSQueuing.[type]}{\sum_{type} RAB.AttEstabPS.[type]}$ $RabEstabSR = \frac{\sum_{type} \left\{ \begin{array}{l} RAB.SuccEstabCSNoQueuing.[type] + \\ RAB.SuccEstabCSQueuing.[type] + \\ RAB.SuccEstabPSNoQueuing.[type] + \\ RAB.SuccEstabPSQueuing.[type] \end{array} \right\}}{\sum_{type} RAB.AttEstabCS.[type] + RAB.AttEstabPS.[type]}$ <p>type = € {Conv, Strm, Intact, Bgrd}</p>
Counters	<p>CS: RAB.AttEstabCS.Conv, RAB.AttEstabCS.Strm, RAB.AttEstabCS.Intact, RAB.AttEstabCS.Bgrd RAB.SuccEstabCSNoQueuing.Conv, RAB.SuccEstabCSQueuing.Conv, RAB.SuccEstabCSNoQueuing.Strm, RAB.SuccEstabCSQueuing.Strm, RAB.SuccEstabCSNoQueuing.Intact, RAB.SuccEstabCSQueuing.Intact, RAB.SuccEstabCSNoQueuing.Bgrd, RAB.SuccEstabCSQueuing.Bgrd</p> <p>PS: RAB.AttEstabPS.Conv, RAB.AttEstabPS.Strm, RAB.AttEstabPS.Intact, RAB.AttEstabPS.Bgrd RAB.SuccEstabPSNoQueuing.Conv, RAB.SuccEstabPSQueuing.Conv, RAB.SuccEstabPSNoQueuing.Strm, RAB.SuccEstabPSQueuing.Strm, RAB.SuccEstabPSNoQueuing.Intact, RAB.SuccEstabPSQueuing.Intact, RAB.SuccEstabPSNoQueuing.Bgrd, RAB.SuccEstabPSQueuing.Bgrd</p>
Object	RncFunction
Unit/Range	Range
Type	RATIO
Remark	---

## 4.4 RRC Connection Establishment Success Rate

Long name	a) RRC connection establishment success rate
Short name	a) RrcEstabSR
Description	This KPI describes the ratio of successful RRC connection establishments related to the total number of RRC connection establishment attempts.
Formula	$RrcEstabSR = \frac{\sum_{cause} RRC.SuccConnEstab.[cause]}{\sum_{cause} RRC.AttConnEstab.[cause]}$ <p>The respective causes are detailed in 3GPP [2]</p>
Counters	RRC.AttConnEstab.Cause RRC.SuccConnEstab.Cause
Object	UtranCell
Unit/Range	Range
Type	RATIO
Remark	The RRC Connection Attempts are excluding multiple repetitions of RRC Connection Attempts from the same UE in order to correctly reflect the RRC Connection establishment rate from an UE perspective. The RRC Connection Request to be considered in this KPI is the first RRC Connection Request for a UE.

Note: It appears the counter definition for RRC connection establishment does include multiple attempts from the same UE despite the remark above; A CR will be required to TS 32.405 to correct or add a new counter.

## 4.5 Call Setup Success Rate

Long name	a) Call setup success rate
Short name	a) CSSR
Description	This KPI describes the ratio of successful call establishments. It is based on the Successful RRC Connection Establishment Rate for call setup purposes and the RAB Establishment Success Rate for all RAB types. Both KPIs are multiplied
Formula	$CSSR = RabEstabSR * \left( \frac{\sum_{cause, cell} RRC.SuccConnEstab.[cause, cell]}{\sum_{cause, cell} RRC.AttConnEstab.[cause, cell]} \right)$ <p>cause* =            Originating Conversational Call,            Originating Streaming Call,            Originating Interactive Call,            Originating Background Call,            Terminating Conversational Call,            Terminating Streaming Call,            Terminating Interactive Call,            Terminating Background Call            (only causes for call related in 3GPP 25.331)</p>
Counters	RabEstabSR (4.3) RRC.AttConnEstab.Cause RRC.SuccConnEstab.Cause
Object	RNCFunction
Unit/Range	Range
Type	RATIO
Remark	Since RRC counters are measured per cell object, the sum over all cells within one RNC needs to be built, in order to get this rate on RNC level.



## 4.6 UTRAN initiated lu connection drop rate

Long name	a) lu Connection Drop rate CS b) lu Connection Drop rate PS c) lu Connection Drop rate
Short name	a) luConnDR.CS b) luConnDR.PS c) luConnDR
Description	This KPI describes the ratio of abnormal UTRAN initiated lu releases related to the total number of CN initiated lu releases.
Formula	$luConnDR.CS = \frac{\sum_{cause^*} IU.AttConnRelReqUTRANCs.[cause^*]}{\sum_{cause} IU.AttConnRelCNCS.[cause]}$ $luConnDR.PS = \frac{\sum_{cause^*} IU.AttConnRelReqUTRANPS.[cause^*]}{\sum_{cause} IU.AttConnRelCNPS.[cause]}$ $luConnDR = \frac{\sum_{cause^*} \left\{ IU.AttConnRelReqUTRANCs.[cause^*] + IU.AttConnRelReqUTRANPS.[cause^*] \right\}}{\sum_{cause} \left\{ IU.AttConnRelCNCS.[cause] + IU.AttConnRelCNPS.[cause] \right\}}$ <p>cause* = only causes for <b>abnormal</b> release; all causes are detailed in 3GPP 25.413</p>
Counters	CS: IU.AttConnRelReqUTRANCs.cause, IU.AttConnRelCNCS.cause PS: IU.AttConnRelReqUTRANPS.cause, IU.AttConnRelCNPS.cause
Object	RNCFunction
Unit/Range	Range
Type	RATIO
Remark	This KPI reflects the user (UE) point of view, since the user may complain about a connection which is released unexpectedly. This KPI would be better if it could be based on counters for each lu Interface ( i.e object = lu Interface rather than RNCFunction), The KPI may be updated in this respect if 3GPP counters per lu Interface become available ( This may be possible in 3GPP Release 7)

## 4.7 Call Drop Rate

Long name	a) Call drop rate CS b) Call drop rate PS c) Call drop rate
Short name	a) CallDR.CS b) CallDR.PS c) CallDR
Description	This KPI describes the ratio of RAB release requests related to the number of successful RAB establishment (per CS/PS domain). Drops are derived from 'IU Release Request' and 'RAB Release Request' messages sent from UTRAN to the CN.
Formula	$CallDR.CS = \frac{RAB.RelReqCS.sum + \sum_{cell} RAB.NbrIuRelReqCS.sum}{\sum_{type} RAB.SuccEstabCSNoQueuing.[type] + \sum_{type} RAB.SuccEstabCSQueuing.[type]}$ $CallDR.PS = \frac{RAB.RelReqPS.sum + \sum_{cell} RAB.NbrIuRelReqPS.sum}{\sum_{type} RAB.SuccEstabPSNoQueuing.[type] + \sum_{type} RAB.SuccEstabPSQueuing.[type]}$ $CallDR = \frac{RAB.RelReqCS.sum + \sum_{cell} RAB.NbrIuRelReqCS.sum + RAB.RelReqPS.sum + \sum_{cell} RAB.NbrIuRelReqPS.sum}{\sum_{type} \left\{ \begin{array}{l} RAB.SuccEstabCSNoQueuing.[type] + \\ RAB.SuccEstabCSQueuing.[type] + \\ RAB.SuccEstabPSNoQueuing.[type] + \\ RAB.SuccEstabPSQueuing.[type] \end{array} \right\}}$ <p>type = € {Conv, Strm, Intact, Bgrd},</p>
Counters	<p>CS:</p> <p>RAB.SuccEstabCSNoQueuing.Conv RAB.SuccEstabCSNoQueuing.Strm RAB.SuccEstabCSNoQueuing.Intact RAB.SuccEstabCSNoQueuing.Bgrd RAB.SuccEstabCSQueuing.Conv RAB.SuccEstabCSQueuing.Strm RAB.SuccEstabCSQueuing.Intact RAB.SuccEstabCSQueuing.Bgrd RAB.RelReqCS.sum RAB.NbrIuRelReqCS.sum</p> <p>PS:</p> <p>RAB.SuccEstabPSNoQueuing.Conv RAB.SuccEstabPSNoQueuing.Strm RAB.SuccEstabPSNoQueuing.Intact RAB.SuccEstabPSNoQueuing.Bgrd RAB.SuccEstabPSQueuing.Conv RAB.SuccEstabPSQueuing.Strm RAB.SuccEstabPSQueuing.Intact RAB.SuccEstabPSQueuing.Bgrd RAB.RelReqPS.sum RAB.NbrIuRelReqPS.sum</p>
Object	RncFunction
Unit/Range	Percent
Type	RATIO
Remark	Call drop rate reflects the retainability of communication as well as system reliability and stability; it is a significant performance indicator.

	Radio system call drop rate only consider the drops caused from access side, not including the drops caused by traffic overload, means those enforced drops demanded by RRM traffic control cannot be taken into account. Call drop rate can be divided into CS domain drop rate, PS domain drop rate and a total one.
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## 4.8 Soft Handover Success Rate

Long name	a) Radio link addition success rate
Short name	a) RLAddSR
Description	This KPI describes the ratio of successful radio link additions related to the total number of radio link addition attempts.
Formula	a) $RLAddSR = \frac{SHO.SuccRLAddUESide}{SHO.AttRLAddUESide}$
Counters	SHO.SuccRLAddUESide SHO.AttRLAddUESide
Object	UtranCell
Unit/Range	Range
Type	RATIO
Remark	Remark, the measured object is the cell, which has been added to the active link (set).

## 4.9 Outgoing Hard Handover success rate

Long name	a) Outgoing Hard Handover success rate (Intra Node B) b) Outgoing Hard Handover success rate (Intra RNC) c) Outgoing Hard Handover success rate (Inter RNC via Iur) d) Outgoing Hard Handover success rate (Inter RNC CN) e) Outgoing Hard Handover success rate
Short name	a) HHOSR.IntraNB b) HHOSR.IntraRNC c) HHOSR.InterRNCviaIur d) HHOSR.InterRNCCN e) HHOSR
Description	This KPI provides the ratio between successful outgoing hard handover related to the attempted outgoing hard handover.
Formula	<p>a) <math>HHOSR\_IntraNB = \frac{HHO.SuccOutIntraNodeB}{HHO.AttOutIntraNodeB}</math></p> <p>b) <math>HHOSR\_IntraRNC = \frac{HHO.SuccOutInterNodeBINtraRNC}{HHO.AttOutInterNodeBINtraRNC}</math></p> <p>c) <math>HHOSR\_InterRNCIur = \frac{HHO.SuccOutInterRNCIur}{HHO.AttOutInterRNCIur}</math></p> <p>d) <math>HHOSR\_InterRNCCN = \frac{HHO.SuccOutInterRNCCN}{HHO.AttOutInterRNCCN}</math></p> <p>e) <math>HHOSR = \frac{\left\{ \begin{array}{l} HHO.SuccOutIntraNodeB + \\ HHO.SuccOutInterNodeBINtraRNC + \\ HHO.SuccOutInterRNCIur + \\ HHO.SuccOutInterRNCCN \end{array} \right\}}{\left\{ \begin{array}{l} HHO.AttOutIntraNodeB + \\ HHO.AttOutInterNodeBINtraRNC + \\ HHO.AttOutInterRNCIur + \\ HHO.AttOutInterRNCCN \end{array} \right\}}</math></p>
Counters	HHO.AttOutIntraNodeB, HHO.SuccOutIntraNodeB HHO.AttOutInterNodeBINtraRNC, HHO.SuccOutInterNodeBINtraRNC HHO.AttOutInterRNCIur, HHO.SuccOutInterRNCIur HHO.AttOutInterRNCCN, HHO.SuccOutInterRNCCN
Object	UtranCell (per neighbor cell relation)
Unit/Range	Range
Type	RATIO
Remark	HHOSR.InterRNCIur and HHOSR.InterRNCCN is collected in the SRNC.

## 4.10 Outgoing Inter RAT Handover success rate

Long name	a) Outgoing Inter RAT Handover success rate (CS) b) Outgoing Inter RAT Handover success rate (PS)
Short name	a) IRATHOSR.CS b) IRATHOSR.PS
Description	This KPI indicates the overall hard handover inter RAT success rate towards GSM network (UMTS -> GSM).
Formula	a) $IRATHOSR\_CS = \frac{IRATHO.SuccOutCS}{IRATHO.AttRelocPrepOutCS}$ b) $IRATHOSR\_PS = \frac{IRATHO.SuccOutPSUTRAN}{IRATHO.AttOutPSUTRAN}$
Counters	CS: IRATHO.AttRelocPrepOutCS, IRATHO.SuccOutCS PS: IRATHO.AttOutPSUTRAN, IRATHO.SuccOutPSUTRAN
Object	UtranCellI (per neighbor cell relation)
Unit/Range	Range
Type	RATIO
Remark	Measurements are collected in the SRNC. Inter RAT handover for CS calls (UMTS -> GSM) starts from the relocation attempt. Inter RAT handover for PS call (UMTS -> GPRS Cell Reselection, Network Initiated) considers only the UTRAN controlled handover.

## 4.11 Throughput Measurements

Long name	<p>Throughput on lub-Interface</p> <p>a) Mean User Data Throughput uplink on lub interface (CS)  b) Mean User Data Throughput downlink on lub interface (CS)  c) Mean User Data Throughput uplink on lub interface (PS)  d) Mean User Data Throughput downlink on lub interface (PS)</p> <p>Throughput on lu-Interface</p> <p>e) Mean User Data Throughput uplink on luCS interface  f) Mean User Data Throughput downlink on luCS interface  g) Mean User Data Throughput uplink on luPS interface  h) Mean User Data Throughput downlink on luPS interface</p>
Short name	<p>a) MeanUserDataULlub.CS  b) MeanUserDataDLlub.CS  c) MeanUserDataULlub.PS  d) MeanUserDataDLlub.PS  e) MeanUserDataULluCS  f) MeanUserDataDLluCS  g) MeanUserDataULlubPS  h) MeanUserDataDLlubPS</p>
Description	This indicator is an estimation of the mean user data throughput on dedicated channels in kbit per second per cell on the lub interface in the uplink/downlink direction.
Formula	<p>a) <math>MeanUserDataULlub.CS = Iub.UserThroughput.([UL][CS]) * 8 / 1000</math></p> <p>b) <math>MeanUserDataDLlub.CS = Iub.UserThroughput.([DL][CS]) * 8 / 1000</math></p> <p>c) <math>MeanUserDataULlub.PS = Iub.UserThroughput.([UL][PS]) * 8 / 1000</math></p> <p>d) <math>MeanUserDataDLlub.PS = Iub.UserThroughput.([DL][PS]) * 8 / 1000</math></p> <p>e) <math>MeanUserDataULluCS = IuCS.UserThroughput.([UL]) * 8 / 1000</math></p> <p>f) <math>MeanUserDataDLluCS = IuCSUserThroughput.([DL]) * 8 / 1000</math></p> <p>g) <math>MeanUserDataULlubPS = IuPSUserThroughput.([UL]) * 8 / 1000</math></p> <p>h) <math>MeanUserDataDLlubPS = IuPS.UserThroughput.([DL][PS]) * 8 / 1000</math></p>
Counters	<p>Iub.UserThroughput,  IuCS.UserThroughput,  IuPS.UserThroughput  Trigger = Transmission/reception RLC PDU octets on lub</p>
Object	<p>Iub: NodeB,  Iur: RncFunction</p>
Unit/Range	kbit/sec
Type	CUM
Remark	There are no standardized counters which provide the mean user data throughput on dedicated channels on lu, lub interface per UL/DL direction and per CS/PS domain.

## 5 CO-OP GERAN KPI Definitions

The following clause contains a definition of the GERAN KPIs with an associated formula indicating how the KPI is calculated from a set of component raw measurements, further definition of the raw measurements used is given in TS 52.402 [5].

### 5.1 Call Volume

Long name:	Call Volume
Short name:	
Description:	This formula calculates the number of call originations which successfully access a TCH.
Formula:	$CallVolume = succTCHSeizures \times (1 - SDCCHBlockingRate)$
Counter:	3GPP 52.402:  a) succTCHSeizures b) SDCCHBlockingRate
Elem. Object:	CELL
Unit:	Calls
Type:	CUM
Remarks:	See below for SDCCHBlockingRate KPI definition

### 5.2 Call Success Rate

Long name:	a) Call Success Rate
Short name:	a) CSR
Description:	Single overall figure for network quality from a subscriber's perspective which represents the proportion of calls which complete successfully i.e. Set-Up successfully and do not suffer an RF loss before user termination or successful hand out.
Formula:	$CallSuccessRate = CallSetupSuccessRate \times \left(1 - \frac{CallDropRate}{100}\right)$
Counter:	Call Setup Success Rate – see definition below. Call Drop Rate – see definition below.
Elem. Object:	CELL
Unit:	Percent
Type:	RATIO
Remarks:	Please refer to KPI definitions for Call Setup Success Rate and Drop Call Rate below.

## 5.3 Call Drop Rate (Cell Level)

Long name:	a) Call Drop Rate
Short name:	
Description:	This formula calculates the proportion of mobiles which, having successfully accessed the TCH, subsequently suffer an abnormal release, caused by loss of the radio link. This figure is comprised of RF Losses on the TCH plus losses during handover.
Formula:	$CallDropRateCell = \frac{\left( \begin{array}{l} nbrOfLostRadioLinksTCH + \\ unsuccInternalHDOsIntraCell + \\ unsuccHDOsWithReconnection + \\ unsuccHDOsWithLossOfConnection \end{array} \right)}{\left( \begin{array}{l} succTCHSeizures + succInternalHDOsIntraCell \\ + succIncomingInternalInterCellHDOs \end{array} \right)}$
Counter:	3GPP 52.402:  a) nbrOfLostRadioLinksTCH b) unsuccInternalHDOsIntraCell c) unsuccHDOsWithReconnection d) unsuccHDOsWithLossOfConnection e) succTCH seizures f) succInternalHDOsIntraCell g) succIncomingInternalInterCellHDOs
Elem. Object:	CELL
Unit:	Percent
Type:	RATIO
Remarks:	



## 5.4 Handover Success Rate (BSC and Cell)

Long name:	a) Handover Success Rate
Short name:	
Description:	The HANDOVER_SUCCESS_RATE statistic tracks the percent of handovers that were attempted from the source cell (cell for which the statistic is presented) that succeeded in making it to the destination cell.
Formula:	$\text{HandoverSuccessRateBsc} = \left( \frac{\text{succInternalHDOsPerBSC}}{\left( \text{succInternalHDOsPerBSC} + \text{unsuccInternalHDOsWithReconnectionPerBSC} + \text{unsuccInternalHDOsWithLossOfConnectionPerBSC} \right)} \times 100\% \right)$ $\text{HandoverSuccessRateCell} = \left( \frac{\text{succOutgoingInternalInterCellHDOs}}{\text{attOutgoingInternalInterCellHDOs}} \right)$
Counter:	3GPP 52.402  BSC Handover Success Rate  a) succInternalHDOsPerBSC b) unsuccInternalHDOsWithReconnectionPerBSC c) unsuccInternalHDOsWithLossOfConnectionPerBSC  Cell Handover Success Rate  a) succOutgoingInternalInterCellHDOs b) attOutgoingInternalInterCellHDOs
Elem. Object:	BSC, CELL
Unit:	Percent
Type:	RATIO
Remarks:	

## 5.5 Call Setup Success Rate

Long name:	a) Call Setup Success Rate
Short name:	
Description:	This formula calculates the proportion of mobiles which successfully access a TCH.
Formula:	$\text{CallSetupSuccessRate} = \frac{\text{succTCHSeizures}}{\text{attTCHSeizures}}$
Counter:	3GPP 52.402:  a) succTCHSeizures b) attTCHseizures
Elem. Object:	CELL
Unit:	Percent
Type:	RATIO
Remarks:	

## 5.6 Assignment Procedure Success Rate

Long name:	Assignment Procedure Success Rate
Short name:	
Description:	This formula calculates the proportion of mobiles which successfully access to resources, having requested an appropriate service on accessing the SDCCH.
Formula:	<p><b>Formula</b></p> $AssignProcSuccRate = \frac{\left( succImmediateAssingProcsPerBSC + \right)}{succInternalHDOsPerBSC} \cdot attImmediateAssingProcsPerBSC$
Counter:	<p>3GPP 52.402:</p> <ul style="list-style-type: none"> <li>a) succImmediateAssingProcsPerBSC</li> <li>b) succInternalHDOsPerBSC</li> <li>c) attImmediateAssingProcsPerBSC</li> </ul>
Elem. Object:	BSC
Unit:	Percent
Type:	RATIO
Remarks:	

## 5.7 SDCCH Blocking Rate

Long name:	a) SDCCH Blocking Rate
Short name:	
Description:	This formula calculates the proportion of all SDCCH resource requests and failed due to no SDCCH resource available.
Formula:	$SDCCHBlockingRate = \frac{attSDCCHSeizuresMeetingSDCCHBlockedState}{succImmediateAssingProcs}$
Counter:	3GPP 52.402: a) attSDCCHSeizuresMeetingSDCCHBlockedState b) succImmediateAssingProcs
Elem. Object:	CELL
Unit:	Percent
Type:	RATIO
Remarks:	

## 5.8 TCH Blocking Rate

Long name:	a) TCH Blocking Rate
Short name:	
Description:	This formula calculates the proportion of all requests for TCH resources (call origination and incoming handover) and fail due non available TCH resources.
Formula:	$TCHBlockingRate = \frac{attTCHSeizuresMeetingTCHBlockedState}{attTCHSeizures}$
Counter:	3GPP 52.402: a) attTCHSeizuresMeetingTCHBlockedState b) succTCHSeizures
Elem. Object:	CELL
Unit:	Percent
Type:	RATIO
Remarks:	

## 5.9 TCH Traffic Carried

Long name:	a) TCH Traffic Carried
Short name:	
Description:	This KPI provides the arithmetic mean number of Time slots which are simultaneously in use for Circuit Switched traffic (TCHs)
Formula:	$TCHTrafficCarried = meanNbrOfBusyTCHs$
Counter:	3GPP 52.402: a) meanNbrOfBusyTCHs
Elem. Object:	CELL
Unit:	TCH
Type:	MEAN
Remarks:	

---

## 6 High Level KPI Definitions

For some KPIs, even if the KPI definition could be common across equipment vendors and network operators, the related calculation formulas and the Network Element's raw counters may not be. It is different between vendors, and can change over time as the Network Elements or the technologies evolve. 3GPP specifications allow different implementation alternatives that consequently lead to non uniform counter updates or even different counter definitions between vendors. Such High Level KPIs should be well described, including a clear rationale, but the details about which measurements (counters) or formulas to use should not be standardized.

Subsection 6.1 gives an overview of example UTRAN KPIs and categories that are further detailed in sections 6.2-6.4.

### 6.1 Overview of UTRAN KPIs and Categories

The UTRAN KPIs described in this clause are categorized as follows:

Category	KPI
Retainability	Call Drop Rate
Availability	Cell Unavailability
Integrity	UL BLER (Uplink Block Error Rate)

Additionally, the KPIs can be sub-categorized based on RAB types. Which RAB types to use should be vendor-specific.

The KPI categories in the table above are service performance categories from ITU-T Recommendation E.800 [7]. Any future KPI specification work should consider close alignment with ITU-T Recommendation E.800 [7].

## 6.2 Call Drop Rate

Long name	<ul style="list-style-type: none"> <li>a) Call drop rate CS RABtype1</li> <li>b) Call drop rate CS.RABtype2</li> <li>c) Call drop rate CS RABTypeN</li> <li>.....</li> </ul>
Short name	<ul style="list-style-type: none"> <li>a) CallDR.CS.RABtype1</li> <li>b) CallDR.CS.RABtype2</li> <li>c) CallDR.CS.RABtypeN</li> <li>.....</li> </ul>
Description	<p>This KPI describes the ratio of abnormal RAB releases related to the total number of RAB releases.</p> <p>Abnormal RAB releases are all RAB releases not initiated by the user or the application.</p>
Rational	<p>Call drop rate reflects the retainability of communication as well as system reliability and stability; it is a significant performance indicator.</p>
Definition	<p>The Call Drop Rate is the ratio of the number of abnormal RAB releases (for a certain RAB type) related to the total number of RAB releases (for a certain RAB type).</p>
Counters	<p>Not specified.</p> <p>Reason: The counters can be vendor specific.</p>
Object	<p>UtranCell/RncFunction</p>
Unit/Range	<p>Percent</p>
Type	<p>RATIO</p>
Remark	<p>RABtype is Conv, Strm etc.</p>

Note: High level definition of Call to be added

## 6.3 Cell Unavailability

Long name	Cell Unavailability
Short name	CellUnavailability
Description	This KPI describes the unavailability of the cell as perceived by the end-user.
Rationale	This KPI gives the operator the end-user perception of the availability of a cell.
Definition	Cell Unavailability is the ratio of the time when a cell is out of service (not caused by operator interference) related to a specified measurement time interval.
Counters	Not specified.  Reason: The counters can be vendor specific, or the unavailability can be caused by e.g. a hardware fault.
Object	UtranCell
Unit/Range	Percent
Type	RATIO
Remark	.

Note: High level definition of “cell out of service “ to be added

## 6.4 Uplink Block Error Rate

Long name	Uplink Block Error Rate
Short name	ULBLER
Description	This KPI describes the Uplink Block Error Rate.
Rationale	This KPI gives the operator an indication of the Uplink Block Error Rate (UL BLER, 3GPP TS 25.423).  The UL BLER can be mapped on the perceived speech quality.
Definition	Uplink Block Error Rate is the ratio of the number of faulty UL transport blocks in relation to the total number of UL transport blocks.
Counters	Not specified.  Reason: the counters can be vendor specific.
Object	UtranCell
Unit/Range	Percent
Type	RATIO
Remark	-

## 7 Template for definition of KPIs

This section contains the KPI definition template that has been used for the KPIs defined in section 6.

Long name (mandatory)	a) b) c) .....
Short name (mandatory)	a) b) c) .....
Description (mandatory)	
Rationale (mandatory)	
Definition (mandatory)	a) (formula) b) (formula) c) (formula)  (if no formulas are specified, a verbal definition of the KPI should be given here)
Counters (optional)	(if no counters are specified, a reason for that can be given here)
Object (mandatory)	
Unit/Range (mandatory)	
Type (mandatory)	RATIO / MEAN / CUM
Remark (optional)	

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## 8 Conclusion

This present document by way of examples has detailed two methods of defining Key Performance Indicators (KPI's), the first method (sections 4 and 5) is characterised by using performance measurements defined in the 32.4xx series specifications, the second method takes a higher level approach that does not require the use of standardised performance measurements.

This study concludes that where standardised measurements are available, the first definition approach should be used, however when standardised measurements are not available or not appropriate to use, e.g. when differing implementation alternatives have led to non uniform counter updates or even different counter definitions between vendors, then a higher level KPI definition approach as detailed in section 6 may be used.

Note: This study has not used a uniform template between the two different KPI methods, this is something that should be addressed in any future KPI standardisation work.



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## Annex A: Change history

Change history								
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Cat	Old	New
Dec 2006	SA_34	SP-060738	--	--	Submitted to SA#34 for Information	--	1.0.0	
Mar 2007	SA_35	SP-070050	--	--	Submitted to SA#35 for Approval	--	2.0.0	7.0.0