Draft Quality of Service Business Rules

(Issued Pursuant to the Quality of Service Regulations)

June 2023

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TABLE OF CONTENTS

Page

PART I: GENERAL

1. Introduction

These Business Rules are to be read in conjunction with the Quality of Service Regulations, 2023 (the "Regulations"). These Business Rules are dated [insert date of issue].

2. Definitions

All terms used in the Business Rules have their meanings defined in the Nigerian Communications Act, 2003 (the "Act") and the Quality of Service Regulations.

3. Scope of the Business Rules

The Business Rules stipulate the minimum quality and standards of service, associated measurements, and key performance indicators for measuring quality of service

4. Amendment and Publication of the Business Rules

These Business Rules may be reviewed, modified or updated by the Commission from time-to-time and such amendment shall be published on the Commission's website.

PART II: THRESHOLD TARGETS AND KPIS

1.0. WIRELINE SERVICES KPIs.

Table 1 : Fixed Wireline Telephony Services for End Users

Parameter Name	KPI
Disconnection complaint rate	<0.002% of customers in the Reporting Period
Disconnection complaint resolution time	<1 working day for the mean
Fault report rate	<0.002% of customers in the Reporting Period
Fault repair time	<2 working days for the mean in the Reporting Period
Service supply time	<5 working days for the mean in the reporting period
Other related KPIs which are not stated in this table	Same as that stated in section 2.0 of this schedule

2.0 WIRELINE SERVICES KPIs

TABLE 2 : Account Complaint KPIs		
Ten complaints to every one million bills/accounts		
2.1. Account complaint		KPI Target Resolution time
1.	Charging for line rental at incorrect rate	≤ 5 days
2.	Charging for calls/SMS/MMS messages at incorrect. Rate or more than once for the same call/SMS	≤ 1 Hour ≤ 24 Hours for Roaming
3.	Charging for services not rendered	≤ 24 Hours

4.	Charging for uncompleted/unsuccessful calls/SMS, or charging for access not rendered	≤ 1 Hour
5.	Charging for calls beyond their duration	≤ 24 Hour

6.	Failed attempts to load recharge payments.	(a) ≤ 3 Hours for network related faults (NB. Except for exceptional circumstances that have been made public, each time within 2 hours of occurrence of the failure in the affected area. Each failure in this category that has taken longer than 48 hours to resolve must formally and specifically be communicated to the commission (b) ≤ 1 Hour for software related faults
7.	System failure at Contact Centers inhibiting bill payments	≤ 30 Minutes
8.	Failed attempts to check/determine the account balance	≤ 2 Hours
9.	Losing credited amounts from the account.	≤ 1 Hour
10.	Miscellaneous complaint resolution time	≤ 48 Hours
11.	Inability to change tariff plan for qualified subscriber	≤ 24 Hours
12.	Credit deducted but not reflected in the receiving account in case of virtual top-up	≤ 1 Hour
13.	Invalid system response for genuine service request	≤ 2 Hour
14.	Unjustified call-barring/restriction (local, national or international	≤ 2 Hour
15.	Inability to activate offered service	≤ 2 Hour
16.	Inability to access offered service by a qualified customer on an enable device	≤ 1 Hour
17.	Inability to load credit from an over-scratched card	≤ 1 Hour
18.	Request for blocking of reported lost/stolen SIM card which subscriber ownership has been confirmed	≤ 30 minutes Blocking allowed, and further usage should not be chargeable to the consumer from the moment of filing the report.

19.	Request for PUK code	Should be met within 3 Hours
20.	Inability to send or receive SMS (local or international)	≤ 1 Hour
21.	Inability to send or receive blackberry messages	≤ 2 Hour
22.	Inability to retrieve or send voice SMS	≤ 1 Hour
2.2.	Miscellaneous Complaints	**KPI Target** **Resolution Time**
23.	Unsolicited messages	(i) The service provider must provide an option for the subscriber to "Opt out" of receiving such messages in case of messages originating from the service provider or its third party business partners. (ii) The service provider should make reasonable effort to identify and block or filter bulk, unsolicited and offensive messages from other sources.
24.	Time for recharge/bill payments to reflect on the account.	≤ 10 seconds recharge from mobile ≤ minutes recharge from Bank Automated Teller Machine (ATM) ≤ 1 Hour over the counter ≤ 10 Minutes after receipt of payment confirmation, for internet-based transaction
25.	Number of complaints upheld Per day related to: (i) wrongly cleared balance (ii) wrong IVS/System response message (iii) failed attempts to determine the account balance (iv) failure to provide agreed content	≤ 10

26.	Number of complaints per month related to incorrect settings by a licensee leading to inhibition of two-way communication while roaming internationally.	≤ 10
27.	Meeting advertisement commitment	There shall be no disparity between advertised rates and that eventually received by the consumer
28.	Complaints call ID	Each complaint call must be given a unique reference number that identifies its nature/category, for follow up and statistical analysis
28.	Complaints call ID	Each complaint call must be given a unique reference number that identifies its nature/category, for follow up and statistical analysis.
29.	Number of complaints per day related to any of the following : (a) One-way/two-way loss of audio (b) Cross-talk (c) Call misdirection to un-intended number (d) Voice quality	≤ 50 per day
30.	Number of complaints per day in respect of Network-related blocking of incoming calls	≤ 5
31	Number of complaints per day related to inability to meet SMS/MMS end-to-end delivery time threshold.	≤ 10
32.	Voice-mail related complaints per day	≤ 2
33.	Acknowledgment of delivery of all SMS/MMS/IMS messages sent	= 100% unless deactivated by subscriber
34.	Cost information for all completed calls or RGE via text to the consumer	= 100% within 5 minutes of hang-up unless deactivated by subscriber or deactivated at his/her behest.
35.	Promotions and games	Rules of participation must be clear and widely published, and promotions shall not lead to breach of any part of these regulations

2.3 *Disconnection of subscriber*		
36.	Disconnection resolution time I. Post-Paid	(a) There should be : (i) A text notice after reaching 75% of credit limit (ii) On reaching 100% of credit limit a constant IVR notice of credit expiry remains ON for the next 1 week, during which the Operator is at liberty to allow/disallow outgoing calls until debt is settled. (b) If there is dispute, resolution time ≤ 24 Hours • 1/30th of average monthly spending should be allowed for out-going calls to be used by the customer within the dispute resolution time.
	II. PRE-PAID	• A subscriber line may be deactivated if it has not been used, within six (6) months, for a Revenue Generating Event (RGE). If the situation persists for another 6 months the subscriber may lose his/her number, except for Network related fault inhibiting an RGE. • Monies left in account on deactivation can be claimed by subscribers once proof of ownership can be established at any given time within 1 year (less any fee paid by the

		operator for the number within the 1-year of non-RGE). • Deduction of Line rental charge (if any) is regarded as an RGE. • A subscriber with a proof of good reason for absence is at liberty to request for line-parking
	III. INTERNET SERVICE	• To be restored within 2 hours except for service lawfully disconnected
	IV. Number of complaints received per day by the operator/NCC's consumer Affairs Bureau with respect to the Operator's inability to meet I, II, and III	≤ 10/1 million subscribers ≤ 10 for operators with ≤ 1 million subscribers
37.	Credit run-out alert wilst on a call	A single short-beep to the call initiator at : (i) 2 Minutes, and at (iii) 30 seconds to termination of the ongoing call Low credit announcement to be played while the call is being originated in a situation where the call cannot last up to 30 secs.
38.	Credit loading and balance checks	Free of charge ; operators must provide options such as by text and/or voice or other means that will support physically challenged persons.
39.	Handset/Recipient Rejected Calls	IVR must be in place to state that the called number does not accept calls from the calling number.
Table 3 : Customer Care Services KPIs		
3.1. *Call Centre*		
1.	Call Handling	• Maximum number of call-attempts before connecting to Customer

		Care Lines should not be more than three (3) times ; • Maximum number of rings before a call is answered by either an IVR machine or a live agent should not be more than five (5) ; and • Where a customer decides to speak to a live agent, the maximum duration allowable on the queue/IVR should be 5 minutes before answer. • In exceptional cases where live agent may be unavailable within 5 minutes to answer the call, a customer should be given an option to hanging up to be called back within a maximum time of 30 minutes.
2.	Customer care lines that can be accessible through other networks	≥ 1 free access number and if 1 number then it should accommodate multiple calls at the same time.
3.2. *Customer Care Centre*		
	Waiting time to be physically attended to by relevant staff at customer care centers	≤ 30 minutes. The Licensee shall provide means of measuring the waiting time, starting from time of arrival at the premises.
TABLE 4 : Network Performance KPIs		
4.1. *Network Node Performance*		
1.	BH Call setup success rate	≥ 98% of attempted calls
2.	BH call completion rate	≥ 97% of attempted calls
3.	BH call setup time	≤ 6 seconds for local/national calls
4.	Location update success rate	≥ 99% of attempts
5.	Paging success rate	≥ 98% of attempts
6.	BH Dropped calls rate	≤ 1%

7.	BH Traffic Channel (TCH) Congestion (to be measured at BSC level)		≤ 2%
8.	BH TCH Assignment success rate		≥ 99%
9.	BH SDCCH congestion (to be measure at BSC and cell levels)		≤ 0.2%
10.	BH SDCCH drop rate		≤ 0.5%
11.	BH Hand over success rate at all levels		≥ 98%
12.	BH Interconnect circuit (Pol) congestion		≤ 0.5%
13.	HLR and BH VLR, capacity utilization		≤ 70%
14.	BH BSC, MSC capacity utilization		≤ 60%
15.	BH processor loading BH Erlang Utilization/BSc		≤ 60%
16.	No. of interconnect points per 3 contiguous covered states (standalone or shared)		≥ 1
17.	Interference protection ratio		(a) Co-channel C/1≥ 12dB (b) Adjacent channel C/I ≥ - 12dB (c) A Licensee must operate within its permitted frequency band without causing harmful interference to parts of its network or network of other licensees.
18.	Upgrade/Integration/Cut-over related errors	Life-time of any : (a) CIC mismatch, (b) Global Cell Identity- error, (c) Improper neighboring- cell definition Life –time of Error in : (a) Neigboring MSC definition (b) Roaming number of New MSC (c) Exchange parameter settings, including SS-Tone sending (d) IN trigger table definition	Life-time of error in ≤ 1 hour or 12 hrs if it justified to the satisfaction of the commission
19.	Resolution time of BTS faults impacting on traffic		≤ 2.5 hrs Rural

		≤ 1.5hrs Urban Exceptional circumstances such as late night failures in difficult locations must be announced via electronic media covering such location, within 2hrs
20.	Resolution time of BSC faults impacting on traffic	≤ 45 minutes
21.	HLR/STP-in-pool implementation	=100%
22.	Geographical location of HLRs/STPs/SDPs/SCPs	≥ 2 locations
23.	Resolution time of MSC faults impacting on traffic	≤ 10 Min and/or ≥ 99.99% availability
	MSC/VLR (MSS) System Availability (monthly)	≥ 99.99% of (720Hrs)
	MSC/VLR (MSS) System Down time (monthly)	➢ 0.01% of (720Hrs)
24.	Time to repair other failures that affect traffic	≤ 1.5 hours
25.	Service coverage received signal level	Out-door ≥ -65 dBm In-door ≥ -70 dBm In-vehicle ≥ -70 dBm
26.	ASR IN/OUT (for on-net and off-net	Should be equal, and ≥ 50%. Any variation which in the opinion of the commission is significant may lead to fines. Licensees engaged in call-gapping will be individually or collectively fined in accordance with schedule 3 to these regulations. Misleading ringback-tone is regarded as breach.
27.	Signaling (SS7) utilization	≤ 40% HSL ; ≤ 30% NBL
	Signaling (SS7) Link Availability	≥ 99.99%
	LinkSet Unavailability	≤ 0.01%
28.	Conversational voice quality on ON-NET calls	MOS ≥ 3.6 on the MOS scale
		SQI ≥ 26
29.	Speech encoding	Use full-rate (FR), enhanced FR, but, specific authorization must

		be obtained from the commission to use of half-rate whether manually set or automatic through adptive multirate (AMR), for the specific period of use.
30.	BH SMS delivery success rate for enabled-handsets that are in working order, fit for purpose, ON, and in the service area, assuming sufficient account balance.	≥ 99% of attempts
31.	SMS end-to-end delivery time for enabled-handsets that are in working order, fit for purpose, ON, and in the service area, assuming sufficient account balance.	≤ 8 seconds for MO and MT switched ON and within the service area (ON-NET) ≤ 10 seconds for OFF-NET
32.	Minimum time for storage of SMS/MMS before deletion by the operator i.e for SMS/MMS that the sent to mobile stations that cannot be reached	30
33.	Maximum time allowed for B-number/routing table to be out-of-date, or problem-resolution and inclusion of omitted numbers	≤ 24 hrs
4.3	Transmission Path	
1.	Maximum time for transmission/physical link outage	≤ 2 Hours
2	Percentage of microwave links with space as well as frequency diversity	≥ 60%
3.	BH congestion on trucks	≤ 0.2%
4.	Redundancy on transmission links	Must conveniently handle 100% of the primary link BH traffic. There should not be redundancy on all critical links
5	Compression ration on transmission system	≤ 1 : 1, but for any other compression ratio a specific authorization must be obtained from the commission for the specific transmission rout and for a particular period of use.
6.	Error second ration (ESR)	≤ 0.01 (≤ 1×10^{-4} for IP Traffic)

7.	Background block error ratio (BBER)	$\leq$ 0.00005 ($\leq$ 1 x 10^{-6} for IP traffic)
8.	Severely error seconds (SESR)	$\leq$ 0.02 ($\leq$ 1 x 10^{-5} for IP traffic)
9.	Availability	$\geq$ 99.99%
10.	Delay	$\leq$ 50ms
11.	Average delay	$\geq$ 29ms
12.	Delay variation	$\leq$ 5ms
13.	Packet loss	$\leq$ 2%
14.	Slip	$\leq$ 5%
4.3.	Synchronization Network (Node Output)	
1.	Primary reference clock (PRC)	MTIE = 25 + 0.275$_T$ ns {T = 900s} TDEV $\leq$ 3 ns
2.	Synchronization supply unit (SSU)	MTIE = 2000 ns TDEV $\leq$ 3 ns
3.	SDH equipment clock (SEC)	MTIE = 250 ns
4.	PDH synchronization interface	MTIE = 2000 ns TDEV $\leq$ 34 ns

S/N	KPI	TARGET	COMMENT
	The General KPIs		
1	Percentage of cells reporting QoS data for each KPI	≥97% of cells reporting for 98% days of the month	
2	Percentage NCC QoE applets registered in QoS Infrastructure Tool Server	≥98%	
	Performance Network Node		
3	BH Traffic Channel (TCH) Congestion (measured at Cell level)	≤1.5%	With impact outside operators control removed
4	BH SDCCH Congestion (measured at BSC)	≤0.4%	
5	BH SDCCH Congestion (measured Cell levels)	≤0.2%	With impact outside operators control removed
6	BH SDCCH Congestion (measured Cell levels)	≤0.2%	With impact outside operators control removed

	Threshold for 3G Network		
1	Call Setup Success Rate (PS)	≥97.5%	
2	Call Setup Success Rate (CS)	≥97.5%	
3	RRC connection establishment success rate (PS)	≥97.5%	
	RRC connection establishment success rate (CS)	≥97.5%	
4	RAB Establishment Success Rate	≥97.5%	
5	HSUPA Setup Success Ratio [%] for Streaming(**S**), Interactive(**I**) and Background(**B**) Services	≥97.5%	
6	HSDPA Setup Success Ratio [%] for Streaming(**S**), Interactive(**I**) and Background(**B**)	≥97.5%	
7	Iub Congestion	≤ 1%	For Monitoring
9	RRC Congestion	≤ 1%	
10	Circuit Switched RAB Congestion	≤ 1%	
11	Paging Success Rate	≥96%	For Monitoring
1	CS RAB Abnormal Release Rate	≤ 2%	
2	PS RAB Abnormal Release Rate	≤ 2%	
1	Soft Handover Success Rate	≥98%	
2	Inter RAT Handover Success Rate for CS Domain	≥97%	For monitoring
1	Cell Availability (or Node-B Accumulated downtime (not available for service)	≥ 98% (2%)	Measured as a percentage of site availability
1	Average Downlink Throughput per User	≥1.50 mbps	To be measured via not less than 100 random samples using ftp only or in combination with http, etc at busy hour
2	CS Call setup time (CST) for on-net calls	≤ 8 sec	Startup target of CST will be ≤ 8 sec and then graduated towards the final target of ≤ 6 sec over a one year period

1	Average Downlink Throughput per User	≥1.50 mbps	To be measured via not less than 100 random samples using ftp only or in combination with http, etc at busy hour
2	CS Call setup time (CST) for on-net calls	≤ 8 sec	Startup target of CST will be ≤ 8 sec and then graduated towards the final target of ≤ 6 sec over a one year period
	Threshold for 4G Network		
1	Cell Availability	98% - 99%	
2	CSFB CST	9sec – 8sec	
3	CSFB Preparation Success Rate	98% - 99%	Monitoring
4	ERAB Set up Success Rate	98%	
5	RRC Set up Success Rate	98.5% -99%	
6	ERAB Drop Rate	2% - 1%	
7	E – UTRAN Downlink User Throughput (Mbps)	3 - 5 Mbps	Glide path (Subject to National broadband policy)
8	E – UTRAN Uplink Throughput (Mbps)	0.5 Mbps	Monitoring
9	LTE HOSR (Inter Cell/Inter Frequency)	95% - 98%	Monitoring
10	Mean Session Utilization		Monitoring
11	MOS	90% of Samples≥ 3	DT (POLQA)
12	SRVCC		Monitoring

Table 5 : Data Services KPIs

1.	Circuit switched data services (CDS)	Upstream data rate ≥ 95% of the data rate agreed with consumer, at BH downstream data rate ≥ 95% of the data rate agreed with consumer, at BH
2.	Packet switched data services (PDS)	Upstream data rate ≥ 95% of the data rate agreed with consumer, at BH downstream data rate ≥ 95% of the data rate agreed with consumer, at BH
3.	GPRS attach success rate	> 98%
	PDP Context Activation success rate	≥ 98%
	Data service login success/availability	≥ 98%
	Latency	GPRS <500ms, EDGE < 100ms

	Uplink/Downlink throughput for various evolution of mobile technology standards		Must meet the minimum speed specified in the 3GPP/International mobile telecommunication (IMT) standards
4.	Meeting advertisement commitments		There shall be no disparity between advertised rates and that eventually received by the consumer
5.	Compensation for hours of data services not rendered		At least 100% of loss in supply time
6.	Contention ratio	Committed Rate	Must be specified in the contract
		Maximum Data Rate	Must be specified in the contract
7.	End-to-end throughput		Must be specified in the contract
8.	Data rate of each link from end-to-end		Must be specified in the contract, and should make provision to enable measurement.
9.	Data rate of slowest link (bottleneck)		Must be specified in the contract
10.	Permissible download data-size per billing period without additional charge on the plan		Must be specified in the contract
11.	Response time in case of major faults		Must be specified in the contract
12.	Customer details including address and long files		Must be available for NCC verification if required
	Additional Thresholds for 3G Network		
13.	RRC_CSSR		$\geq$ 98%
14.	RAB_SR		$\geq$ 98%
15.	RTWP		$\leq$ -100dBm
16.	RSCP		$\geq$ -85dBm
17.	Ec/Io		$\geq$ -9dBm
18.	Iub congestion		$\leq$ 2%
19.	CS_IRAT HHO Failure		$\leq$ 2%
20.	PS_IRAT HHO Failure		$\leq$ 2%

	KPI	TARGET	COMMENT
1	**LATENCY**		
	Metro Latency	≤ 10ms	
	Long Distance Latency	≤ 40ms	
	International Latency	≤ 120ms	
2	**AVAILABILITY**	≥ 98%	Cell availability only
3	**PACKET LOSS**	≤ 2%	
4	**JITTER**	± 10% of latency	
	Metro Latency	± 1ms	
	Long Distance Latency	± 4ms	
	International Latency	± 12ms	
5	**LINK UTILIZATION**	≤ 80%	
6	**THROUGHPUT**	≥ Advertised rates	A minimum expected throughput rate shall be stated in all adverts. To be measured via not less than 100 random samples using ftp only or in combination with http, etc at busy hour

REGIONAL BTS/NODE MONITORING OF QoS PARAMETERS

To ensure compliance with the QoS Regulations, 2023 and for proper monitoring on a State-by-State basis, the Commission has categorised the various States into 3 designated State priority groups. A list of States (Reporting Areas) which shall be subject to the additional rules which are stated hereunder

1. The Operator shall submit its QoS report on a State by State basis (Reporting Areas) to enable the Commission review its threshold.
2. The Operator shall comply with the prioritization of Reporting Areas and KPI set for the Reporting Areas.
3. The Operator shall meet the KPI targets in all of the Priority 1 States, resolve QoS issues and meet the specified KPI targets within 28 (Iwenty Eight) days of notification by the Commission.
4. The Operator shall meet KPI targets in at least 10 (Ten) States of the 15 (Fifteen) Priority 2 States, resolve QoS issues and meet KPI targets within 56 (Fifty Six) days upon notification by the Commission.
5. The Operator shall meet KPI targets in at least 4 (Four) Priority 3 States, resolve QoS issues and meet KPI target within 70 (Seventy) days of notification by the Commission.
6. The Operator shall meet KPI targets at the national level, resolve QoS issues and meet KPI targets between 28 (Twenty Eight) days to 42 Forty Two days of notification by the Commission.
7. The failure to meet the specified KPI targets in Priority 1 or Priority 2 States for the last 90 (Ninety) days prior to the KPI assessment will result in the denial of any application for any promotion to be run on the network of the Operator until the KPI targets are met.

STATE PRIORITISATION LIST

S/N	STATE	STATE PRIORITY	COMMENT
1	LAGOS	1	
2	OGUN	1	
3	ABUJA	1	
4	OYO	1	
5	KANO	1	
6	KADUNA	1	
7	RIVERS	1	
8	DELTA	1	
9	ANAMBRA	1	
10	EDO	1	

S/N	STATE	STATE PRIORITY	COMMENT
1	IMO	2	
2	NIGER	2	
3	OSUN	2	
4	ABIA	2	
5	ENUGU	2	
6	ONDO	2	
7	AKWA-IBOM	2	
8	BENUE	2	
9	PLATEAU	2	
10	ADAMAWA	2	MONITORING ONLY
11	KATSINA	2	
12	KWARA	2	
13	KOGI	2	
14	NASARAWA	2	
15	BAUCHI	2	

S/N	STATE	STATE PRIORITY	COMMENT
1	BORNO	3	MONITORING ONLY
2	TARABA	3	
3	CROSS RIVER	3	
4	SOKOTO	3	
5	KEBBI	3	
6	GOMBE	3	
7	EKITI	3	
8	YOBE	3	MONITORING ONLY
9	EBONYI	3	
10	ZAMFARA	3	
11	JIGAWA	3	
12	BAYELSA	3	

PART III: DEFINITION OF TERMS AND PARAMETERS

The following terms shall convey the meanings ascribed to them hereunder in the context of these regulations. Formula-based definitions can be implemented using the formula specified hereunder or formula with similar effect (should the counters specified not be directly available). All KPIs must be achieved by pre-and post-paid services.

1. Call: A generic term related to the establishment, utilization and release of connection.
2. Call attempt : an attempt to achieve to a connection to one or more devices attached to a telecommunication network.
3. Successful call: A call that has reached the desired number and allows conversation to proceed.
4. Busy Hour (BH) : The continuous 1 – hour period lying wholly in the time interval concerned (usually 24hrs) for which the traffic or number of call attempts is greatest.
5. Call setup success rate (CSSR) = ((1 – (SDCCH congestion)) * (1 – (SDCCH Drop Rate)* (TCH Assignment success rate))
   OR
   100* ((1 – ((CCONGS+CCONGSSUB) / CCALLS + CCALLSSUB)))
   (1 – ((CNDROP – (CNRELCONG + CNRELCONGSUB)) / CMSESTAB))
   ((TFCASSALL + TFCASSALLSUB + THCASSALL + THCASSALLSUB)/TASSALL)) (%)
6. Call completion rate = CSSR * (1 – TCHDropRate)
   Where TCH Drop rate = (TFNDROP + TTFNDROP + THNDROP + THNDROPSUB) / (TFCASSALL + TFCASSALLSUB + THCASSALL + THCASSALLSUB + (SUMIHOSUCC-SUMIAWSUCC-SUMIABSUCC)-(SUMOHOSUCC-SUMOAWSUCC-SUMOABSUCC)) *100 [%]
7. Handover Success Rate = Successful Internal and Extenal outgoing handovers of total number of internal and external handover attempts
   OR

(SUMOHOSUCC + SUMEOHOSUCC) / (SUMOHOATT + SUMEOHATT) * 100 [%]

8. Location Update Success Rate (Registered and non-registered subscribers) = (NLOCNRGSUCC + NLOCOLDSUCC + NLOCNRG2SUCC + NLOCNRG2SUCC) / (NLOCNRGTOT + NLOCOLDTOT + NLOCNRG2TOT + NLOCOLD2TOT) * 100 [%]
9. Paging Success Rate = (NPAGIRESUC + NPAG2RESUC) / (NPAGILATOT + NPAGIGLTOT) *100 [%]
10. SDCCH Drop Rate=Dropped SDCCH Connections of the Total Number of SDCCH Connections without TCH Congestion
    OR
    (CNDROP (CNRELCONG+ CNRELCONGSUB) CMSESTAB) *100

11. SDCCH Congestion SDCCH Congestion of Total Number of SDCCH Seizure Attempts OR
    (CCONGS+CCONGSSUB)/(CCALLS+CCALLSSUB)100 [%]

12. TCH Assignment Success Rate = Successful TCH Assignments of Total Number of Assignment Attempts

    OR

    ((TFCASSALL + TFCASSALLSUB + THCASSALL + THCASSALLSUB)/TASSALL) 100 [%]

13. Call Setup Time (Post Dialing Delay): Time interval between the end of dialing by the user and the reception by him of the appropriate ring-back tone or recorded announcement, or the abandonment of the call without a tone.

14. Call Drop Rate: The Call Drop Rate is the number of dropped calls divided by the total number of call attempts at busy hour expressed as a %.

    Note: A dropped call is a call that is prematurely terminated before being released normally by either the caller or called party.

    $$\frac{\text{Number of dropped calls}}{\text{Number of Successfully Completed Call Setups}} \times 100$$

    OR ((TFNDROP + TFNDROPSUB+ THNDROP +THNDROPSUB) / (TFCASSALL + TFCASSALLSUB+ THCASSALL+THCASSALLSUB) *100

15. Traffic Channel Congestion (TCH Cong): This is the percentage congestion of the traffic channel measured at busy hour.

Number of unavailable (blocked) TCH requests at all stages x 100
Total Number of TCH Requests

16. Handover: In a mobile systems, a system-driven change of the current association between an established connection and a channel (mobile to base station and/or base station to mobile channel) in the segment spanned by one cell. The change may result in association between connection and a new channel either in the same cell or in a different cell. The handover request may be issued due to deteriorated transmission quality of the channel as determined on the basis of a quality criterion (signal strength, carrier to interference ratio, etc.).

17. Interconnect Circuit (Pol) Congestion: This is the percentage congestion of the Interconnect Circuits measured at busy hour.

Total Number of unavailable Pol circuit requests x 100
Total Number of available Pol circuits

18. Processor Load: This is the percentage of MSC Processor Workload measured at busy hour.

I. BHHIR, MSC Utilization: % Capacity Utilization VLR and MSC at busy hour.

II. Transceiver Unit (TRX) Utilization: % Capacity Utilization of TRX at busy hour.

19. No. of Interconnect points per zone: Is the existence of at least one interconnection point per zone.

20. Interference Protection Ratio: Is the interference protection due to Co-Channel and Adjacent Channels.

21. Resolution Time of CIC mismatch: Is the time taken to resolve a CIC mismatch.

22. Resolution time of BTS faults impacting on traffic: This is the time taken to resolve faults that hinder traffic flow in the BTS.

23. Resolution time of BSC faults impacting on traffic: This is the time taken to resolve faults that hinder traffic flow in the BSC.

24. Resolution time of MSC faults impacting on traffic: This is the timetaken to resolve faults that hinder traffic flow in the MSC.

25. Time to repair other failures that affect traffic: Time taken to repair other failures (not specifically captured in other parts of this document) that affect traffic.

26. Maximum time for Transmission/Physical link outages: Is the Maximum time allowed for transmission/Physical link to remain in a failed state or state of operation that negatively affects services to consumers.

27. Service Coverage in cities/towns: Is the measured Radio Signal Level in urban and sub-urban areas, in-door and out-door and in moving vehicles in

28. Percentage of Radio Links with Space and Frequency Diversity: Is the percentage of Microwave Transmission Links employing Space and Frequency diversity in the entire transmission network.

29. Conversational Voice Quality: Is the Mean Opinion Score (MOS) of the speech quality perceived by Caller or Called party in accordance with ITU-T P.862.

30. Compression Ratio: Is the compression ratio on the transmission network.

31. Voice Encoding: Is the type of voice encoding that is used on the radio network.

32. SMS Delivery Success Rate: Is the ratio of the failed SMS to the total number of delivered SMS at busy hour if the recipient is active and in coverage area.

$$\frac{\text{Number of SMS received by recipient}}{\text{Total Number of SMS sent to the recipient}} \times 100$$

33. SMS End-to-End Delivery time: Is the maximum End-to-End delivery time of SMS if the recipient is active and the area.

34. Number of Complaints per day related to:

(i) One way or both way loss of audio: A situation whereby either caller or called party cannot hear the audio message or both could not hear each other.

(ii) Cross-Talk: A situation whereby unintended conversation interferes with that of caller or called party or both.

(iii) Call Misdirection to unintended number: A situation whereby a call is terminated at unintended destination.

(iv) Voice Quantity: Conversation with bad speech quality.

35. Number of complaints per day in respect of Network blocking of incoming calls: Number of complaints received per day in respect of blocking of incoming calls in the network.

36. Number of complaints per day related to inability to meet SMS/MMS End-to-End Delivery Time Threshold: Complaints per day received on the network related to inability to meet SMS/MMS delivery time.

37. SMS Delivery Failure Rate: This is the ratio of SMS undelivered to recipient to the total number of SMS received at the Service Center for the recipient.

$$\frac{\text{Number of SMS to recipient undelivered}}{\text{Total Number of SMS received at Service Center}} \times 100$$

38. Voice Mail related complaints per day: The complaints related to voice- mail received per day.

39. Acknowledgement of delivery of SMS/MMS/IMS messages sent: Successful delivery acknowledgement of SMS/MMS/IMS messages sent must be received by the sender for all messages delivered.

40. Cost information for all completed calls or Revenue Generative Events (RGE) via text to consumer: Charging information must be communicated to the consumer for all calls and RGES on the network.

41. Circuit Switched Data Services (CDS): Upstream/Downstream throughput of Circuit Switched Data Services. Greater or equal to 95% of the agreed data rate must be delivered to customer at busy hour.

42. Packet Switched Data Services (PDS): Upstream/Downstream throughput of Packet Switched Data Services. Greater or equal to 95% of the agreed data rate must be delivered to customer at busy hour.

43. CIC: Circuit Identification Code.

44. RGE: Revenue Generating Event (RGE) is any action by one or more subscribers that leads to Revenue being derived directly or indirectly by one or more operators. Examples include but not limited to Sending or Receiving Calls/SMS/MMS/ data Down-load/ Line rental Payment, etc.

45. MSC/VLR, MSS System Availability/Down Time: Amount of time the MSC and MSC-S were in/out of service during a given period excluding planned outage. Obtainable from system logs.

46. Signaling (SS7) Link Availability: Availability for ETSI SS7 signaling network, evaluated as:
(ASLDUR/(ASLDUR+UNAVAILDUR))* 100

47. Signaling (SST) LinkSet Unavailability: Duration of unavailability of signaling link set in seconds, evaluated from: STUNADURAT

48. Answer Seizure Ratio (ASR): Answer/Seizure ratio (ASR) is the number of successfully answered calls divided by the total number of calls attempted (seizures) multiplied by 100. It is evaluated as follows:

    Number of B answers in the Incoming route

    ASR IN (ANSWERSINCALLSI)*100 Number of B answers in the Outgoing route

    ASR_OUT (NANSWERSO/NCALLSO)*100

    Number of calls answered (B-answer) for both outgoing and Incoming calls ASR_TOT ((NANSWERSI+ NANSWERSO) (NCALLSI + NCALLSO))*100

49. Background Block Error Ratio (BBER): The ratio of Background Block Errors (BBE) to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during Severely Error

    Seconds (SESs). It is expressed as:

    BBER = BBE (TEUAS-SES)

    TT Total Measurement Time

    UAS Unavailable Second

50. Error Second Ratio (ESR): The ratio of Error Second (ES) to total seconds in available time during a fixed measurement interval. It is expressed as:

    ESR = [ES/(TT-UAS)]

51. Severely Error Seconds (SESR): SESR is a one-second period that contains over 30 percent error blocks or at least one defect. SES is a subset of ES. It is expressed as:
    SESR = [SES/(TT-UAS)]

    WHERE:
    CCONGS Congestion counter for underlaid subcell. Stepped per congested allocation attempt. The counter for overlaid subcell is CCONGSSUB

CCALLS-Channel allocation attempt counter (on SDCCH). The Counter for overlaid subcell is CCALLSSUB

CNDROP-The total number of dropped SDCCH channels in a cell

CNRELCONG-Number of released connection on SDCCH due to TCH- and transcoder congestion in underlaid and overlaid subcell. The subset for overlaid subcells is CNRELCONGSUB. Note That CNDROP is stepped at the same time.

CMSESTAB-Successful MS channel establishments on SDCCH. This counter is a sum of both overlaid and underlaid subcells.

TENDROP The total number of dropped full-rate TCH in underlaid subcell. The identical counter for overlaid subcells, TFNDROPSUB. The corresponding counters for half-rate, THNDROP and THNDROPSUB, respectively.

TFCASSALL Number of assignment complete messages for all MS power classes in underlaid subcell, full-rate. The identical counter for overlaid subcells, TFCASSALLSUB. The corresponding counters for half-rate, THCASSALL and THCASSALLSUB, respectively.

TCASSALL-Successful assignment attempts

TASSALL-Assignment attempts for all MS power classes. 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)

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)

SUMOHOATT Sum of Internal Handover Attempts (Outgoing Handover)

SUMEOHOATT- Sum of External handover Attempts (Outgoing Handover)

NPAGILOTOT-No. of first global page attempts over A-Interface

NPAG2LOTOT-No. of repeated page attempts to a location area over A-Interface

NPAG2GLTOT- No. of repeated global page attempts over A-Interface

NPAGIRESUCC-No. of page responses to first page over A- interface

NPAG2RESUCC-No. of page responses to repeated page over A-interface

NLOCOLDTOT Total no. of location updating attempts for already registered subscribers over A-interface and lu-interface

NLOCNRGTOT - Total no. of location updating attempts from non-registered subscribers (IMSI attach, normal LU or periodic LU) over A-interface and lu-interface

NLOCOLDSUCC No. of successful location updating for already registered subscribers over A-interface and lu-interface

NLOCNRGSUCC-No. of successful location updating for non-registered subscribers over A-interface and lu-interface

NLOCNRG2TOT Number of location updating registered subscribers (IMSI attach, normal location updating, or periodic updating) over Gs-Interface

NLOCNRG2SUCC – Number of successful location updates for non-registered subscribers over Gs-Interface

NLOCOLD2TOT – Number of location updating attempts for already registered subscribers over Gs-Interface.

NLOCOLD2SUCC – Number of successful location updates for already registered subscribers over Gs-interface.

ASLDUR – Accumulated duration in seconds the link is in in-service state incremented by the duration in seconds the link is in in-service state.

UNAVAILDUR – Accumulated duration in seconds a link is unavailable because of any reason incremented by the duration in seconds a link is unavailable because of any reason.

STUNADURAT – Duration of unavailability of signaling link set, in seconds.

NANSWERSI – Number of B-answers in the incoming route.

NANSWERSO – Number of B-answers in the outgoing rout.

NCALLSI – Number of detected seizures, (incoming rout). The counter is stepped up when an accepted seizure is received.

NCALLSO – Number of seizure attempts (bids), outgoing rout.

GPRS_ATTACH_SUC – The number of successfully performed GPRS attach procedures within this SGSN of total number of attempts of attache procedures.

SUCC_PDP_CONTEXT_ACT – Successful GPRS attaches is considered to be successful when 'PDP activation accept' is send from SGSN to MS.

TDEV – Time Deviation

MTIE – Maximum Time Interval Error

RRC_CSSR – Radio Resource Call setup success rate which depends on CE (Channel Element) or Transmission Resources

RAB_SR – Radio Access Bearer Success rate which depends on CE (Channel Element) or Tranmission Resources

RTWP – Received Total Wideband Power

RSCP-Received Signal Code Power

lub Transmission Interface

Ec/lo-Chip Energy per Interference Spectral Density

CS_IRAT HHO Failure - Circuit Switch Inter Radio Access Technology Hard Handover Failure

PS IRAT HHO Failure-Packet Switch Inter Radio Access Hard Handover Failure

Cell-Emission coverage area of a cell site Technology

A CELL SITE is a term used to describe a site where antennas and electronic communications equipment are placed, usually on a radio mast, tower or other high place, to create a cell in a cellular network.

BASE TRANSCEIVER STATION (BSc) also referred to as the radio base station (RBS), node B (in 3G Networks), eNB (in LTE Standard) or, simply, the base station (BS) is a piece of equipment that facilitates wireless communication between user equipment (UE) and a network.

BASE STATION CONTROLLER (BSC) is equipment that provides the intelligence behind the BTSs. It has tens or even hundreds of BT3s under its control. The BSC handles allocation of radio channels, receive measurements from the mobile phones, and controls handovers from BTS to BTS.

The Mobile Switching Center (MSC) is the primary service delivery node for GSM/CDMA, responsible for routing voice calls and SMS as well as other

S/N	KPIs	Meaning
38	HTTP	Hyper Text Transfer Protocol
39	CSSR	Call Set Up Success Rate

services. It has a number of BSCs under its control. The MSC sets up and releases the end-to-end connection, handles mobility and hand-over requirements during the call and takes care of charging and real time pre-paid account monitoring.

3G refers to Third Generation

LTE refers to Long Term Evolution Pol: Point of Interconnect

General packet radio service (GPRS): is a packet oriented mobile data service on the 2G and 3G cellular communication systems.

Enhanced Data rates for GSM Evolution (EDGE) (also known as Enhanced GPRS (EGPRS): is a digital mobile phone technology that allows improved data transmission rates as a backward-compatible extension of (Global System for Mobile Communications (GSM).

Network Segment: is an identifiable part of a Telecommunications Network such as BTS, BSC, MSC, Interfaces, etc.

High Speed Packet Access (HSPA) is an amalgamation of two mobile telephony protocols, High Speed Downlink Packet Access (HSDPA) and High Speed Uplink Packet Access (HSUPA) that extends and improves the performance of existing Wideband CDMA (WCDMA) protocols.

		Table 6- Further Definitions
S/N	**KPIs**	**Meaning**
1	CSSR	Call Set-up Success Rate
2	BCR	Block Call Rate
3	CDR	Call Drop Rate
4	CST	Call Set-up Time
5	SQI	Speech Quality Index
6	MOS	Mean Opinion Score
7	HoSR	Handover Success Rate
8	RxQual	Receive signal quality
9	RxLev	Receive signal level
10	RSCP	Received Signal Code Power
11	EcIo	Chip Energy per Interference
12	IRAT HO	lnter Radio Access Technology Hard Handover
13	RSRP	The average power received from a single Reference signal
14	RSRQ	Quality of the received signal
15	SiNR	Signal to Noice Ratio
16	CSFB	Circuit Switch Fall Back
17	RRC	Radio Resource Call Setup Success Rate
18	PS	Packet Switch
19	CS	Circuit Switch
20	QOS	Quality of Service
21	QOE	Quality of Experience
22	BH	Busy Hour
23	SDCCH	Stand Alone Dedicated Control Channel
24	TCH	Traffic Channel
25	RAB	Radio Access Bearer
26	HSDPA	High-Speed Down-link Packet Access
27	HSUPA	High-Speed Up Link Packet Access
28	RAT	Radio Access Technology
29	CSFB	Circuity Switch Fall Back
30	ERAB	Extended Radio Access Bearer
31	E-UTRAN	Evolved- UMTS terrestrial Radio Access Network
32	LTE	Long Term Evolution
33	HOSR	Hand Over Success Rate
34	MOS	Mean Opinion Score
35	SRVCC	Single Radio Voice Call Continuity
36	DT(POLQA)	Perceptual Objective Listening Quality Analysis
37	PtP	Point to Point