

Key Performance Indicator

QoS Criteria		Key Performance Indicator		Definition	Formula
Service independent QoS Parameters					
1	1	Radio Network Unavailability [%]		Probability that the mobile services are not offered to a user.	$\text{Radio Network Unavailability [\%]} = \frac{\text{probing attempts with mobile services not available}}{\text{all probing attempts}} \times 100$
	2	Network Non-Accessibility [%]	[Manual / Automatic] Network Selection and Registration Failure Ratio [%]	Probability that the user cannot perform a successful selection and registration on the desired PLMN (manual selection mode, automatic selection mode with a defined desired PLMN) or on some PLMN (automatic selection mode without a defined desired PLMN).	$[\text{Manual} / \text{Automatic}] \text{Network Selection and Registration Failure Ratio [\%]} = \frac{\text{unsuccessful selection and registration attempts on PLMN}}{\text{all selection and registration attempts}} \times 100$
			[Manual / Automatic] Network Selection and Registration Time [s]	Time it takes the user to perform a successful selection and registration on the desired PLMN (manual selection mode, automatic selection mode with a defined desired PLMN) or on some PLMN (automatic selection mode without a defined desired PLMN).	$\text{Network Selection and Registration Time [s]} = (\tau_{\text{start of network selection and registration attempt}} - \tau_{\text{successful network selection and registration}}) [s]$
	3	Attach Failure Ratio [%]		The attach failure ratio describes the probability that a subscriber cannot attach to the PS network.	$\text{Attach Failure Ratio [\%]} = \frac{\text{unsuccessful PDP context activation attempts}}{\text{all attach attempts}} \times 100$
	4	Attach Setup Time [s]		The attach setup time describes the time period needed to attach to the PS network.	$\text{Attach Setup Time [s]} = (\tau_{\text{attach complete}} - \tau_{\text{attach request}}) [s]$
	5	PDP Context Activation Failure Ratio [%]		The PDP context activation failure ratio describes the probability that the PDP context cannot be activated. It is the proportion of unsuccessful PDP context activation attempts and the total number of PDP context activation attempts.	$\text{PDP Context Activation Failure Ratio [\%]} = \frac{\text{unsuccessful PDP context activation attempts}}{\text{all PDP context activation attempts}} \times 100$
	6	PDP Context Activation Time [s]		The PDP context activation time describes the time period needed for activating the PDP context.	$\text{PDP Context Activation Time [s]} = (\tau_{\text{PDP context activation accept}} - \tau_{\text{PDP context activation request}}) [s]$
	7	PDP Context Cut-off Ratio [%]		The PDP context cut-off ratio describes the probability that a PDP context is deactivated without being initiated intentionally by the user.	$\text{PDP Context Cut-off Ratio [\%]} = \frac{\text{PDP context losses not initiated by the user}}{\text{all successfully activated PDP contexts}} \times 100$
	8	Data Call Access Failure Ratio [%]		A subscriber (A-party) wants to take advantage of a given service offering to be shown by the network (B-party) in the display of the user equipment and establish a data call to a B-party. The failure of the data call access from initiating the data call to alerting is covered by this parameter.	$\text{Data Call Access Failure Ratio [\%]} = \frac{\text{unsuccessful data call accesses}}{\text{all data call access attempts}} \times 100$
	9	Data Call Access Time [s]		A subscriber (A-party) wants to take advantage of a given service offering to be shown by the network (B-party) in the display of the user equipment and establish a data call to a B-party. The time elapsing from initiating the data call to alerting or a busy signal is covered by this parameter. This parameter is not calculated unless the call attempt is successful and not cut-off beforehand.	$\text{Data Call Access Time [s]} = (\tau_{\text{successful data call access}} - \tau_{\text{initiation of data call}}) [s]$
	10	DNS Host Name Resolution Failure Ratio [%]		The DNS host name resolution failure ratio is the probability that a host name to host address translation of a DNS resolver was not successful.	$\text{DNS Host Name Resolution Failure Ratio [\%]} = \frac{\text{unsuccessful DNS host name resolution requests}}{\text{all DNS host name resolution requests}} \times 100$
	11	DNS Host Name Resolution Time [s]			$\text{DNS Host Name Resolution Time [s]} = (\tau_{\text{StandardQueryResponse}} - \tau_{\text{StandardQuery}}) [s]$
Direct Services QoS Parameters					
1	File Transfer (FTP)	1	FTP (Download/Upload) Service Non-Accessibility [%]	The service accessibility ratio describes the probability that a subscriber cannot establish a PDP context and access the service successfully.	$\text{FTP (Download / Upload) Service Non-Accessibility [\%]} = \frac{\text{unsuccessful attempts to reach the point when content is sent or received}}{\text{all attempts to reach the point when content is sent or received}} \times 100$
		2	FTP (Download/Upload) Setup Time [s]	The setup time describes the time period needed to access the service successfully, from starting the dial-up connection to the point of time when the content is sent or received.	$\text{FTP (Download / Upload) Setup Time [s]} = (\tau_{\text{Service access successful}} - \tau_{\text{Service access start}}) [s]$
		3	FTP (Download/Upload) IP-Service Access Failure Ratio [%]	The IP-service access ratio describes the probability that a subscriber cannot establish a TCP/IP connection to the server of a service successfully.	$\text{FTP (Download / Upload) IP-Service Access Failure Ratio [\%]} = \frac{\text{unsuccessful attempts to establish a TCP/IP connection to the server}}{\text{all attempts to establish a TCP/IP connection to the server}} \times 100$
		4	FTP (Download/Upload) IP-Service Setup Time [s]	The IP-service setup time is the time period needed to establish a TCP/IP connection to the server of a service, from sending the initial query to a server to the point of time when the content is sent or received.	$\text{FTP (Download / Upload) IP-Service Setup Time [s]} = (\tau_{\text{Service access successful}} - \tau_{\text{Service access start}}) [s]$
		5	FTP (Download/Upload) Session Failure Ratio [%]	The session failure ratio is the proportion of unsuccessful sessions and sessions that were started successfully.	$\text{FTP (Download / Upload) Session Failure Ratio [\%]} = \frac{\text{unsuccessfully terminated sessions}}{\text{all successfully started sessions}} \times 100$
		6	FTP (Download/Upload) Session Time [s]	The session time is the time period needed to successfully complete a PS data session.	$\text{FTP (Download / Upload) Session Time [s]} = (\tau_{\text{Session end}} - \tau_{\text{Session start}}) [s]$
		7	FTP (Download/Upload) Mean Data Rate [bit/s]	After a data link has been successfully established, this parameter describes the average data transfer rate measured throughout the entire connect time to the service. The data transfer shall be successfully terminated. The prerequisite for this parameter is network and service access.	$\text{FTP (Download / Upload) Mean Data Rate [bit/s]} = \frac{\text{user data transferred}}{\tau_{\text{data transfer complete}} - \tau_{\text{data transfer start}}} [s] \times 100$
		8	FTP (Download/Upload) Data Transfer Cut-off Ratio [%]	The data transfer cut-off ratio is the proportion of incomplete data transfers and data transfers that were started successfully.	$\text{FTP (Download / Upload) Data Transfer Cut-off Ratio [\%]} = \frac{\text{incompletely data transfers}}{\text{all successfully started data transfers}} \times 100$
2	Mobile Broadcast	1	Mobile Broadcast Network Non-Accessibility [Broadcast Beamer]	Probability that the Mobile Broadcast Services are not offered to an end user by the target network indicators on the User Equipment (UE) in idle mode.	$\text{Mobile Broadcast Network Non-Accessibility [\%]} = \frac{\text{unsuccessful Mobile Broadcast registration attempts}}{\text{all Mobile Broadcast registration attempts}} \times 100$
		2	Mobile Broadcast Program Menu Non-Accessibility [Broadcast Beamer]	This parameter describes the probability that the Mobile Broadcast Program Menu is successfully accessible by the user when requested.	$\text{Mobile Broadcast Program Menu Non-Accessibility [\%]} = \frac{\text{unsuccessful programme menu access attempts}}{\text{all programme menu access attempts}} \times 100$
		3	Mobile Broadcast Program Menu Access Time [Broadcast Beamer]	The parameter Mobile Broadcast Program Menu Access Time is the time period elapsed between a session start attempt of the Mobile Broadcast service and the reception of the complete menu channels list. Hence, the time the device requires to discover the available channels for the first time is considered.	$\text{Mobile Broadcast Program Menu Access Time [s]} = (\tau_{\text{Program menu reception}} - \tau_{\text{Program menu request}}) [s]$
		4	Mobile Broadcast Channel Non-Accessibility [Broadcast Beamer]	Probability that the requested Mobile Broadcast channel is not started to be delivered to the user. This parameter applies also to changing situations in which the user changes the offered streaming content frequently in short intervals.	$\text{Mobile Broadcast Program Menu Non-Accessibility [\%]} = \frac{\text{unsuccessful channel access attempts}}{\text{all channel attempts}} \times 100$
		5	Mobile Broadcast Channel Access Time [Broadcast Beamer]	The parameter Mobile Broadcast Channel Access Time is the time period elapsed between the user's request to access the channel and the channel reception/displayed.	$\text{Mobile Broadcast Channel Access Time [s]} = (\tau_{\text{Channel reception}} - \tau_{\text{Channel request}}) [s]$
		6	Mobile Broadcast Interactivity Response Failure Ratio [Mobile Network Beamer/Broadcast Beamer]	The Mobile Broadcast Interactivity Response Failure Ratio measures the probability that a service request of a Mobile Broadcast service as an interactive channel does not result in an expected reaction (i.e. changes in content updated due to user interaction, reception of any kind of notification to the user, etc.) on either the broadcast beamer or the mobile network beamer.	$\text{Mobile Broadcast Interactivity Response Failure Ratio [\%]} = \frac{\text{unsuccessful Mobile Broadcast service outcome responses}}{\text{all Mobile Broadcast service requests over interactive channel}} \times 100$
		7	Mobile Broadcast Interactivity Response Time [Mobile Network Beamer/Broadcast Beamer]	The parameter Mobile Broadcast Interactivity Response Time is the time elapsed between a service request attempt of the Mobile Broadcast service as an interactive channel and the reception of a notification to the user.	$\text{Mobile Broadcast Interactivity Response Time [s]} = (\tau_{\text{Service response}} - \tau_{\text{Service request}}) [s]$
		8	Mobile Broadcast Session Cut-off Ratio [Broadcast Beamer]	Session Cut-off defines the probability of abnormal termination of the specific service requested by the user.	$\text{Mobile Broadcast Session Cut-off Ratio [\%]} = \frac{\text{unsuccessfully terminated sessions}}{\text{all successfully established sessions}} \times 100$
		9	Mobile Broadcast Service Integrity [Broadcast Beamer]	Mobile Broadcast technology provides the way for network operation and service providers to offer a huge palette of mobile services, which can be divided in the following categories:	$\text{Mobile Broadcast Interactivity Response Failure Ratio [P]}_1 = \frac{\sum \tau_{\text{Real audio/video restart}} - \tau_{\text{Signal absent}}}{\tau_{\text{reproduction finished}} - \tau_{\text{reproduction started}}} \times 100$
		10	Mobile Broadcast Reproduction Soft Cut-off Ratio [Broadcast Beamer]	Reproduction Soft Cut-off defines the probability that the end-user cannot see normally the channel when connected to the specific service.	$\text{Mobile Broadcast Interactivity Response Failure Ratio [P]}_2 = \frac{\sum \tau_{\text{Real audio/video restart}} - \tau_{\text{Signal absent}}}{\tau_{\text{reproduction finished}} - \tau_{\text{reproduction started}}} \times 100$
		11	Mobile Broadcast Reproduction Hard Cut-off Ratio [Broadcast Beamer]	Reproduction Hard Cut-off defines that the end-user cannot see normally the channel when connected to the specific service.	$\text{Mobile Broadcast Reproduction Hard Cut-off Ratio [P]}_3 = \frac{\sum \tau_{\text{Real audio/video restart}} - \tau_{\text{Signal absent}}}{\tau_{\text{reproduction finished}} - \tau_{\text{reproduction started}}} \times 100$
		12	Mobile Broadcast Audio Quality [Broadcast Beamer]	Mobile Broadcast Audio Quality describes the audio quality as perceived by the end-user. (Since the streams can contain but not only speech information, an algorithm like ITU Recommendation P.862 [2] is not suitable for all scenarios and should not be used)	Not.
		13	Mobile Broadcast Video Quality [Broadcast Beamer]	Mobile Broadcast Video Quality describes the video quality as perceived by the end-user.	Not.
3	Ping	1	Ping Round Trip Time [ms]	The round trip time is the time required for a packet to travel from a source to a destination and back. It is used to measure the delay on a network at a given time. For this measurement the service must already be established.	$\text{Ping Round Trip Time [ms]} = (\tau_{\text{Packet received}} - \tau_{\text{Packet sent}}) [ms]$
		1	PoC Registration Failure Ratio [%]	The PoC registration failure ratio is the probability that the terminal cannot register with the Push to Talk over Cellular service when requested.	$\text{PoC Registration Failure Ratio [\%]} = \frac{\text{unsuccessful PoC registration attempts}}{\text{all PoC registration attempts}} \times 100$
		1	PoC Registration Time [s]	The PoC registration time is the time period between the registration request of the PoC service and being registered to the PoC service.	$\text{PoC Registration Time [s]} = (\tau_{\text{PoC Available}} - \tau_{\text{PoC Activated}}) [s]$
		2	PoC Publish Failure Ratio [%]	The PoC publish failure ratio is the probability that the terminal cannot successfully publish his PoC service settings to the PoC server, after the terminal is registered to the PoC service.	$\text{PoC Publish Failure Ratio [\%]} = \frac{\text{unsuccessful PoC publish attempts}}{\text{all PoC publish attempts}} \times 100$
		3	PoC Publish Time [s]	The PoC publish time is the period of time that it takes to publish the terminal's PoC service settings to the PoC server.	$\text{PoC Publish Time [s]} = (\tau_{\text{PoC Publish end}} - \tau_{\text{PoC Publish start}}) [s]$
		4	PoC Registration Failure Ratio [ongo]	The PoC registration failure ratio (ongo) is the probability that the terminal cannot successfully register to the PoC service and publish his PoC service settings.	$\text{PoC Registration Failure Ratio [ongo] [\%]} = \frac{R \times P}{\Delta \tau_{\text{PoC registration [ongo] attempts}}} \times 100$
		5	PoC Registration Time [ongo]	The PoC registration time (ongo) is the combined duration for a SIP registration and a SIP publish.	$\text{PoC Registration Time [ongo] [\%]} = (\tau_{\text{PoC Publish end}} - \tau_{\text{PoC Activated}}) [s]$
		6	PoC Session Initiation Failure Ratio [on-demand]	The PoC session initiation failure ratio (on-demand) is the probability that a PoC session cannot be successfully initiated. A PoC session is initiated when the user pushes the PoC button on the terminal (and thereby requests a talk burst) and is granted a talk burst.	$\text{PoC Session Initiation Failure Ratio [on-demand] [\%]} = \frac{\text{unsuccessful PoC session initiations}}{\text{all PoC session initiations}} \times 100$
		7	PoC Session Initiation Time [on-demand]	The PoC session initiation time (on-demand) is the time period between pushing the PoC button on the terminal in order to initiate a PoC session and being granted the talk burst, e.g. indicated by a "beep" tone on the terminal.	$\text{PoC Session Initiation Time [on-demand] [\%]} = \frac{\tau_{\text{beep received}} - \tau_{\text{PoC button pressed}}}{\tau_{\text{beep received}} - \tau_{\text{PoC button pressed}}} [s]$
		8	PoC Session Media Parameters Negotiation Failure Ratio [pre-established]	The PoC session media parameters negotiation failure ratio (pre-established) is the probability that a negotiation procedure of media parameters for a posterior pre-established session cannot be successfully accomplished.	$\text{PoC Session Media Parameters Negotiation Failure Ratio [pre-established] [\%]} = \frac{\text{unsuccessful negotiation attempts}}{\text{all negotiation attempts}} \times 100$
		9	PoC Session Media Parameters Negotiation Time [pre-established]	The PoC session media parameters negotiation time (pre-established) describes the time period needed to accomplish a successful negotiation of media parameters.	$\text{PoC Session Media Parameters Negotiation Time [pre-established] [s]} = (\tau_{\text{beep received}} - \tau_{\text{negotiation initiation}}) [s]$
		10	PoC Session Initiation Failure Ratio [pre-established]	The PoC session initiation failure ratio (pre-established) is the probability that a pre-established session cannot be successfully initiated, after the negotiation of media parameters, a pre-established session is initiated when the user pushes the PoC button on the terminal (and thereby requests a talk burst) and is granted the talk burst.	$\text{PoC Session Initiation Failure Ratio [pre-established] [\%]} = \frac{\text{unsuccessful pre-established session initiation attempts}}{\text{all pre-established session initiation attempts}} \times 100$
		11	PoC Session Initiation Time [pre-established]	The PoC session initiation time (pre-established) is the time period between pushing the PoC button on the terminal in order to initiate a pre-established session and being granted the talk burst, e.g. indicated by a "beep" tone on the terminal.	$\text{PoC Session Initiation Time [pre-established] [s]} = (\tau_{\text{beep received}} - \tau_{\text{PoC button pressed}}) [s]$
		12	PoC Session Setup Failure Ratio [on-demand]	The PoC session setup failure ratio (on-demand) is the probability that a terminal cannot successfully register to the PoC service and initiate an on-demand session.	$\text{PoC Session Setup Failure Ratio [on-demand] [\%]} = \frac{R \times S}{\text{all PoC session setup attempts}} \times 100$

4	Push to Talk over Cellular (PoC)	14	PoC Session Setup Failure Ratio (pre-established) [%]	The PoC session setup failure ratio (pre-established) is the probability that a terminal cannot successfully register to the PoC service and initiate a pre-established session.	$PoCSessionSetupFailureRatio = \frac{PoCSessionSetupFailure}{PoCSessionSetupAttempts} \times 100$
		15	PoC Session Setup Time [s]	The PoC session setup time is the time period for the registration to the PoC service plus the time period for the initiation of the PoC session.	$PoCSessionSetupTime[s] = (t_{SetupReceived} - t_{PoCActivated})[s]$
		16	PoC Push to Speak Failure Ratio [%]	The PoC push to speak failure ratio is the probability that terminal A cannot successfully set up a PoC session and start with speech leading to no other terminal receiving speech.	$PoCPushToSpeakFailureRatio[\%] = \frac{NoT}{all PoC push to speak attempts} \times 100$
		17	PoC Push to Speak Time [s]	The PoC push to speak time is the period of time that it takes to setup a PoC session and start with speech in addition to the delay until terminal B receives the speech (as defined in clause 6.4.1.2).	$PoCPushToSpeakTime[s] = (t_{B_hears} - t_{PoCActivated})[s]$
		18	PoC Session Leaving Failure Ratio (on-demand) [%]	The PoC session leaving failure ratio (on-demand) is the probability that the user cannot leave the PoC session he is participating.	$PoCSessionLeavingFailureRatio(on-demand)[\%] = \frac{Unsuccessful PoCSessionLeavingAttempts}{all PoCSessionLeavingAttempts} \times 100$
		19	PoC Session Leaving Time (on-demand) [s]	The PoC session leaving time (on-demand) is the time period between sending the on-demand session leaving request and being disconnected from the on-demand session.	$PoCSessionLeavingTime(on-demand)[s] = (t_{SessionLeft} - t_{SessionLeaveRequest})[s]$
		20	PoC Session Leaving Failure Ratio (pre-established) [%]	The PoC session leaving failure ratio (pre-established) is the probability that the user cannot leave the PoC pre-established session he is participating.	$PoCSessionLeavingFailureRatio(pre-established)[\%] = \frac{Unsuccessful PoCSessionLeavingAttempts}{all PoCSessionLeavingAttempts} \times 100$
		21	PoC Session Leaving Time (pre-established) [s]	The PoC session leaving time (pre-established) is the time period between sending the PoC session leaving request and being disconnected from the pre-established session.	$PoCSessionLeavingTime(pre-established)[s] = (t_{SessionLeft} - t_{SessionLeaveRequest})[s]$
		22	PoC Deregistration Failure Ratio [%]	The PoC deregistration failure ratio is the probability that the user can not be deregistered from the Push to Talk over Cellular service when requested.	$PoCDeregistrationFailureRatio[\%] = \frac{Unsuccessful PoC Deregistration Attempts}{all PoC Deregistration Attempts} \times 100$
		23	PoC Deregistration Time [s]	The PoC deregistration time is the time period between the deregistration request and the successful deregistration from the PoC service.	$PoCDeregistrationTime[s] = (t_{PoCDeregistered} - t_{DeregistrationRequest})[s]$
		24	PoC Busy Floor Response Failure Ratio [%]	The PoC busy floor response failure ratio is the probability that, once in a PoC session, the talk burst request from the terminal fails.	$PoCBusyFloorResponseFailureRatio[\%] = \frac{UnsuccessfulTalkBurstRequests}{allTalkBurstRequests} \times 100$
		25	PoC Busy Floor Response Time [s]	The PoC busy floor response time is the time period between requesting the talk burst and receiving the indication the floor is busy within an already established PoC session.	$PoCBusyFloorResponseTime[s] = (t_{FloorResponse} - t_{FloorRequest})[s]$
		26	PoC Talk Burst Request Failure Ratio [%]	The PoC talk burst request failure ratio is the probability that, once in a PoC session, the terminal's request of the floor fails.	$PoCTalkBurstRequestFailureRatio[\%] = \frac{UnsuccessfulTalkBurstRequests}{allTalkBurstRequests} \times 100$
		27	PoC Talk Burst Request Time [s]	The PoC talk burst request time is the time period between requesting the talk burst and being granted the previously allocated floor within an already established PoC session.	$PoCTalkBurstRequestTime[s] = (t_{FloorGranted} - t_{FloorRequest})[s]$
		28	PoC Talk Burst Cut-off Ratio [%]	The PoC talk burst cut-off ratio is the probability that the terminal on the originating side (terminal A) has the floor and creates and sends data packets containing speech data (RTP media stream), but the stream does not arrive (or arrives only partly) at the terminating side (terminal B).	$PoCTalkBurstCutOffRatio[\%] = \frac{DroppedTalkBursts}{allTalkBursts} \times 100$
		29	PoC Talk Burst Packet Drop Ratio [%]	The PoC talk burst packet drop ratio is the ratio between the number of data packets containing speech data sent by the terminal on the originating side (terminal A) and the number of data packets containing speech data received on the terminating side (terminal B).	$PoCTalkBurstPacketDropRatio[\%] = \frac{DroppedRTPSpeechPackets}{allSentRTPSpeechPackets} \times 100$
		30	PoC Voice Transmission Delay (first) [s]	The parameter PoC speech transmission delay (first) describes the period of time between a terminal sending speech data (RTP media stream) and the first terminal receiving the speech data for the first talk burst after a PoC session has been established successfully.	$PoCVoiceTransmissionDelay(first)[s] = (t_{B_hears} - t_{A_speaks})[s]$
		31	PoC Speech Transmission Delay (others) [s]	The parameter PoC speech transmission delay (others) describes the period of time between a terminal sending speech data (RTP media stream) and the first terminal receiving the speech data within an already established PoC session.	$PoCSpeechTransmissionDelay(others)[s] = (t_{B_hears} - t_{A_speaks})[s]$
		1	Streaming Service Non-Accessibility [%]	The parameter Streaming Service Non-Accessibility describes the probability that the first data packet of the stream cannot be received by the UE when requested by the user. The "packet reception" is completed by appearance of the "buffering" message on the player at user side.	$StreamingServiceNonAccessibility[\%] = \frac{UnsuccessfulStreamRequestAttempts}{allStreamRequestAttempts} \times 100$
		2	Streaming Service Access Time [s]	The parameter Streaming Service Access Time describes the duration of a service access from requesting the stream at the portal until the reception of the first stream data packet at the UE.	$StreamingServiceAccessTime[s] = (t_{ReceptionOfFirstDataPacket} - t_{StreamRequest})[s]$
		3	Streaming Reproduction Cut-off Ratio [%]	The parameter Streaming Reproduction Cut-off Ratio describes the probability that a successfully started stream reproduction is ended by a cause other than the intentional termination by the user.	$StreamingReproductionCutOffRatio[\%] = \frac{UnintentionallyTerminatedStreamReproductions}{allSuccessfullyStartedStreamReproductions} \times 100$
		4	Streaming Audio Quality	The parameter Streaming Audio Quality describes the audio quality as perceived by the end-user. Since the streams can contain not only speech information, an algorithm like P-RS is not suitable for all contents.	To be defined.
		5	Streaming Video Quality	The parameter Streaming Video Quality measures the quality of the video stream.	NOTE 1: Although evaluation algorithms exist, there are no standardised solutions yet. NOTE 2: Standardisation process of evaluation algorithms is on-going and new recommendations are expected during the 10th study period 2005-2008.
5	Streaming Video	6	Streaming Audio/Video De-Synchronization	The parameter Streaming Audio/Video De-Synchronization describes the percentage of times that time difference of the audio and video signal at the user side exceeds a predefined threshold.	No validated or standardised algorithm has been selected for the evaluation for video streaming content quality.
		7	Streaming Reproduction Start Failure Ratio [%]	The parameter Streaming Reproduction Start Failure Ratio also describes the probability of unsuccessful stream reproduction.	$StreamingReproductionStartFailureRatio[\%] = \frac{ReproductionFailures}{allSuccessfulServiceAccesses} \times 100$
		8	Streaming Reproduction Start Delay [s]	The parameter Streaming Reproduction Start Delay describes the duration between the reception at UE of the first stream data packet and the start of the reproduction of the stream on the UE.	$StreamingReproductionStartDelay[s] = (t_{StartOfStreamReproduction} - t_{ReceptionOfFirstDataPacket})[s]$
		9	Streaming Handdown Failure Ratio [%]	The parameter Handdown Failure Ratio describes the probability that the "handdown" RTP message is sent from the UE client to the server and no "200 OK" RTPS response is received from the server.	$StreamingHanddownFailureRatio[\%] = \frac{CasesWithoutHanddownServerResponse}{allHanddownAttemptsbyUEClient} \times 100$
		10	Streaming Handdown Time [s]	The parameter Handdown Time Ratio describes the duration between the UE client sending the "handdown" RTPS message and the "200 OK" RTPS response from the server.	$StreamingHanddownTime[s] = (t_{ServerResponseToHanddownMessage} - t_{UEClientSendingHanddownMessage})[s]$
		11	Streaming Buffering Failure Ratio [%]	The parameter Buffering Failure Ratio describes the probability that a stream goes into buffering mode and does not recover the stream reproduction afterwards.	$StreamingBufferingFailureRatio[\%] = \frac{UnsuccessfulBufferingAttempts}{allBufferingAttempts} \times 100$
		12	Streaming Buffering Time [s]	The parameter Buffering Time describes the duration between a stream going into buffering mode and continuation of the stream afterwards.	$StreamingBufferingTime[s] = (t_{ContinuationOfStream} - t_{BufferingMessageAppears})[s]$
		1	Telephony Service Non-Accessibility [%]	The telephony service non-accessibility denotes the probability that the end-user cannot access the mobile telephony service when requested if it is offered by display of the network indicator on the UE.	$TelephonyServiceNonAccessibility[\%] = \frac{UnsuccessfulCallAttempts}{allCallAttempts} \times 100$
		2	Telephony Setup Time [s]	The telephony setup time describes the time period between sending of complete address information and receipt of call set-up notification.	$TelephonySetupTime[s] = (t_{ConnectEstablished} - t_{UserPressesSendButtononUE})[s]$
		3	Telephony Speech Quality on Call Basis	The telephony speech quality on call basis is an indicator representing the quantification of the end-to-end speech transmission quality of the mobile telephony service. This parameter computes the speech quality on the basis of completed calls.	$TelephonySpeechQualityonCallBasis = F(MQI-LOD) - F(MQI-HOD)$ $TelephonySpeechQualityonCallBasis = F(MQI-LOD) - F(MQI-HOD)$
		4	Telephony Speech Quality on Sample Basis	The telephony speech quality on sample basis is an indicator representing the quantification of the end-to-end speech transmission quality of the mobile telephony service. This parameter computes the speech quality on a sample basis.	$TelephonySpeechQualityonSampleBasis = F(MQI-LOD) - F(MQI-HOD)$ $TelephonySpeechQualityonSampleBasis = F(MQI-LOD) - F(MQI-HOD)$
6	Telephony	5	Telephony Cut-off Call Ratio [%]	The telephony cut-off call ratio denotes the probability that a successful call attempt is ended by a cause other than the intentional termination by A or B-party.	$TelephonyCutOffCallRatio[\%] = \frac{UnintentionallyTerminatedTelephonyCalls}{allSuccessfulTelephonyCallAttempts} \times 100$
		6	Telephony CLIP Failure Ratio [%]	The telephony CLIP failure ratio denotes the percentage of call setups where a valid calling party number (CPN) parameter was sent but not received intact.	$TelephonyCLIPFailureRatio[\%] = \frac{NumberofCallsReceivedbyB-partywithoutIntactCPN}{numberofcallsinitiatedbyA-partywithvalidCPN} \times 100$
		1	VT Service Non-Accessibility [%]	Probability that the end-user cannot access the service when requested while it is offered by network indicators on the mobile equipment.	$VTServiceNonAccessibility[\%] = \frac{UnsuccessfulVideoTelephonyCallAccessAttempts}{allVideoTelephonyCallAccessAttempts} \times 100$
		2	VT Service Access Time [s]	Time between pushing and button after input of MSISDN and receipt of alerting at MD side.	$VTServiceAccessTime[s] = (t_{AlertingTone} - t_{PushSendButton})[s]$
		3	VT Audio/Video Setup Failure Ratio [%]	Probability of audio/video setup failure after service access. The audio/video setup is successful if audio and video output is performed at both sides.	$VTAudioVideoSetupFailureRatio[\%] = \frac{AudioVideoSetupFailures}{allAcceptedCallsatMTSide} \times 100$
		4	VT Audio/Video Setup Time [s]	The elapsed time from the first call acceptance indicated at MD side until audio and video output starts at both sides.	$VTAudioVideoSetupTime[s] = (t_{AudioVideoStart} - t_{MTAcceptance})[s]$
7	Video Telephony	5	VT Cut-off Call Ratio [%]	Probability that a successful service access is ended by a cause other than the intentional termination of the user (calling or called party).	$VTCutOffCallRatio[\%] = \frac{UnsuccessfulVideoTelephonyCallAccessAttempts}{allVideoTelephonyCallAccessAttempts} \times 100$
		6	VT Speech Quality on Call Basis	Indicator representing the quantification of the end-to-end speech transmission quality of the Video Telephony service. This parameter computes the speech quality on the basis of completed calls.	ITU-T Recommendation P.862 [1] (02/2001) together with the related mapping given in ITU-T Recommendation P.862.1 [3] (10/2003) is recommended. This algorithm describes the opinion of users related to speech transmission quality (SDS) on a 100 Hz to 8 kHz range and its connected
		7	VT Speech Quality on Sample Basis	Indicator representing the quantification of the end-to-end speech transmission quality as perceived by the user. This parameter computes the speech quality on a sample basis.	$VTSpeechQualityonSampleBasis = F(MQI-LOD) - F(MQI-HOD)$ $VTSpeechQualityonSampleBasis = F(MQI-LOD) - F(MQI-HOD)$
		8	VT Video Quality	End-to-end quality of the video signal as perceived by the end-user during a VT call. This parameter computes the video quality on a sample basis.	To be specified.
		9	VT End-to-End Mean One-Way Transmission Time [s]	Delay time from input of the signal at MS (MQM) (pre-call) to output of the signal at MS (MQM) (post-call/answer).	$VTEndtoEndMeanOneWayTransmissionTime[s] = \frac{EncodingofAudio/Video(t_{lowest}) + (a) + DecodingofAudio/Video(t_{lowest}) + (d)}{2}$ $VTEndtoEndMeanOneWayTransmissionTime[s] = \frac{EncodingofAudio/Video(t_{lowest}) + (a) + DecodingofAudio/Video(t_{lowest}) + (d)}{2}$
		10	VT Audio/Video Synchronization [%]	Percentage of times that the time differences of the audio and video signal at the user side exceeds a predefined threshold.	To be specified.
		1	HTTP Service Non-Accessibility [%]	The service non-accessibility ratio denotes the probability that a subscriber cannot establish a PDP context and access the service successfully.	$HTTPServiceNonAccessibility[\%] = \frac{UnsuccessfulAttemptsToReachThePointWhenContentIsReceived}{allAttemptsToReachThePointWhenContentIsReceived} \times 100$
		2	HTTP Setup Time [s]	The setup time describes the time period needed to access the service successfully, from starting the dial-up connection to the point of time when the content is sent or received.	$HTTPSetupTime[s] = (t_{ServiceAccessSuccessful} - t_{ServiceAccessStart})[s]$
		3	HTTP IP-Service Access Failure Ratio [%]	The IP-service access ratio denotes the probability that a subscriber cannot establish a TCP/IP connection to the server of a service successfully.	$HTTPIPServiceAccessFailureRatio[\%] = \frac{UnsuccessfulAttemptsToEstablishanIPConnectionToTheServer}{allAttemptsToEstablishanIPConnectionToTheServer} \times 100$
		4	HTTP IP-Service Setup Time [s]	The IP-service setup time is the time period needed to establish a TCP/IP connection to the server of a service, from sending the initial query to a server to the point of time when the content is sent or received.	$HTTPIPServiceSetupTime[s] = (t_{IPServiceAccessSuccessful} - t_{IPServiceAccessStart})[s]$
8	Web Browsing (HTTP)	5	HTTP Session Failure Ratio [%]	The completed session ratio is the proportion of (un)completed sessions and sessions that were started successfully.	$HTTPSessionFailureRatio[\%] = \frac{UnsuccessfulSessions}{allSessions} \times 100$
		6	HTTP Session Time [s]	The session time is the time period needed to successfully complete a PS data session.	$HTTPSessionTime[s] = (t_{SessionEnd} - t_{SessionStart})[s]$
		7	HTTP Mean Data Rate [bits/s]	After a data link has been successfully established, this parameter describes the average data transfer rate measured throughout the active session time to the service. The data transfer shall be successfully terminated. The prerequisite for this parameter is network and device capabilities.	$HTTPMeanDataRate[bits/s] = \frac{UserDataTransferred[bits]}{t_{DataTransferComplete} - t_{DataTransferStart}[s]}$
		8	HTTP Data Transfer Cut-off Ratio [%]	The data transfer cut-off ratio is the proportion of incomplete data transfers and data transfers that were started successfully.	$HTTPDataTransferCutOffRatio[\%] = \frac{IncompleteDataTransfers}{successfullyStartedDataTransfers} \times 100$
		1	Web Radio EPG Retrieval Failure Ratio [%]	This parameter denotes the probability that a subscriber cannot access the Web Radio EPG successfully.	$WebRadioEPGRetrievalFailureRatio[\%] = \frac{UnsuccessfulAttemptsToAccessTheEPG}{allAttemptsToAccessTheEPG} \times 100$
		2	Web Radio EPG Retrieval Time [s]	This parameter describes the time period needed to access the Web Radio EPG successfully.	$WebRadioEPGRetrievalTime[s] = (t_{Setup_EPG} - t_{Start_EPG})[s]$
		3	Web Radio Tune-in Failure Ratio [%]	This parameter denotes the probability that a subscriber cannot obtain the tune-in information for a Web Radio streaming server successfully.	$WebRadioTuneinFailureRatio[\%] = \frac{UnsuccessfulTuneinAttempts}{allTuneinAttempts} \times 100$
		4	Web Radio Tune-in Time [s]	This parameter describes the time period needed to obtain the tune-in information for a Web Radio streaming server successfully.	$WebRadioTuneinTime[s] = (t_{Setup_TR} - t_{Start_TR})[s]$
9	Web Radio	5	Web Radio Reproduction Set-up Failure Ratio [%]	This parameter denotes the probability that a subscriber cannot successfully start listening to a given Web Radio station.	$WebRadioReproductionSetupFailureRatio[\%] = \frac{UnsuccessfulReproductionSetUpAttempts}{allReproductionSetUpAttempts} \times 100$
		6	Web Radio Reproduction Set-up Time [s]	This parameter describes the time period from request of audio stream from Stream Server to reception of first data packet of audio content.	$WebRadioReproductionSetupTime[s] = (t_{Setup_RP} - t_{Start_RP})[s]$

14	Group Call	2	Group Call Setup Time [s]	The group call setup time is the time period between pushing the Push To Talk (PTT) button at the UE and receipt of call setup notification by an associated end-user optical indication at the UE that the group call is successfully established.	Group Call Setup Time [s] = (T _{connection established} - "user pressed button") [s]
		3	Group Call Speech Quality on Call Basis	The group call speech quality on call basis is an indicator representing the quantification of the end-to-end speech transmission quality of the group call service. This parameter computes the speech quality on the basis of completed calls.	The applicability of a suitable speech quality evaluation method for the narrow-band speech codec within 3GPP networks is for further study.
		4	Group Call Speech Quality on Sample Basis	The group call speech quality on sample basis is an indicator representing the quantification of the end-to-end speech transmission quality of the group call service. This parameter computes the speech quality on a sample basis.	The group call speech quality on sample basis is an indicator representing the quantification of the end-to-end speech transmission quality of the group call service. This parameter computes the speech quality on a sample basis.
		5	Group Call Cut-off Call Ratio [%]	The group call cut-off ratio denotes the probability that a successful call attempt is ended by a cause other than the administrative termination by the A- or B-party.	Group Call Cut-off Call Ratio [%] = $\frac{\text{unsuccessfully terminated group calls}}{\text{all successful group call attempts}} \times 100$
		6	Group Call Speech Transmission Delay [s]	The group call speech transmission delay describes the time period between a UE sending speech data and the group members (receiving the speech data) for a unique role based on speech sample within a successfully established group call.	Group Call Speech Transmission Delay [s] = (T _{B,listen} - T _{A,send}) [s]
		Store-and-forward (S&F) Services QoS Parameters			
1	Generic Store-and-forward Parameters	1	Service Message Upload Session Failure Ratio [%]	The message upload session failure ratio describes the proportion of unsuccessful message upload sessions and message upload sessions that were started successfully. The upload is successful if the message is marked as sent.	Service Message Upload Session Failure Ratio [%] = $\frac{\text{unsuccessful message upload sessions}}{\text{all message upload session start attempts}} \times 100$
		2	Service Message Upload Session Time [s]	The message upload session time describes the time period needed to successfully complete a message upload session.	Service Message Upload Session Time [s] = (T _{successful message upload session} - "message upload session start attempt") [s]
		3	Service Message Upload Access Failure Ratio [%]	The message upload access failure ratio describes the probability that the customer cannot successfully establish a data connection to the message server to upload messages.	Service Message Upload Access Failure Ratio [%] = $\frac{\text{unsuccessful message upload access attempts}}{\text{all message upload access attempts}} \times 100$
		4	Service Message Upload Access Time [s]	The message upload access time describes the time period needed to establish a data connection to the message server, from sending the initial query to the message server to the point of time when the message upload starts.	Service Message Upload Access Time [s] = (T _{successful message upload access} - "message upload access attempt") [s]
		5	Service Message Upload Data Transfer Cut-off Ratio [%]	The message upload data transfer cut-off ratio describes the proportion of unsuccessful message uploads and message uploads that were started successfully.	Service Message Upload Data Transfer Cut-off Ratio [%] = $\frac{\text{unsuccessful message uploads}}{\text{all successfully started message uploads}} \times 100$
		6	Service Message Upload Data Transfer Time [s]	The message upload data transfer time describes the time period from the start to the end of the complete message upload.	Service Message Upload Data Transfer Time [s] = (T _{successful message upload} - "successfully started message upload") [s]
		7	Service Notification Start Failure Ratio [%]	The notification start failure ratio describes the probability that the notification download by the B-party is not successfully initiated after the successful upload of the message by the A-party.	Service Notification Start Failure Ratio [%] = $\frac{\text{unsuccessful notification download attempts by B-party}}{\text{all successful message uploads by A-party}} \times 100$
		8	Service Notification Start Time [s]	The notification start time describes the time period from the successful message upload by the A-party to the start of the notification download attempt by the B-party.	Service Notification Start Time [s] = (T _{notification download attempt by B-party} - T _{successful message upload by A-party}) [s]
		9	Service Notification Download Session Failure Ratio [%]	The notification download session failure ratio describes the proportion of unsuccessful notification downloads and notification downloads that were started successfully.	Service Notification Download Session Failure Ratio [%] = $\frac{\text{unsuccessful notification download sessions}}{\text{all notification download session start attempts}} \times 100$
		10	Service Notification Download Session Time [s]	The notification download session time describes the time period needed to successfully complete a notification download session.	Service Notification Download Session Time [s] = (T _{successful notification download session} - "notification download session start attempt") [s]
		11	Service Notification Download Access Failure Ratio [%]	The notification download access failure ratio describes the probability that the customer cannot successfully establish a data connection to the message server to download the notification of a new message.	Service Notification Download Access Failure Ratio [%] = $\frac{\text{unsuccessful notification download access attempts}}{\text{all notification download access attempts}} \times 100$
		12	Service Notification Download Access Time [s]	The notification download access time describes the time period needed to establish the data connection to the message server, from sending the initial query to the message server to the point of time when the notification download starts.	Service Notification Download Access Time [s] = (T _{successful notification download session} - "notification download session start attempt") [s]
		13	Service Notification Download Data Transfer Cut-off Ratio [%]	The notification download data transfer cut-off ratio describes the proportion of unsuccessful notification downloads and notification downloads that were started successfully.	Service Notification Download Data Transfer Cut-off Ratio [%] = $\frac{\text{unsuccessful notification downloads}}{\text{all successfully started notification downloads}} \times 100$
		14	Service Notification Download Data Transfer Time [s]	The notification download data transfer time describes the time period from the start to the end of the complete notification download.	Service Notification Download Data Transfer Time [s] = (T _{successful notification download} - "successfully started notification download") [s]
		15	Service Message Download Session Failure Ratio [%]	The message download session failure ratio describes the proportion of unsuccessful message download sessions and message download sessions that were started successfully.	Service Message Download Session Failure Ratio [%] = $\frac{\text{unsuccessful message download sessions}}{\text{all message download session start attempts}} \times 100$
		16	Service Message Download Session Time [s]	The message download session time describes the time period needed to successfully complete a message download session.	Service Message Download Session Time [s] = (T _{successful message download session} - "message download session start attempt") [s]
		17	Service Message Download Access Failure Ratio [%]	The message download access failure ratio describes the probability that the customer cannot successfully establish a data connection to the message server to download messages.	Service Message Download Access Failure Ratio [%] = $\frac{\text{unsuccessful message download access attempts}}{\text{all message download access attempts}} \times 100$
		18	Service Message Download Access Time [s]	The message download access time describes the time period needed to establish a data connection to the message server, from sending the initial query to the message server to the point of time when the message download starts.	Service Message Download Access Time [s] = (T _{successful message download access} - "message download access attempt") [s]
		19	Service Message Download Data Transfer Cut-off Ratio [%]	The message download data transfer cut-off ratio describes the proportion of unsuccessful message downloads and message downloads that were started successfully.	Service Message Download Data Transfer Cut-off Ratio [%] = $\frac{\text{unsuccessful message downloads}}{\text{all successfully started message downloads}} \times 100$
		20	Service Message Download Data Transfer Time [s]	The message download data transfer time describes the time period from the start to the end of the complete message download.	Service Message Download Data Transfer Time [s] = (T _{successful message download} - "successfully started message download") [s]
		21	Service Notification and Message Download Failure Ratio [%]	The notification and message download failure ratio describes the probability that the customer cannot download first the notification and thereafter the complete message with the UE. User reaction times are not considered.	Service Notification and Message Download Failure Ratio [%] = $\frac{\text{unsuccessful notification and message downloads}}{\text{all notification and message download attempts}} \times 100$
		22	Service Notification and Message Download Time [s]	The notification and message download time describes the time period from the start of the notification download to the end of the reception of the whole message content. User reaction times are not considered.	Service Notification and Message Download Time [s] = (T _{successful notification and message download} - "notification and message download attempt") [s]
		23	Service End-to-End Failure Ratio [%]	The end-to-end failure ratio describes the probability that the complete service usage from the start of the message upload at the A-party to the complete message download at the B-party cannot be completed successfully. This transmission is unsuccessful if the message upload, the notification (if possible) or the message download fails.	Service End-to-End Failure Ratio [%] = $\frac{\text{unsuccessful message downloads by B-party}}{\text{all message upload attempts by A-party}} \times 100$
		24	Service End-to-End Time [s]	The end-to-end time describes the time period needed for the complete service usage, from the start of the message upload at the A-party to the complete message download at the B-party.	Service End-to-End Time [s] = (T _{successful message download} - "message upload attempt") [s]
2	E-mail	25	Service Login Non-Accessibility [%]	The login non-accessibility describes the probability of a login failure between the message client and the message server. The client needs to prepare the client of the B-party to be able to receive new notifications or messages. The parameter does not consider an actual message transfer.	Service Login Non-Accessibility [%] = $\frac{\text{unsuccessful logins}}{\text{all login attempts}} \times 100$
		26	Service Login Access Time [s]	The login access time describes the time period from starting the login procedure to the point of time when the login procedure is successfully completed and the client can receive notifications or messages at the B-party side.	Service Login Access Time [s] = (T _{successful login} - "login attempt") [s]
		1	E-Mail (Download/Upload) Service Non-Accessibility [%]	This parameter was removed due to major changes in the e-mail QoS concept.	This parameter was removed due to major changes in the e-mail QoS concept
		2	E-Mail (Download/Upload) Setup Time [s]	This parameter was removed due to major changes in the e-mail QoS concept.	This parameter was removed due to major changes in the e-mail QoS concept
		3	E-Mail (Download/Upload) IP Service Access Failure Ratio [%]	This parameter was replaced by the "Login Non-Accessibility" parameter specified in clause 7.2.11.	This parameter was replaced by the "Login Non-Accessibility" parameter specified in clause 7.2.11
		4	E-Mail (Download/Upload) IP Service Setup Time [s]	This parameter was replaced by the "Login Non-Accessibility" parameter specified in clause 7.2.12.	This parameter was replaced by the "Login Non-Accessibility" parameter specified in clause 7.2.12.
		5	E-Mail (Upload/Download) Session Failure Ratio [%]	The e-mail session failure ratio describes the proportion of unsuccessful sessions and sessions that were started successfully.	E-mail (Upload/Download) Session Failure Ratio [%] = $\frac{\text{unsuccessful sessions}}{\text{all session start attempts}} \times 100$
		6	E-Mail (Upload/Download) Header Download (Download) Session Time [s]	This parameter was removed due to the fact that the significance of the parameter is weak due to the following factors: • Different e-mail client implementations behave quite differently during a session with respect to the	This parameter was removed due to the fact that the significance of the parameter is weak due to the following factors:
		7	E-Mail (Upload/Download) Header Download (Download) Mean Data Rate [bit/s]	The e-mail mean data rate describes the average data transfer rate measured throughout the entire session time to the email server. The data transfer shall be successfully terminated.	E-mail (Upload/Download) Header Download (Download) Mean Data Rate [bit/s] = $\frac{\text{user data transferred [bits]}}{(T_{\text{successful data transfer}} - \text{successfully started data transfer}) [s]} \times 100$
		8	E-Mail (Upload/Download) Header Download (Download) Data Transfer Cut-off Ratio [%]	The e-mail data transfer cut-off ratio describes the proportion of unsuccessful data transfers and data transfers that were started successfully.	E-mail (Upload/Download) Header Download (Download) Data Transfer Cut-off Ratio [%] = $\frac{\text{unsuccessful data transfers}}{\text{all successfully started data transfers}} \times 100$
		9	E-Mail (Upload/Download) Header Download (Download) Data Transfer Time [s]	The e-mail data transfer time describes the time period from the start to the end of the complete transfer of e-mail content.	E-mail (Upload/Download) Header Download (Download) Data Transfer Time [s] = (T _{successful data transfer} - "successfully started data transfer") [s]
		10	E-Mail Login Non-Accessibility [%]	The e-mail login non-accessibility describes the probability that the e-mail client is not able to get access to the e-mail server.	E-mail Login Non-Accessibility [%] = $\frac{\text{unsuccessful logins}}{\text{all login attempts}} \times 100$
3	Multimedia Messaging Service (MMS)	11	E-Mail Login Access Time [s]	The e-mail login access time describes the time period from starting the login procedure to the point of time when the client is authenticated.	E-mail Login Access Time [s] = (T _{successful login} - "login attempt") [s]
		12	E-mail Notification Push Failure Ratio [%]	The e-mail notification push failure ratio describes the probability that the notification announcement was not successfully conveyed to the B-party.	E-mail Notification Push Failure Ratio [%] = $\frac{\text{unsuccessful attempts to push the notification to the B-party}}{\text{all attempts to push the notification to the B-party}} \times 100$
		13	E-mail Notification Push Transfer Time [s]	The e-mail notification push transfer time describes the time period from starting the notification push to the successful confirmation of the e-mail server of the end of the idle period.	E-mail Notification Push Transfer Time [s] = (T _{successful idle complete} - "notification push attempt") [s]
		14	E-mail End-to-End Failure Ratio [%]	The e-mail end-to-end failure ratio describes the probability that the complete service usage from the start of a mail upload at the A-party to the complete e-mail download at the B-party with an e-mail client cannot be completed successfully. This transmission is unsuccessful if the e-mail upload, the header download (if applicable) or the e-mail	E-mail End-to-End Failure Ratio [%] = $\frac{\text{unsuccessful e-mail downloads by B-party}}{\text{all e-mail upload attempts by A-party}} \times 100$
		1	MMS Send Failure Ratio [%]	The parameter MMS Send Failure Ratio describes the probability that a MMS-message cannot be sent by the subscriber, although he has requested to do so by pushing the "send button".	MMS Send Failure Ratio [%] = $\frac{\text{unsuccessful MMS send attempts}}{\text{all MMS send attempts}} \times 100$
		2	MMS Retrieval Failure Ratio [%]	The parameter MMS Retrieval Failure Ratio describes the probability that the MMS-message cannot be downloaded by the MMS mobile, which received a MMS notification before.	MMS Retrieval Failure Ratio [%] = $\frac{\text{unsuccessful MMS delivery attempts}}{\text{all MMS delivery attempts}} \times 100$
		3	MMS Send Time [s]	A subscriber uses the Multimedia Messaging Service (as indicated by the network ID in his mobile phone display). The time elapsing from pushing the "send button" after the setting of a MMS-message to the completion of the data transfer is described by this parameter.	MMS Send Time [s] = (T _{MMS to MMS complete} - "send button") [s]
		4	MMS Retrieval Time [s]	The reception of a MMS-message works as follows: A push-ims is sent to the receiver's mobile. In automatic mode, the push-ims initiates a WAP-connection to download the MMS from the MMS-C. The initiation of the WAP-connection is called the WAP GET REQUEST (WGR). The time elapsing between the WGR and the completion of the download of the MMS is described by this parameter. MMS Notification Failure Ratio [%] describes the probability that the Multimedia Messaging Service (MMS) is not able to deliver the Notification of a MMS-message to the B-party's mobile.	MMS Retrieval Time [s] = (T _{MMS from MMS-C complete} - "first WGR") [s]

4	Short Message Service (SMS), Short Data Service (SDS)	1	[SMS] [SDS] Service Non-Availability [%]	The [SMS] [SDS] service non-availability denotes the probability that the end-user cannot access the Short Message Service (SMS) or Short Data Service (SDS) when requested while it is offered by display of the network indicator on the UE.	$[SMS] [SDS] \text{Service Non-Availability} [\%] = \frac{\text{unsuccessfully received } [SMS] [SDS] \text{ service attempts}}{\text{all } [SMS] [SDS] \text{ service attempts}} \times 100$
		2	[SMS] [SDS] Access Delay [s]	The [SMS] [SDS] access delay is the time period between sending a short message to the network and receiving a send confirmation from the network at the originating side.	$[SMS] [SDS] \text{Access Delay} [s] = (t_{A, \text{receive}} - t_{A, \text{send}}) [s]$
		3	[SMS] [SDS] Completion Failure Ratio [%]	The [SMS] [SDS] Completion Failure Ratio is the ratio of unsuccessfully received and sent messages from one UE to another UE, excluding duplicate received and corrupted messages.	$[SMS] [SDS] \text{Completion Failure Ratio} [\%] = \frac{\text{unsuccessfully received } [SMS] [SDS]}{\text{all } [SMS] [SDS] \text{ service attempts}} \times 100$
		4	[SMS] [SDS] End-to-End Delivery Time [s]	The [SMS] [SDS] end-to-end delivery time is the time period between sending a short message to the network and receiving the very same short message at another UE.	$[SMS] [SDS] \text{End-to-End Delivery Time} [s] = (t_{B, \text{receive}} - t_{A, \text{send}}) [s]$
		5	[SMS] [SDS] Receive Confirmation Failure Ratio [%]	The [SMS] [SDS] receive confirmation failure ratio denotes the probability that the receive confirmation for a sent attempt is not received by the originating UE although requested.	$[SMS] [SDS] \text{Receive Confirmation Failure Ratio} [\%] = \frac{\text{non-confirmed } [SMS] [SDS] \text{ receptions}}{\text{all } [SMS] [SDS] \text{ service attempts}} \times 100$
		6	[SMS] [SDS] Receive Confirmation Time [s]	The [SMS] [SDS] receive confirmation time is the time period between sending a short message to the network and receiving the receive confirmation for this message from the network.	$[SMS] [SDS] \text{Receive Confirmation Time} [s] = (t_{A, \text{receive confirmation}} - t_{A, \text{send}}) [s]$
		7	[SMS] [SDS] Consumed Confirmation Failure Ratio [%]	The [SMS] [SDS] consumed confirmation failure ratio denotes the probability that the consumed confirmation for a sent attempt is not received by the originating UE although requested.	$[SMS] [SDS] \text{Consumed Confirmation Failure Ratio} [\%] = \frac{\text{non-confirmed } [SMS] [SDS] \text{ consumptions}}{\text{all } [SMS] [SDS] \text{ service attempts}} \times 100$
		8	[SMS] [SDS] Consumed Confirmation Time [s]	The [SMS] [SDS] consumed confirmation time is the time period between sending a short message to the network and receiving the consumed confirmation from the network.	$[SMS] [SDS] \text{Consumed Confirmation Time} [s] = (t_{A, \text{consume confirmation}} - t_{A, \text{send}}) [s]$