# 

**Network-as-a-Service Runbook**

**Primer**

**RAN KPIs (Key Performance Indicators)**

**Facebook NaaS Runbook**

*2020*

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# RAN Key Performance Indicators

The present document shows KPIs (Key Performance Indicators) and the description of the corresponding counters that are part of the KPIs for a specific RAN Equipment Vendor. The objective is to give Optimization teams in the NaaS Operator with an overview of the counters that are considered in each KPI, facilitating this way the adaptation to the RAN Vendors that the OEM will utilize in their deployment.

## 2G KPIs

The following table contains 2G KPIs which are recommended to be reviewed and analyzed by the RAN Optimization team in the NaaS Operator:

|  |  |
| --- | --- |
|  | 2G KPIs |
| GROUP | KPI |
| DCR Voice | 2G\_DCR |
| CSSR Voice | 2G\_CSSR |
| CSSR Data | 2G\_CSSR\_DATA (GPRS\_CSSR) |
| Paging | CS Paging Success (2G/3G/4G) |
| 2G Data Paging Success |
| Mobility (HO) | 2G\_HO\_Success\_Rate (Intra-GSM) |
| HO\_2G3G\_Speech |
| Traffic Volume | 2G\_Speech\_minutes |
| % 2G VOICE Traffic (vs. total 2G+3G+4G) |
| 2G DL Data traffic (KB) |
| 2G UL Data traffic (KB) |
| % 2G Data Traffic DL (vs. total 2G+3G+4G) |
| Throughput | Tput DL 2G EDGE |
| Tput UL 2G EDGE |
| Availability | 2G Availability |

The following sections contain the formulas and counters’ description of the 2G KPIs:

### 2G\_DCR

* **KPI formula**:
* **% Drop TCH Rate =** 100 \* TNDROP / (TCASSALL + (SUMIHOSUCC - SUMIABSUCC - SUMIAWSUCC) - (SUMOHOSUCC - SUMOABSUCC - SUMOAWSUCC))
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| TNDROP | Total Number of Drops on TCH |
| TCASSALL | Number of assignment complete messages on TCH for all MS power classes. |
| SUMIHOSUCC | Sum of Successful Internal Handovers (Incoming Handover) |
| SUMIABSUCC | Sum of Successful Internal Assignment Handovers to Better Cell (Incoming Handover) |
| SUMIAWSUCC | Sum of Successful Internal Assignment Handovers to Worse Cell (Incoming Handover) |
| SUMOHOSUCC | Sum of Successful Internal Handovers (Outgoing Handover) |
| SUMOABSUCC | Sum of Successful Internal Assignment Handovers to Better Cell (Outgoing Handover) |
| SUMOAWSUCC | Sum of Successful Internal Assignment Handovers to Worse Cell (Outgoing Handover) |

### 2G\_CSSR

* **KPI formula**:
* **% Call Setup Success Rate =** 100\*( 1-TCH Blocks/TCH Assignment Attempt)\* (1-SDCCH Drops/SDCCH Assignment Success)\* (SDCCH Assignment Success/ SDCCH Assignment Attempts)

Where:

* TCH Blocks = TCH Assignment Attempts - TCH Assignment Success = Tassall - Tcassall
* TCH Assignment Attempts = Tassall
* SDCCH Drops = Cndrop – Clundrop – Cnrelcong - Tfnrelcong - Thnrelcong
* SDCCH Assignment Success = Cmsestab - Clumsestab + Tchsig - Cchhosuc
* SDCCH Assignment Attempts = Cnrocnt – Raother - Racalr1 - Racalr2 – Racalre
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Tassall | Number of first assignment attempts on TCH for all MS power classes. Successful attempts are counted in the target cell and failed attempts are counted in the serving cell. The serving cell is the cell where the mobile station was tuned to an SDCCH or TCH for signalling. |
| Tcassall | Number of assignment complete messages on TCH for all MS power classes. |
| Cndrop | The total number of dropped SDCCH channels in a cell. |
| Clundrop | The total number of dropped SDCCH channels during location area update in a cell. The counter CLUNDROP is incremented for abnormal terminations that occur during location area update. |
| Cnrelcong | Number of released connection on SDCCH due to TCH— and transcoder congestion in underlaid and overlaid subcell. |
| Tfnrelcong | Number of released TCH signalling connections due to transcoder resource congestion during immediate assignment on TCH. |
| Thnrelcong | Number of released TCH signalling connections due to transcoder resource congestion during immediate assignment on TCH (HALF RATE) |
| Cmsestab | Successful MS channel establishments on SDCCH. |
| Clumsestab | Successful MS establishment on SDCCH. This counter is a sum of both overlaid and underlaid. Only incremented in case of location area update, while CMSESTAB and CMSESTABSUB are incremented for all traffic cases. |
| Tchsig | Number of TCH connections for signalling. Object type CLTCH. |
| Cchhosuc | Successful SDCCH handover attempts. |
| Cnrocnt | Number of all accepted random accesses |
| Raother | Number of random accesses, (RAOTHER)  All other cases. |
| Racalr1 | Number of random accesses, Call re-establishment. TCH/H was in use, and the network sets the NECI bit to 1. |
| Racalr2 | Number of random accesses, Call re-establishment. TCH/H+TCH/H was in use, and the network sets the NECI bit to 1. |
| Racalre | Number of random accesses, Call re-establishment. |

### 2G\_CSSR\_DATA

* **KPI formula**:
* **GPRS CSSR =** 100\*(Msestdltbf + Msestultbf ) / ( Pschreq + Dltbfest)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Msestdltbf | The counter MSESTDLTBF counts the number of successfully established DL TBFs where at least one data block has been sent and acknowledged. |
| Msestultbf | Number established uplink TBFs were the MS has started to send data (at least one RLC block received). |
| Pschreq | Number of packet access requests in the cell received in the PCU on any channel: RACH, PRACH or PACCH (in Packet Downlink Ack/Nack). A packet access request is normally to setup an uplink TBF. |
| Dltbfest | Number of DL TBF establishment requests |

### CS Paging Success (2G/3G/4G)

* **KPI formula**:
* **% CS Paging Succ (2G/3G/4G) =** 100\*Sum (Nlapag1resucc + Nlapag2resucc + Nsucccsfb) / Sum (Ntpag1csfb + Nlapag1lotot)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Nlapag1resucc | Number of page responses to first page to an LA (Location Area). |
| Nlapag2resucc | Number of page responses to repeated page to an LA (Location Area). |
| Nsucccsfb | Number of successful CS fallbacks for MT (Mobile Terminating) CS |
| Ntpag1csfb | Number of first page attempts for CS over the SGs-i/f |
| Nlapag1lotot | Number of first page attempts to an LA |

### 2G Data Paging Success

* **KPI formula**:
* **% PS Paging Succ (2G) =** 100\* Sum (Succpspagingprocgb) / Sum (Attpspagingprocgb)
* **Counters (Note: measurements related to the SGSN):**

|  |  |
| --- | --- |
| Counter | Counter description |
| Succpspagingprocgb | Total number of successful PS paging procedures that are initiated at the SGSN, over the Gb interface |
| Attpspagingprocgb | Total number of PS paging procedures that are initiated at the SGSN, over the Gb interface |

### 2G\_HO\_Success\_Rate

* **KPI formula**:
* **Intra GSM HO Success =** 100\*Sum (Hoversuce + Hoversuci) / Sum (Hovercnti + Hovercnte)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Hoversuce | Number of successful external handovers to the neighboring cell. |
| Hoversuci | Number of successful internal handovers to the neighboring cell. |
| Hovercnti | Number of Internal Handover Commands sent to the MS |
| Hovercnte | Number of External Handover Commands sent to the MS |

### HO\_2G3G\_Speech

* **KPI formula**:
* **2G to 3G Voice IRAT HO Success =** 100\*Sum (Hoversucutran) / Sum (Hovercntutran)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Hoversucutran | The number of successful handovers to the neighboring UTRAN cell. |
| Hovercntutran | The number of handover attempts to the neighboring UTRAN cell. |

### 2G Speech minutes

* **KPI formula**:
* **Voice (minutes) =** 60\*((Thtralacc/Thnscan) + (Tftralacc/Tfnscan))
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Thtralacc | Traffic level accumulator for half-rate TCH. |
| Thnscan | Number of accumulations of traffic level counter for  half-rate TCH. |
| Tftralacc | Traffic level accumulator for full-rate TCH. |
| Tfnscan | Number of accumulations of traffic level counter for  full-rate TCH. |

### % 2G VOICE Traffic (vs. total 2G+3G+4G)

* **2G Voice Traffic (minutes) =** 60\*((Thtralacc/Thnscan)+(Tftralacc/Tfnscan)) (see 1.1.9)
* **3G Voice Traffic (minutes) =** 60\*((pmSumBestCS12Establish / pmSamplesBestCS12Establish) + ( pmSumBestAmr12200RabEstablish / pmSamplesBestAmr12200rabestab) + ( pmSumBestAmr7950RabEstablish / pmSamplesBestAmr7950rabestab ) + ( pmSumBestAmr5900RabEstablish / pmSamplesBestAmr5900rabestab ) + ( pmSumBestAmr4750RabEstablish / pmSamplesBestAmr4750RabEstab ) + ( pmSumBestAmrWbRabEstablish / pmSamplesBestAmrWbRabEstablish ) + (pmSumBestAmrNbMmRabEstablish /pmSamplesBestAmrNbMmRabEstabli))
* **4G Voice (VoLTE) Traffic (minutes) =** Pmsessiontimedrbqci1 / 60
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmSumBestCS12Establish | Sum of all sample values ​​recorded within ROP period for “number of distinct CS speech users”, referred to the best cell in the Active Set |
| pmSamplesBestCS12Establish | Number of samples recorded within the ROP period for "number of distinct CS speech users", referred to the best cell in the Active Set. |
| pmSumBestAmr12200RabEstablish | Sum of sample values recorded within ROP period for ‘Number of Speech AMR 12200 RABs established’ for the best cell in the active set. |
| pmSamplesBestAmr12200rabestab | Number of samples recorded within the ROP period for “number of speech AM12200 RABs established” for the best cell in the active set |
| pmSumBestAmr7950RabEstablish | Sum of sample values recorded within ROP period for ‘Number of Speech AMR 7950 RABs established’ for the best cell in the active set. |
| pmSamplesBestAmr7950rabestab | Number of samples recorded within the ROP period for “number of speech AMR7950 RABs established” for the best cell in the active set. |
| pmSumBestAmr5900RabEstablish | Sum of sample values recorded within ROP period for ‘Number of Speech AMR 5900 RABs established’ for the best cell in the active set. |
| pmSamplesBestAmr5900rabestab | Number of samples recorded within the ROP period for “number of speech AMR5900 RABs established” for the best cell in the active set. |
| pmSumBestAmr4750RabEstablish | Sum of sample values recorded within ROP period for ‘Number of Speech AMR 4750 RABs established’ for the best cell in the active set. |
| pmSamplesBestAmr4750RabEstab | Number of samples recorded within the ROP period for “number of speech AMR4750 RABs established” for the best cell in the active set. |
| pmSumBestAmrWbRabEstablish | Sum of sample values recorded within ROP period for ‘Number of Speech Wide band AMR RABs established’ for the best cell in the active set. |
| pmSamplesBestAmrWbRabEstablish | Number of samples recorded within the ROP period for “number of speech Wide band AMR RABs established” for the best cell in the active set. |
| pmSumBestAmrNbMmRabEstablish | Sum of sample values recorded within ROP period for ‘Number of Speech Narrow band AMR RABs established’ for the best cell in the active set. |
| pmSamplesBestAmrNbMmRabEstabli | Number of samples recorded within the ROP period for “number of speech Narrow band AMR RABs established” for the best cell in the active set. |
| Pmsessiontimedrbqci1 | Session time aggregated for DRBs mapping to QCI1. Bandwidth-reduced UEs are excluded from this measurement. |

### 2G DL Data traffic (KB)

* **KPI formula**:
* **Data (KB) =** (Cs14dlack/8000) + (Mc19dlack/8000)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Cs14dlack | Total amount of RLC data volume successfully  acknowledged by MSs with a GPRS mode TBF (CS-1 to CS-4) in RLC acknowledged mode, downlink. |
| Mc19dlack | Total amount of RLC data volume successfully acknowledged by MSs with a EGPRS mode TBF (MCS-1 to MCS-9) in RLC acknowledged mode,  downlink. |

### 2G UL Data traffic (KB)

* **KPI formula**:
* **Data (KB) =** (Cs12ulack/8000) + (Mc19ulack/8000)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Cs12ulack | Counts the total amount of RLC data successfully  received in the PCU for CS-1/2, RLC acknowledged  mode TBFs. |
| Mc19ulack | Counts the total amount of RLC data successfully received by the PCU for EGPRS, RLC acknowledged mode TBFs. |

### % 2G Data Traffic DL (vs. total 2G+3G+4G)

* **2G Data Traffic (KB) DL =** (Cs14dlack/8000)+(Mc19dlack/8000) (see 1.1.11)
* **3G Data Traffic DL = R99 DL traffic (MB) + HSDPA Traffic (MB), where:**
  + **R99 DL traffic (MB) =** 1000 \* (pmDlTrafficVolumePs8 + pmDlTrafficVolumePs16 + pmDLTrafficVolumePs64+ pmDLTrafficVolumePs128 + pmDLTrafficVolumePs384+ pmDLTrafficVolumePsStr16 + pmDLTrafficVolumePsStr64 + pmDLTrafficVolumePsStr128 + pmDlTrafficVolumePsCommon) /( 8 \* 1024\* 1024)
  + **HSDPA Traffic (MB) =** 1000\*Sum (Pmdltrafficvolumepsinths + Pmdltrafficvolumepsstrhs) / (8\*1024\*1024)
* **4G Data Traffic DL (GB) = DL PDCP SDU Traffic (GB) =** (Pmpdcpvoldldrb\*1000)/(8\*1024\*1024\*1024) (see 1.3.17)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmDlTrafficVolumePs8 | Payload traffic in the downlink for the PS Interactive part of the UeRc configurations that carry a downlink Interactive transport channel with a maximum bit rate equal to 8 kbps. |
| pmDlTrafficVolumePs16 | Payload traffic in the downlink for the PS Interactive part of the UeRc configurations that carry a downlink Interactive transport channel with a maximum bit rate equal to 16 kbps. |
| pmDLTrafficVolumePs64 | Payload traffic in the downlink for the PS Interactive part of the UeRc configurations that carry a downlink Interactive transport channel with a maximum bit rate equal to 64 kbps. |
| pmDLTrafficVolumePs128 | Payload traffic in the downlink for the PS Interactive part of the UeRc configurations that carry a downlink Interactive transport channel with a maximum bit rate equal to 128 kbps. |
| pmDLTrafficVolumePs384 | Payload traffic in the downlink for the PS Interactive part of the UeRc configurations that carry a downlink Interactive transport channel with a maximum bit rate equal to 384 kbps. |
| pmDLTrafficVolumePsStr16 | Payload traffic (bits) in DL after macro diversity for UeRc configurations which carry a Streaming DL TrCH with a maximum bit rate equal to 16 kbps. Only the PS Streaming part of the traffic volume is measured. |
| pmDLTrafficVolumePsStr64 | Payload traffic (bits) in DL after macro diversity for UeRc configurations which carry a Streaming DL TrCH with a maximum bit rate equal to 64 kbps. Only the PS Streaming part of the traffic volume is measured. |
| pmDLTrafficVolumePsStr128 | Payload traffic (bits) in DL after macro diversity for UeRc configurations which carry a Streaming DL TrCH with a maximum bit rate equal to 128 kbps. Only the PS Streaming part of the traffic volume is measured. |
| pmDlTrafficVolumePsCommon | Traffic volume on DL in Kbps for PS RAB on FACH/RACH. |
| Pmdltrafficvolumepsinths | Payload traffic (kbits) in DL for UeRc configurations for HS-DSCH. Only Interactive PS traffic is included. |
| Pmdltrafficvolumepsstrhs | Payload traffic (kbits) in DL for UeRc configurations which carries an Streaming PS DL Trch on HS-DSCH. Only PS Streaming traffic is included. |
| Pmpdcpvoldldrb | The total volume (PDCP SDU) on Data Radio Bearers that has been transferred (UM and AM) in the downlink direction. |

### Throughput DL 2G EDGE

* **KPI formula**:
* **THR EDGE DL** = (Dlbgegthr+Dlthp1egthr+Dlthp2egthr+Dlthp3egthr)/ (Dlbgegdata + Dlthp1egdata+ Dlthp2egdata + Dlthp3egdata)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Dlbgegthr | Accumulated throughput per PFC for EGPRS, DL, and Qos class background in a cell |
| Dlthp1egthr | Accumulated throughput per PFC for EGPRS, DL, and Qos class THP1 in a cell |
| Dlthp2egthr | Accumulated throughput per PFC for EGPRS, DL, and Qos class THP2 in a cell |
| Dlthp3egthr | Accumulated throughput per PFC for EGPRS, DL, and Qos class THP3 in a cell |
| Dlbgegdata | Total LLC PDU data for EGPRS ,DL and Qos class background in a cell |
| Dlthp1egdata | Total LLC PDU data for EGPRS, DL and Qos class THP1 in a cell |
| Dlthp2egdata | Total LLC PDU data for EGPRS, DL and Qos class THP2 in a cell |
| Dlthp3egdata | Total LLC PDU data for EGPRS, DL and Qos class THP3 in a cell |

### Throughput UL 2G EDGE

* **KPI formula**:
* **THR EDGE UL =** (Ulbgegthr+Ulthp1egthr+Ulthp2egthr+Ulthp3egthr) / (Ulbgegdata+Ulthp1egdata+Ulthp2egdata+Ulthp3egdata)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Ulbgegthr | Accumulated throughput per PFC for EGPRS, UL, and Qos class background in a cell |
| Ulthp1egthr | Accumulated throughput per PFC for EGPRS ,UL, and Qos class THP1 in a cell |
| Ulthp2egthr | Accumulated throughput per PFC for EGPRS ,UL, and Qos class THP2 in a cell |
| Ulthp3egthr | Accumulated throughput per PFC for EGPRS ,UL, and Qos class THP3 in a cell |
| Ulbgegdata | Total LLC PDU data for EGPRS,UL and Qos class background in a cell |
| Ulthp1egdata | Total LLC PDU data for EGPRS,UL and Qos class THP1 in a cell |
| Ulthp2egdata | Total LLC PDU data for EGPRS,UL and Qos class THP2 in a cell |
| Ulthp3egdata | Total LLC PDU data for EGPRS,UL and Qos class THP3 in a cell |

### 2G Availability

* **KPI formula**:
* **Cell TCH Availability = 1 – TCH Downtime Percentage =** 1 – (TDWNACC / TDWNSCAN)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| TDWNACC | The counter is stepped every tenth second if there are no TCHs in IDLE or BUSY state in the cell and the cell state is ACTIVE. |
| TDWNSCAN | The counter is stepped every tenth second when the cell state is ACTIVE. |

## 3G KPIs

The following table contains 3G KPIs which are recommended to be reviewed and analyzed by the RAN Optimization team in the NaaS Operator:

|  |  |
| --- | --- |
|  | **3G KPIs** |
| **GROUP** | **KPI** |
| DCR Voice | 3G\_DCR |
| CSSR Voice | 3G\_CSSR\_CS |
| CSSR Data | 3G\_CSSR\_PS |
| DCR Data | 3G\_DCR\_PS |
| Paging | 3G Data Paging Success |
| Mobility (HO) | HO\_3G3G (SHO Speech) |
| IRAT\_HO\_3G2G\_speech |
| Traffic Volume | 3G\_Speech\_minutes |
| Throughput | User Throughput DL 3G (MB) |
| User Throughput UL 3G (MB) |
| Availability | 3G Availability |
| Other | RSSI 3G |
| CSFB Succ Rate |

The following sections contain the formulas and counters’ description of the 3G KPIs:

### 3G\_CDR\_SPEECH

* **KPI formula**:
* **% Call Drop Rate =** 100\* ((pmNoSystemRabReleaseSpeech + pmNoSystemRabReleaseCs64) /

(pmNoNormalRabReleaseSpeech + pmNoNormalRabReleaseCs64 +

pmNoSystemRabReleaseSpeech + pmNoSystemRabReleaseCs64))

* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmNoSystemRabReleaseSpeech | Number of successful system RAB releases (Speech release) |
| pmNoSystemRabReleaseCs64 | Number of successful system RAB releases (CS64 release) |
| pmNoNormalRabReleaseSpeech | Number of successful normal RAB releases (Speech) |
| pmNoNormalRabReleaseCs64 | Number of successful normal RAB releases (CS64) |
| pmNoSystemRabReleaseSpeech | Number of successful system RAB releases (Speech release) |
| pmNoSystemRabReleaseCs64 | Number of successful system RAB releases (CS64 release) |

### 3G\_CSSR\_CS

* **KPI formula**:
* **% Circuit Switched Call Setup Success Rate =** CS RRC Success Rate \* CS RAB Success Rate
  + **CS RRC Success Rate:**

**% Circuit Switched RRC Success Rate =** 100\* ([pmTotNoRrcConnectReqCsSucc / (pmTotNoRrcConnectReqCs - pmNoLoadSharingRrcConnCs) ])

* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmTotNoRrcConnectReqCsSucc | Number of successful Conversat. and Emerg. Call RRC requests |
| pmTotNoRrcConnectReqCs | Number of Conversat. and Emerg. call RRC Connection Requests |
| pmNoLoadSharingRrcConnCs | Number of carrier changes due to load sharing feature |

* + **CS RAB Success Rate:**

**% Circuit Switched RAB Success Rate =** 100\*[(pmNoRabEstablishSuccessSpeech + pmNoRabEstablishSuccessCs64 + pmNoDirRetrySuccess) / (pmNoRabEstablishAttemptSpeech + pmNoRabEstablishAttemptCs64) ]

* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmNoRabEstablishSuccessSpeech | Number of successful RAB establishments for speech |
| pmNoRabEstablishSuccessCs64 | The number of successful RAB establishments CS64 referred to the Best Cell in the Active Set |
| pmNoDirRetrySuccess | Number of successful Directed Retry attempts |
| pmNoRabEstablishAttemptSpeech | Number of RAB establishment attempts for speech |
| pmNoRabEstablishAttemptCs64 | Number of RAB establishment attempts for CS64 |

### 3G\_CSSR\_PS

* **KPI formula**:
* **% Packet Switched Call Setup Success Rate =**PS RRC Success Rate \* PS RAB Success Rate
  + **PS RRC Success Rate:**

**% Packet Switched RRC Success Rate =** 100\* pmTotNoRrcConnectReqPsSucc / (pmTotNoRrcConnectReqPs)

* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmTotNoRrcConnectReqPsSucc | Number of Successful Int. and Background RRC Conn attempts |
| pmTotNoRrcConnectReqPs | Number of Int. and Background RRC Connection Requests |

* + **PS RAB Success Rate:**

**% Packet Switched RAB Success Rate =** 100\* **P**mNoRabEstablishSuccessPacketInteractive / pmNoRabEstablishAttemptPacketInteractive

* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmNoRabEstablishSuccessPacketInteractive | No. of successful RAB establishments for PS Int. RAB |
| pmNoRabEstablishAttemptPacketInteractive | No. of RAB establishment attempts for PS Int. RAB |

### 3G\_CDR\_PS

* **KPI formula**:
* **% Packet Switched Call Drop Rate =** 100\* pmNoSystemRabReleasePacket / ( pmNoNormalRabReleasePacket + pmNoSystemRabReleasePacket )
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmNoSystemRabReleasePacket | Number of successful system RAB releases (PS drops) |
| pmNoNormalRabReleasePacket | Number of successful normal RAB releases (PS) |
| pmNoSystemRabReleasePacket | Number of successful system RAB releases (PS drops) |

### 3G\_Data Paging Success

* **KPI formula**:
* **% PS Paging Success =** 100\* (NPAG1RESUCC+NPAG2RESUCC)/(NPAG1LOTOT)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| NPAG1RESUCC | Number of Successful first pages |
| NPAG2RESUCC | Number of Successful second pages |
| NPAG1LOTOT | Total number of first local pages |

### HO\_3G3G (SHO Speech)

* **KPI formula**:
* **% 3G to 3G Voice Soft Handover=** 100\*Sum(Pmrladdsuccessbestcellspeech)/Sum(Pmrladdattemptsbestcellspeech)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Pmrladdsuccessbestcellspeech | Number of radio links additions that succeded for speech RABs |
| Pmrladdattemptsbestcellspeech | Number of radio links additions attempted for speech RAB |

### IRAT\_HO\_3G2G\_speech

* **KPI formula**:
* **3G to 2G Voice IRAT HO=** 100\*Sum(Pmnosuccessoutirathospeech)/ Suma(Pmnoattoutirathospeech)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Pmnosuccessoutirathospeech | No. of successful outgoing IRAT HO for speech |
| Pmnoattoutirathospeech | No. of attempted outgoing IRAT HO for speech |

### 3G Speech minutes

* **KPI formula**:
* **Voice (minutes) =** 60\*((pmSumBestCS12Establish / pmSamplesBestCS12Establish )

+ ( pmSumBestAmr12200RabEstablish / pmSamplesBestAmr12200rabestab)

+ ( pmSumBestAmr7950RabEstablish / pmSamplesBestAmr7950rabestab )

+ ( pmSumBestAmr5900RabEstablish / pmSamplesBestAmr5900rabestab )

+ ( pmSumBestAmr4750RabEstablish / pmSamplesBestAmr4750RabEstab )

+ ( pmSumBestAmrWbRabEstablish / pmSamplesBestAmrWbRabEstablish )

+(pmSumBestAmrNbMmRabEstablish/pmSamplesBestAmrNbMmRabEstabli))

* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmSumBestCS12Establish | Sum of sample values recorded within ROP period for ‘Number of CS12 RABs established’ for the best cell in the active set. |
| pmSamplesBestCS12Establish | Number of samples recorded within the ROP period for “number of CS12 RABs established” for the best cell in the active set |
| pmSumBestAmrXRabEstablish | Sum of sample values recorded within ROP period for ‘Number of Speech AMR X RABs established’ for the best cell in the active set. |
| pmSamplesBestAmrXrabestab | Number of samples recorded within the ROP period for “number of speech AMR X RABs established” for the best cell in the active set |
| PmSumBestAmrWbRabEstablish | Sum of sample values recorded within ROP period for ‘Number of Speech AMR WB RABs established’ for the best cell in the active set. |
| pmSamplesBestAmrWbRabEstablish | Number of samples recorded within the ROP period for “number of speech AMR WB RABs established” for the best cell in the active set |
| pmSumBestAmrNbMmRabEstablish | Sum of sample values recorded within ROP period for ‘Number of Speech AMR NB RABs established’ for the best cell in the active set. |
| pmSamplesBestAmrNbMmRabEstabli | Number of samples recorded within the ROP period for “number of speech AMR NB RABs established” for the best cell in the active set |

### User Throughput DL 3G (MB)

* **KPI formula**:
* **DL Data (MB) =** 1000 \* (pmDlTrafficVolumePs8 + pmDlTrafficVolumePs16 + pmDLTrafficVolumePs64+ pmDLTrafficVolumePs128 + pmDLTrafficVolumePs384+ pmDLTrafficVolumePsStr16 + pmDLTrafficVolumePsStr64 + pmDLTrafficVolumePsStr128) / (8 \* 1024\* 1024)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmDlTrafficVolumePsX | Payload traffic (kbps) in DL after macro diversity for UeRc configurations which carries an Interactive DL with max rate equal to X kbit/s. |
| PmDLTrafficVolumePsStrX | Payload traffic (kbps) in DL after macro diversity for UeRc configurations which carries an Interactive DL with max rate equal to X kbit/s in simultaneous transmission and reception way. |

### User Throughput UL 3G (MB)

* **KPI formula**:
* **UL Data (MB) =** 1000\* (pmUlTrafficVolumePs8 + pmUlTrafficVolumePs16+ pmULTrafficVolumePs64 + pmULTrafficVolumePs128 + pmULTrafficVolumePs384 + pmULTrafficVolumePsStr16+ pmULTrafficVolumePsStr128+ pmULTrafficVolumePsCommon) / (8 \* 1024 \* 1024)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmUlTrafficVolumePsX | Payload traffic (kbps) in UL after macro diversity for UeRc configurations which carries an Interactive UL with max rate equal to X kbit/s. |
| PmULTrafficVolumePsStrX | Payload traffic (kbps) in UL after macro diversity for UeRc configurations which carries an Interactive UL with max rate equal to X kbit/s in simultaneous transmission and reception way. |

### 3G Availability

* **KPI formula**:
* **Cell Availability =** 100\* (1 - SUM( Pmcelldowntimeauto+Pmcelldowntimeman ) / “Seconds of measurement”)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Pmcelldowntimeauto | Time that cell has been unavailable due to a fault |
| Pmcelldowntimeman | Time that cell has been unavailable because of admin state being  manually locked. |

### RSSI 3G

* **KPI formula**:
* **Received Signal Strength Indicator =** -112 + (sum(pmSumUlRssi) / sum(pmSamplesUlRssi)) / 10
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmSumUlRssi | Sum of valid RTWP values as received in NBAP Common Measurement Reports |
| pmSamplesUlRssi | Number of received NBAP Common Measurement Report messages containing valid RTWP values |

### CSFB Succ Rate

Note: In CSFB, it is only possible to measure the success ratio from the point of view of UMTS, that is, any connection lost in the transition between 4G and 3G will not be shown in this KPI.

* **KPI formula definition:**
* **% CSSR CSFB =** 100\*Sum(Pmtotnorrcconnreqcsfbindsucc/(Pmtotnorrcconnreqcsfbind – Pmnoloadsharingrrcconncsfbind))\*Sum(Pmnorabestsucccsfbind/Pmnorabestattcsfbind)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Pmtotnorrcconnreqcsfbindsucc | Total number of successful RRC Connection Requests for which the UE includes the IE ‘CSFB Indication’ |
| Pmtotnorrcconnreqcsfbind | Total number of RRC Connection Requests messages that included the IE ‘CSFB Indication’, not including retransmissions |
| Pmnoloadsharingrrcconncsfbind | Total number of conversational (emergency, originating and terminating) load sharing RRC connection attempts, for UEs that included the IE ‘CSFB Indication’ in the RRC Connection Request. |
| Pmnorabestsucccsfbind | Total number of successful CS RAB Establishments for UEs that included the IE ‘CSFB Indication’ in the RRC Connection Request. |
| Pmnorabestattcsfbind | Total number of CS RAB Establishments attempts for UEs that indicated the IE ‘CSFB Indication’ in the RRC Connection Request. |

## 4G KPIs

The following table contains 4G KPIs which are recommended to be reviewed and analyzed by the RAN Optimization team in the NaaS Operator:

|  |  |
| --- | --- |
|  | **4G KPIs** |
| **GROUP** | **KPI** |
| DCR Voice | 4G\_DCR\_CS (VoLTE) |
| CSSR Voice | 4G CSSR CS (VoLTE) |
| CSSR Data | 4G\_CSSR\_PS\_Success\_Rate |
| DCR Data | 4G\_DCR\_PS |
| Paging | 4G Data Paging Success |
| Mobility (HO) | HO Preparation Success 4G/3G |
| HO Execution Success 4G/3G |
| 4G: CSFB Succ Rate |
| 4G: IntraLTE HO SuccRate |
| 4G: IntrafreqLTE VoLTE SuccRate |
| 4G: InterfreqLTE VoLTE SuccRate |
| CSFB Attempts to 3G |
| CSFB Attempts to 2G |
| Traffic Volume | 4G VoLTE Downlink Volume |
| 4G VoLTE Uplink Volume |
| 4G VoLTE\_Speech\_minutes |
| 4G\_Downlink\_Traffic\_Volume\_MB |
| 4G\_Uplink\_Traffic\_Volume\_MB |
| Throughput | Tput DL 4G |
| Tput UL 4G |
| Availability | 4G Availability |
| Other | Interference 4G PUSCH UL (RSSI UL 4G) |
| 4G\_% MIMO |
| 4G\_% Carrier Aggregation |

The following sections contain the formulas and counters’ description of the 4G KPIs:

### 4G\_DCR\_CS (VoLTE)

* **KPI formula**:

100\*Sum (Pmerabrelabnormalenbqci1)/Sum(pmErabRelMmeQci1 + pmErabRelNormalEnbQci1 + pmErabRelAbnormalEnbQci1 + pmHoExeSuccSrvcc + Pmhoexesucc)

* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmErabRelAbnormalEnbQci1 | The total number of E-RABs released abnormally per cell for QCI1 for requests initiated by eNB. |
| pmErabRelMmeQci1 | The total number of E-RAB Releases (per cell for QCI1) initiated by the MME excluding successful handover. The counter is stepped regardless of whether data was or was not lost in UL/DL buffers. |
| pmErabRelNormalEnbQci1 | The total number of E-RABs released normally (per cell for QCI1) for requests initiated by eNB. |
| pmErabRelAbnormalEnbQci1 | The total number of E-RABs released abnormally per cell for QCI1 for requests initiated by eNB. |
| pmHoExeSuccSrvcc | Number of successful SRVCC handovers to UTRAN. |
| pmHoExeSucc | The number of successful Single Radio Voice Call Continuity (SRVCC) handover executions from LTE to GSM/EDGE Radio Access Network (GERAN). |

### 4G CSSR CS (VoLTE)

* **KPI formula:**

**% VoLTE CSSR=** (% RRC Est Success) \* (% S1 SR/100)\*(% ERAB QCI1 SR/100)\*(% ERAB QCI5 SR/100)

Which is composed of the following components:

(Please note that the RRC and S1 components does not differentiate per QCI)

* **% RRC Est Success**= 100\*Sum(Pmrrcconnestabsuccmta + Pmrrcconnestabsuccmod + Pmrrcconnestabsucchpa + Pmrrcconnestabsuccem)/Suma(Pmrrcconnestabattem + Pmrrcconnestabatthpa + Pmrrcconnestabattmod + Pmrrcconnestabattmta-Pmrrcconnestabattreattem-Pmrrcconnestabattreatthpa-Pmrrcconnestabattreattmod-Pmrrcconnestabattreattmta)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Pmrrcconnestabsuccmta | The total number of successful RRC Connection Establishments for Establishment cause Mobile Terminating Access. |
| Pmrrcconnestabsuccmod | The total number of successful RRC Connection Establishments for Establishment cause Mobile Originating Data. |
| Pmrrcconnestabsucchpa | The total number of successful RRC Connection Establishments for Establishment cause High Priority. |
| Pmrrcconnestabsuccem | The total number of successful RRC Connection Establishments for Establishment cause Emergency. |
| Pmrrcconnestabattem | The total number of RRC Connection Request attempts with establishment cause emergency. |
| Pmrrcconnestabatthpa | The total number of RRC Connection Request attempts with establishment cause highPriorityAccess |
| Pmrrcconnestabattmod | The total number of RRC Connection Request attempts with Establishment cause Mobile Originating Data. |
| Pmrrcconnestabattmta | The total number of RRC Connection Request attempts with Establishment cause Mobile Terminating Access. |
| Pmrrcconnestabattreattem | The total number of RRC Connection Request attempts that are considered as re-attempts for Establishment cause Emergency. |
| Pmrrcconnestabattreatthpa | The total number of RRC Connection Request attempts that are considered as re-attempts for Establishment cause High Priority Access. |
| Pmrrcconnestabattreattmod | The total number of RRC Connection Request attempts that are considered as re-attempts for Establishment cause Mobile Originating Data. |
| Pmrrcconnestabattreattmta | The total number of RRC Connection Request attempts that are considered as re-attempts for Establishment cause Mobile Terminating Access. |

* **% S1 SR**=100\*(pmS1SigConnEstabSucc)/(pmS1SigConnEstabAtt)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmS1SigConnEstabSucc | The total number of successful S1 signaling connection establishments. |
| pmS1SigConnEstabAtt | This measurement provides the number of S1 Signaling connection establishment attempts for any establishment cause. |

* **% ERAB QCI1 SR=** 100\*Sum (pmErabEstabSuccInitQci1 + pmErabEstabSuccAddedQci1)/Sum (pmErabEstabAttInitQci1 + pmErabEstabAttAddedQci1 – pmErabEstabAttAddedHoOngoingQci1)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmErabEstabSuccInitQci1 | The total number of successful initial E-RAB setup per QCI1 |
| pmErabEstabSuccAddedQci1 | The total number of successful additional E-RAB setup per QCI1. |
| pmErabEstabAttInitQci1 | The total number of initial E-RAB setup attempts per QCI1. |
| pmErabEstabAttAddedQci1 | The total number of additional E-RAB setup attempts per QCI1. |
| pmErabEstabAttAddedHoOngoingQci1 | The number of failed establishment attempts of added E-RABs due to ongoing handover per QCI1. Added E-RABs are all E-RABs present in S1 message E-RAB Setup Request. |

* **% ERAB QCI5 SR =** 100\*Sum (pmErabEstabSuccInitQci5 + pmErabEstabSuccAddedQci5)/Sum (pmErabEstabAttInitQci5 + pmErabEstabAttAddedQci5)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmErabEstabSuccInitQci5 | The total number of successful initial E-RAB setup per QCI5 |
| pmErabEstabSuccAddedQci5 | The total number of successful additional E-RAB setup per QCI5. |
| pmErabEstabAttInitQci5 | The total number of initial E-RAB setup attempts per QCI5. |
| pmErabEstabAttAddedQci5 | The total number of additional E-RAB setup attempts per QCI5. |

### 4G\_CSSR\_PS\_Success\_Rate

* **KPI formula definition:**

**% Data ERAB Accessibility (QCI 6 – 9) =** % ERAB Est Success\*(% RRC Est Success/100)\*(% S1 SR/100)

**Where:**

* **% ERAB Est Success =** 100\*Suma(Pmerabestabsuccinitqci6+Pmerabestabsuccinitqci7+Pmerabestabsuccinitqci8+Pmerabestabsuccinitqci9+Pmerabestabsuccaddedqci6+Pmerabestabsuccaddedqci7+Pmerabestabsuccaddedqci8+Pmerabestabsuccaddedqci9) / Suma(Pmerabestabattinitqci6+Pmerabestabattinitqci7+Pmerabestabattinitqci8+Pmerabestabattinitqci9+Pmerabestabattaddedqci6+Pmerabestabattaddedqci7+Pmerabestabattaddedqci8+Pmerabestabattaddedqci9)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Pmerabestabsuccinitqcix | The total number of successful initial E-RAB setup per QCI (for QCI 6-9) |
| Pmerabestabsuccaddedqcix | The total number of successful additional E-RAB setup per QCI. (for QCI 6-9) |
| Pmerabestabattinitqcix | The total number of initial E-RAB setup attempts per QCI. |
| Pmerabestabattaddedqcix | The total number of additional E-RAB setup attempts per QCI. |

* **% RRC Est Success: see 1.3.2**
* **% S1 SR: see 1.3.2**

### 4G\_DCR\_PS

* **KPI formula definition:**
* **% ERAB Drop Call Rate (Data QCI) =** 100\*Suma(pmErabRelAbnormalEnbQci6 + pmErabRelAbnormalEnbQci7 + pmErabRelAbnormalEnbQci8 + pmErabRelAbnormalEnbQci9 + pmErabRelAbnormalMmeQci6 + pmErabRelAbnormalMmeQci7 + pmErabRelAbnormalMmeQci8 + pmErabRelAbnormalMmeQci9)/SUMA(pmErabRelMmeQci6 + pmErabRelMmeQci7 + pmErabRelMmeQci8 + pmErabRelMmeQci9 + pmErabRelNormalEnbQci6 + pmErabRelNormalEnbQci7 + pmErabRelNormalEnbQci8 + pmErabRelNormalEnbQci9 + pmErabRelAbnormalEnbQci6 + pmErabRelAbnormalEnbQci7 + pmErabRelAbnormalEnbQci8 + pmErabRelAbnormalEnbQci9 + UtranCellRelation.Pmhoexesucc – UtranCellRelation.pmHoExeSuccSrvcc)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmErabRelAbnormalEnbQcix | The total number of E-RABs released abnormally per cell per QCI for requests initiated by eNB. (Qci 6 to 9) |
| pmErabRelAbnormalMmeQcix | The total number of E-RAB releases by the MME per QCI with a cause regarded as abnormal. (Qci 6 to 9) |
| pmErabRelMmeQcix | The total number of E-RAB Releases (per cell per QCI) initiated by the MME excluding successful handover. The counter is stepped regardless of whether data was or was not lost in UL/DL buffers. (Qci 6 to 9) |
| pmErabRelNormalEnbQcix | The total number of E-RABs released normally (per cell per QCI) for requests initiated by eNB. (Qci 6 to 9) |
| pmErabRelAbnormalEnbQcix | The total number of E-RABs released abnormally per cell per QCI for requests initiated by eNB. (Qci 6 to 9) |
| UtranCellRelation.Pmhoexesucc | Number of successful handovers to UTRAN or TD-SCDMA. |
| UtranCellRelation.pmHoExeSuccSrvcc | Number of successful SRVCC handovers to UTRAN. |

### 4G Data Paging Success

* **KPI formula definition:**
* **% PS Paging Succ (4G) =** 100\*Suma(Succpspaging E)/Suma(Attpspaging E)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Succpspaging.E | This measurement provides the total number of successful PS paging procedures, irrespect  the paging being an initial paging request or the resending of paging request. The counter  incremented when a Service Request or any NAS message from UE is received. |
| Attpspaging.E | This measurement provides the total number of attempted PS paging procedures initiated a MME over the S1-MME interface. The counter is incremented when a PS paging procedure started, that is at the transmission of the first paging message in the procedure. The paging procedure consists of one or more paging messages with the current S-TMSI. Optionally, the paging procedure is followed by paging messages with the old S-TMSI. A new set of paging messages, triggered by a new Downlink Data Indication from the Serving Gateway is regard as a new procedure. |

### HO Preparation Success 4G/3G

* **KPI formula definition:**
* **HO Preparation Success 4G/3G =** 100\*Sum (PmhoPrepSucc) / Sum(PmhoPrepAtt)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| PmhoPrepSucc | Number of successful handover to UTRAN or TD-SCDMA preparations. |
| Pmhoprepatt | Number of handover to UTRAN or TD-SCDMA preparation attempts. |

### HO Execution Success 4G/3G

* **KPI formula definition:**
* **HO Execution Success 4G/3G =** 100\*Sum (PmhoExeSucc) / Sum(PmhoExeAtt)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Pmhoexesucc | Number of successful handovers to UTRAN or TD-SCDMA. |
| Pmhoexeatt | Number of handover to UTRAN or TD-SCDMA execution attempts. |

### IntraLTE HO SuccRate

* **KPI formula definition:**
* **% Intra LTE HO Success Rate** **(excluding preparation) =** 100\* Sum(pmHoExeSuccLteIntraF+pmHoExeSuccLteInterF) / Sum(pmHoExeAttLteIntraF+ pmHoExeAttLteInterF)
* **% Intra LTE HO Success Rate** **(including preparation) =** 100 \*Sum (Pmhoexesucclteinterf + Pmhoexesucclteintraf) / Sum(Pmhoprepattlteinterf + Pmhoprepattlteintraf - pmHoPrepRejOutUlThres)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmHoExeSuccLteIntraF | The number of successful intra LTE intra frequency handovers. |
| pmHoExeSuccLteInterF | The number of successful outgoing intra LTE inter frequency handovers. |
| pmHoExeAttLteIntraF | The number of intra LTE intra frequency handover execution attempts. |
| pmHoExeAttLteInterF | The number of outgoing intra LTE inter frequency handover execution attempts. |
| Pmhoprepattlteinterf | The number of attempts to start outgoing intra LTE inter frequency handover preparation. |
| Pmhoprepattlteintraf | The number of attempts to start intra LTE intra frequency handover preparation. |
| pmHoPrepRejOutUlThres | Number of handover preparations that failed due to the target cell UL quality being under required threshold. The HO preparation attempt may be triggered both by UL and DL measurements.  Used when feature Uplink-Triggered Inter-Frequency Mobility feature is activated. |

### IntrafreqLTE VoLTE SuccRate

* **KPI formula definition:**
* **% VOLTE\_Intrafreq\_HO\_exec\_SR =** 100 \* Sum (pmHoExeOutSuccQci1) / Sum (pmHoExeOutAttQci1)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmHoExeOutSuccQci1 | The number of ERABs per QCI (QCI=1) that was successfully handovered to the target cell. |
| pmHoExeOutAttQci1 | The number of handover execution attempt for ERABs per QCI (QCI=1) towards target cell. |

### InterfreqLTE VoLTE SuccRate

* **KPI formula definition:**
* **% VOLTE\_Interfreq\_HO\_exec\_SR =** 100 \* Sum(pmHoExeOutSuccLteInterFQci1) / Sum(pmHoExeOutAttLteInterFQci1)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| pmHoExeOutSuccLteInterFQci1 | Number of successful out-going intra LTE inter frequency handover execution for QCI1 ERAB. |
| pmHoExeOutAttLteInterFQci1 | Number of out-going intra-LTE, inter-frequency handover execution attempts for QCI1 ERAB. |

### CSFB Attempts to 3G

* **KPI formula definition:**
* **CSFB attempts to WCDMA =** Pmuectxtrelcsfbwcdma + Pmuectxtrelcsfbwcdmaem
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Pmuectxtrelcsfbwcdma | The number of RRC Connection Release with redirect to WCDMA triggered either by CS Fallback or CS FallBack to WCDMA based on PSHO. |
| Pmuectxtrelcsfbwcdmaem | The number of RRC Connection Release with redirect to WCDMA triggered either by CS Fallback Emergency or CS Fallback Emergency to WCDMA based on PSHO. |

### CSFB Attempts to 2G

* **KPI formula definition:**
* **CSFB attempts to GSM =** Pmuectxtrelcsfbgsm + Pmuectxtrelcsfbgsmem
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| Pmuectxtrelcsfbgsm | The number of RRC Connection Release with redirect to GSM triggered either by CS Fallback or CS Fallback to WCDMA based on PSHO. |
| Pmuectxtrelcsfbgsmem | The number of RRC Connection Release with redirect to GSM triggered either by CS Fallback Emergency or CS Fallback Emergency to WCDMA based on PSHO. |

### 4G VoLTE Downlink Volume (MB)

* **KPI formula definition:**
* **4G VoLTE Downlink Volume (MB) =** (PMPDCPVOLDLDRBQCI(1)\*1000)/(8\*1024\*1024)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| PMPDCPVOLDLDRBQCI(1) | The total volume (PDCP SDU) that has been transferred (UM and AM) on Data Radio Bearers in the downlink direction per QCI(1).  When carrier aggregation is used, a PDCP SDU can be sent over multiple cells (PCell/SCell(s)). The total volume (PDCP SDU) that has been transferred (UM and AM) on Data Radio Bearers in the downlink direction per QCI(1) is measured on PCell. |

### 4G VoLTE Uplink Volume (MB)

* **KPI formula definition:**
* **4G VoLTE Uplink Volume (MB)** = (PMPDCPVOLULDRBQCI(1)\*1000)/(8\*1024\*1024)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| PMPDCPVOLULDRBQCI(1) | The total volume (PDCP SDU) that has been received on Data Radio Bearers in the uplink direction per QCI(1). |

### 4G VoLTE\_Traffic\_minutes

* **KPI formula definition:**
* **4G VoLTE\_Speech\_minutes =** PMSESSIONTIMEDRBQCI(1)/60
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| PMSESSIONTIMEDRBQCI(1) | Session time aggregated for DRBs mapping to a QCI(1). Bandwidth-reduced UEs are excluded from this measurement. |

### 4G\_Downlink\_Traffic\_Volume\_MB (PDCP Layer)

* **KPI formula definition:**
* **4G\_Downlink\_Traffic\_Volume\_MB (PDCP Layer) =** (PMPDCPVOLDLDRB\*1000)/(8\*1024\*1024\*1024)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| PMPDCPVOLDLDRB | The total volume (PDCP SDU) on Data Radio Bearers that has been transferred (UM and AM) in the downlink direction.  When carrier aggregation is used, a PDCP SDU can be sent over multiple cells (PCell/SCell(s)). The total volume (PDCP SDU) on Data Radio Bearers that has been transferred (UM and AM) in the downlink direction is measured on PCell. |

### 4G\_Uplink\_Traffic\_Volume\_MB (PDCP Layer)

* **KPI formula definition:**
* **4G\_Uplink\_Traffic\_Volume\_MB (PDCP Layer)** = (PMPDCPVOLULDRB \*1000) / (8\*1024\*1024\*1024)
* **Counters**

|  |  |
| --- | --- |
| Counter | Counter description |
| PMPDCPVOLULDRB | The total volume (PDCP SDU) on Data Radio Bearers that has been received in the uplink direction for the UEs served by PLMN0.  PLMN0 refers to the PLMN configured in the attribute eNodeBPlmnId located on ENodeBFunction. |

### Tput DL 4G (PDCP per User)

* **KPI formula definition:**
* **Tput DL 4G (PDCP per User)** = (PMPDCPVOLDLDRB - PMPDCPVOLDLDRBLASTTTI) /( PMUETHPTIMEDL)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| PMPDCPVOLDLDRB | The total volume (PDCP SDU) on Data Radio Bearers that has been transferred (UM and AM) in the downlink direction. |
| PMPDCPVOLDLDRBLASTTTI | The total volume (PDCP SDU) on Data Radio Bearers that has been transferred (acknowledged by the UE) in the downlink direction in the last TTI when a buffer is emptied. |
| PMUETHPTIMEDL | The effective DL transport time comprises those periods from when the first part of the PDCP SDU of the DL buffer was transmitted on Uu until the buffer is emptied, excluding the TTI emptying the buffer. This counts for carrier aggregation and non-carrier aggregation UEs. Used for PDCP timebase.  When carrier aggregation is used, a PDCP SDU can be sent over multiple cells (PCell/SCell(s)). The effective DL transport time, comprising those periods from when the first part of the PDCP SDU of the DL buffer was transmitted on Uu until the buffer is emptied, excluding the TTI emptying the buffer, is registered on PCell. |

### Tput UL 4G (PDCP per User)

* **KPI formula definition:**
* **Tput DL 4G (PDCP per User) =** (PMUETHPVOLUL) /( PMUETHPTIMEUL)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| PMUETHPVOLUL | The UL DRB volume used for UL UE Throughput. It comprises of the MAC SDU volume received on Uu, excluding the volume received in the first 4 data receptions of an UL buffer transfer and the TTI emptying the UL buffer. |
| PMUETHPTIMEUL | The UL volume transfer time used for UL UE Throughput. It comprises of time periods from when the 5th MAC SDU data reception of an UL buffer transfer on Uu until the buffer is emptied, excluding the TTI emptying the buffer. |

### 4G Cell Availability

* **KPI formula definition:**
* **Cell Availability =** 100\* (1 - SUM( Pmcelldowntimeauto+Pmcelldowntimeman ) / “Seconds of measurement”)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| **Pmcelldowntimeauto** | Length of time the cell has been disabled due to a fault (system has set cell MO OperationalState to Disabled). The counter is only incremented when the RBS is operational. |
| **Pmcelldowntimeman** | Length of time the cell has been disabled due to:  - AdministrativeState of the cell MO or another MO the cell depends on has been set to Locked by the operator  or  - the operator has performed a reconfiguration request on an Unlocked cell which requires the cell to be taken down temporarily.  The counter is only incremented when the RBS is operational. |

### Interference 4G PUSCH UL (RSSI UL 4G)

* **KPI formula definition:**
* **Interference 4G PUSCH UL (RSSI UL 4G)** = -120 + 10\*Log10(Sum(0,794328235\* PMRADIORECINTERFERENCEPWR1 + 0,897164117\*PMRADIORECINTERFERENCEPWR2+1,129462706\*PMRADIORECINTERFERENCEPWR3+1,421909302\*PMRADIORECINTERFERENCEPWR4 + 1,790077754\*PMRADIORECINTERFERENCEPWR5 + 2,253574373\*PMRADIORECINTERFERENCEPWR6+2,837082046\*PMRADIORECINTERFERENCEPWR7+3,571674683\*PMRADIORECINTERFERENCEPWR8+4,496472021\*PMRADIORECINTERFERENCEPWR9+5,660722891\*PMRADIORECINTERFERENCEPWR10+ 11,07925268\*PMRADIORECINTERFERENCEPWR11+27,82982449\*PMRADIORECINTERFERENCEPWR12+69,90535853\*PMRADIORECINTERFERENCEPWR13 + 175,5943216\* PMRADIORECINTERFERENCEPWR14 + 441,0729938\* PMRADIORECINTERFERENCEPWR15 + 630,9573445\* PMRADIORECINTERFERENCEPWR16) /Suma(PMRADIORECINTERFERENCEPWR1 + PMRADIORECINTERFERENCEPWR2 + PMRADIORECINTERFERENCEPWR3 + PMRADIORECINTERFERENCEPWR4 + PMRADIORECINTERFERENCEPWR5 + PMRADIORECINTERFERENCEPWR6 + PMRADIORECINTERFERENCEPWR7 + PMRADIORECINTERFERENCEPWR8 + PMRADIORECINTERFERENCEPWR9 + PMRADIORECINTERFERENCEPWR10 + PMRADIORECINTERFERENCEPWR11 + PMRADIORECINTERFERENCEPWR12 + PMRADIORECINTERFERENCEPWR13 + PMRADIORECINTERFERENCEPWR14 + PMRADIORECINTERFERENCEPWR15 + PMRADIORECINTERFERENCEPWR16))
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| PMRADIORECINTERFERENCEPWR[1-16] | The measured Noise and Interference Power on PUSCH[1-16], according to 36.214 |
| PMRADIORECINTERFERENCEPWR[1-16] | The accumulated interference power for PRB [1-16] |

### 4G\_% MIMO traffic according to the UE

* **KPI formula definition:**
* **4G\_% MIMO traffic according to the UE** = 100\* Sum(PMRADIOUEREPRANKDISTR\_1 + PMRADIOUEREPRANKDISTR\_2 + PMRADIOUEREPRANKDISTR\_3)/Sum(PMRADIOUEREPRANKDISTR\_0 + PMRADIOUEREPRANKDISTR\_1 + PMRADIOUEREPRANKDISTR\_2 + PMRADIOUEREPRANKDISTR\_3)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| PMRADIOUEREPRANKDISTR | The reported rank distribution indicates the rank of UEs that are in an Open and Closed Loop Spatial Multiplexing mode, where rank is reported.  PDF ranges:  [0]: Rank = 1  [1]: Rank = 2  [2]: Rank = 3  [3]: Rank = 4 |

### 4G\_% MIMO traffic according to the scheduler

* **KPI formula definition:**
* **4G\_% MIMO traffic according to the scheduler =** 100\* Sum(PMRADIOTXRANKDISTR14+ PMRADIOTXRANKDISTR13+ PMRADIOTXRANKDISTR12+ PMRADIOTXRANKDISTR10+ PMRADIOTXRANKDISTR9+ PMRADIOTXRANKDISTR5+ PMRADIOTXRANKDISTR3)/ Sum(PMRADIOTXRANKDISTR14+ PMRADIOTXRANKDISTR13+ PMRADIOTXRANKDISTR12+ PMRADIOTXRANKDISTR11+ PMRADIOTXRANKDISTR10+ PMRADIOTXRANKDISTR9+ PMRADIOTXRANKDISTR5++ PMRADIOTXRANKDISTR4 + PMRADIOTXRANKDISTR3 + PMRADIOTXRANKDISTR2 + PMRADIOTXRANKDISTR1)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| PMRADIOTXRANKDISTR | The transmission mode and rank distributions provide more detailed information on the extent to which each transmission mode and rank is used.  PDF ranges:  [0]: Transmit diversity  [1]: Open Loop SM Rank 1  [2]: Open Loop SM Rank 2  [3]: Closed Loop SM rank 1  [4]: Closed Loop SM rank 2  [5]: Reserved  [6]: Reserved  [7]: Reserved  [8]: Closed Loop SM rank 3  [9]: Closed Loop SM rank 4  [10]: Multiple Layer Transmission rank 1  [11]: Multiple Layer Transmission rank 2  [12]: Open Loop SM rank 3  [13]: Open Loop SM rank 4  [14]: Multiple Layer Transmission rank 3  [15]: Multiple Layer Transmission rank 4 |

### 4G\_% Traffic that is CA (is the total referenced to the PCell)

* **KPI formula definition:**
* **% Traffic that is CA (is the total referenced to the PCell) =** 100\*Sum(1000\* PMPDCPVOLDLDRBCA)/Sum(1000\* PMPDCPVOLDLDRB)
* **Counters:**

|  |  |
| --- | --- |
| Counter | Counter description |
| PMPDCPVOLDLDRBCA | The total volume (PDCP SDU) on Data Radio Bearers that has been transferred (UM and AM) in the downlink direction of carrier aggregation UE. |
| PMPDCPVOLDLDRB | Total PDCP SDU volume on DRB transferred in DL for each QCI. When CA is used, PDCP SDU is sent over PCell and all SCells. Filter is applied to total SDU volume transmitted on all cells. Filtered volume is reported on PCell. |