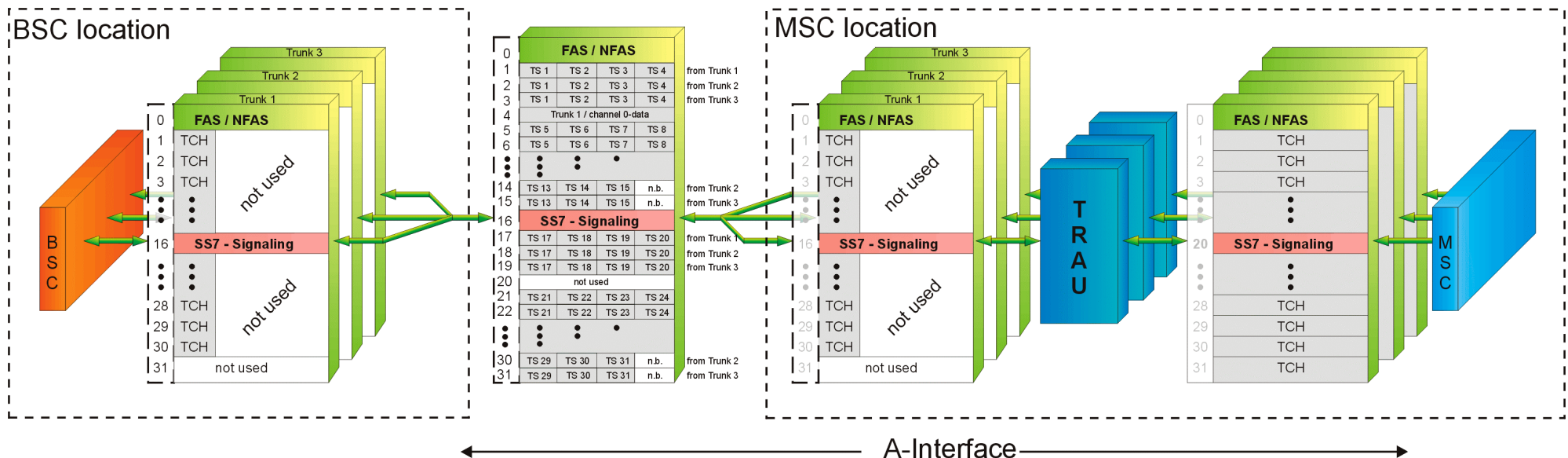


The A-Interface and Error Analysis in GSM

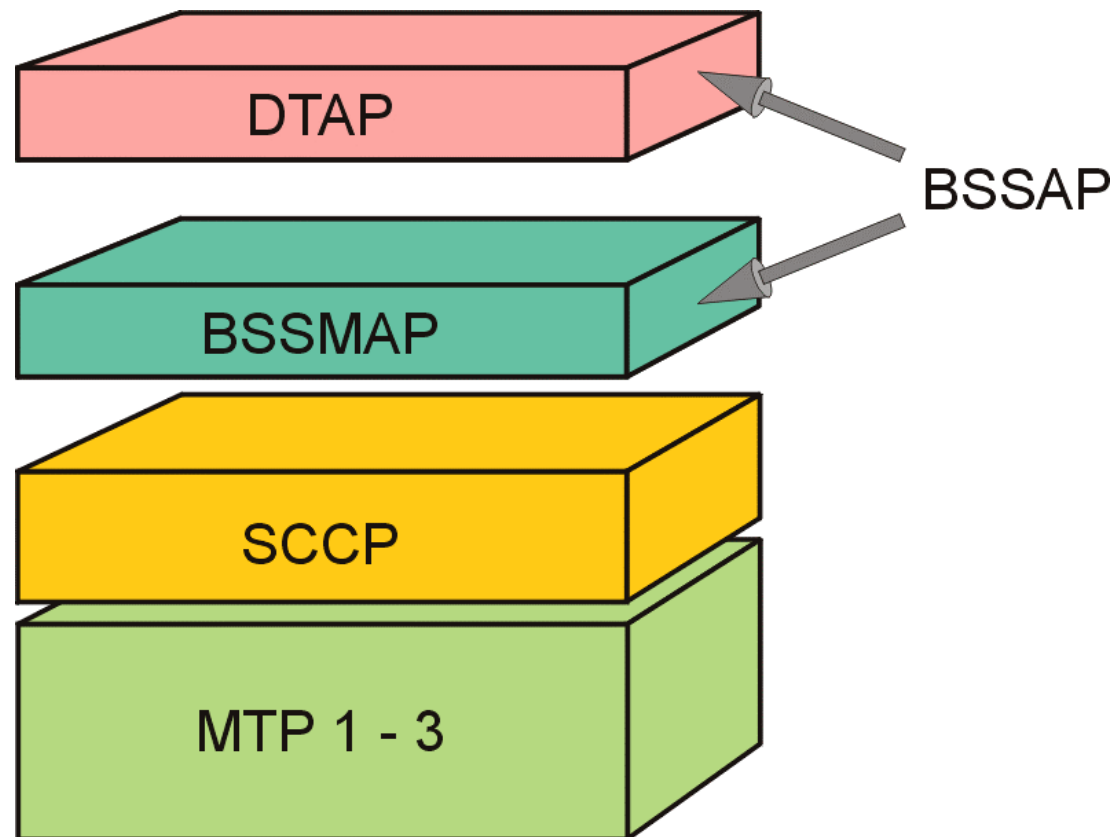
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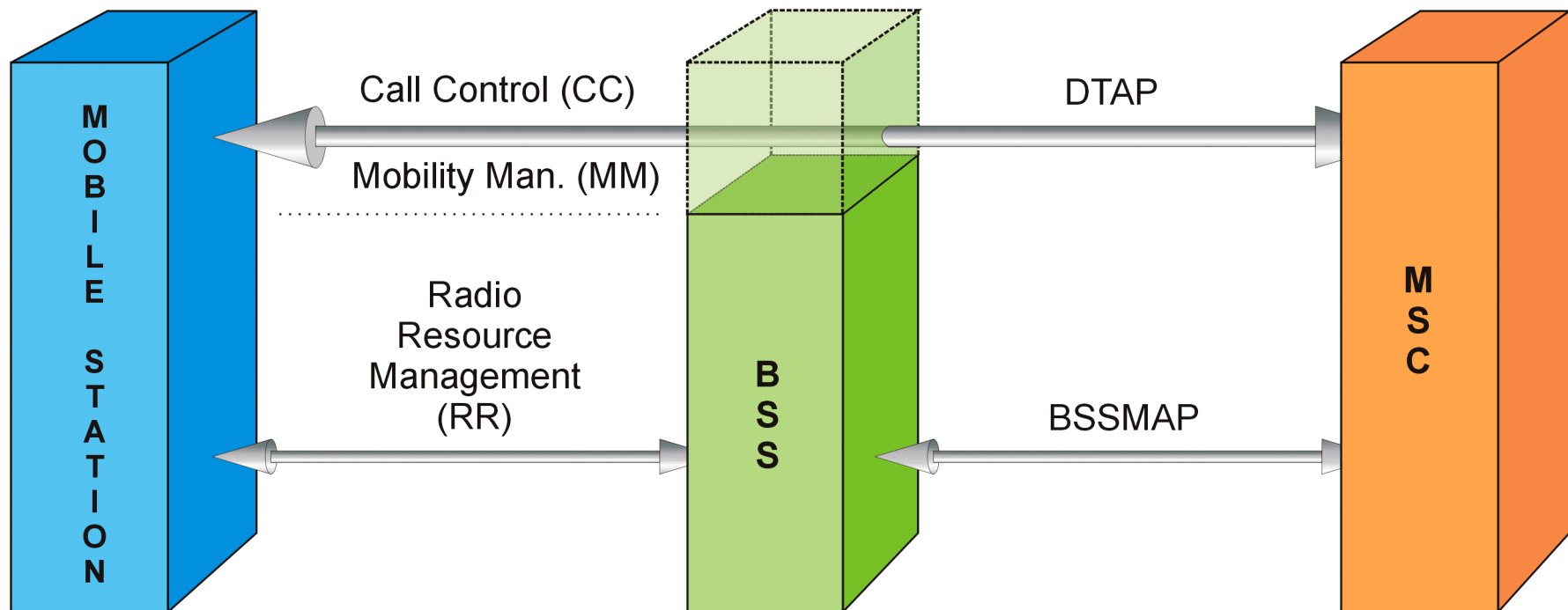
Channel Configuration on the A-Interface:



The Protocol Stack on the A-Interface:



(1) BSSAP and BSSMAP:



(2) BSSAP and BSSMAP:

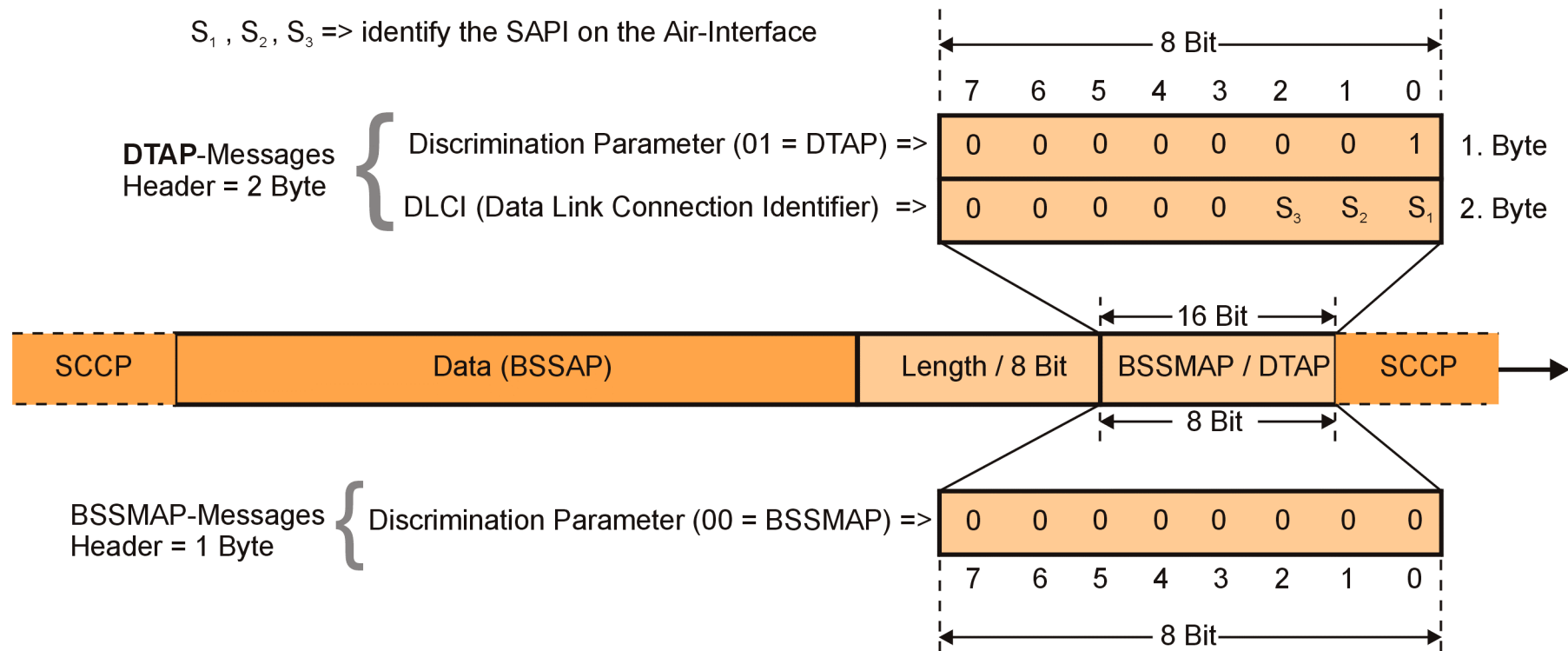
BSSAP (Base Station System Application Part):

The BSSAP is the user of the SCCP on the A-Interface. BSSAP includes the transfer of transparent (for the BSS) messages between the mobile station and the NSS and the exchange of messages between MSC and BSC. The transparent messages are referred to as DTAP-messages (Direct Transfer Application Part) and belong mainly to Call Control (CC) and Mobility Management (MM).

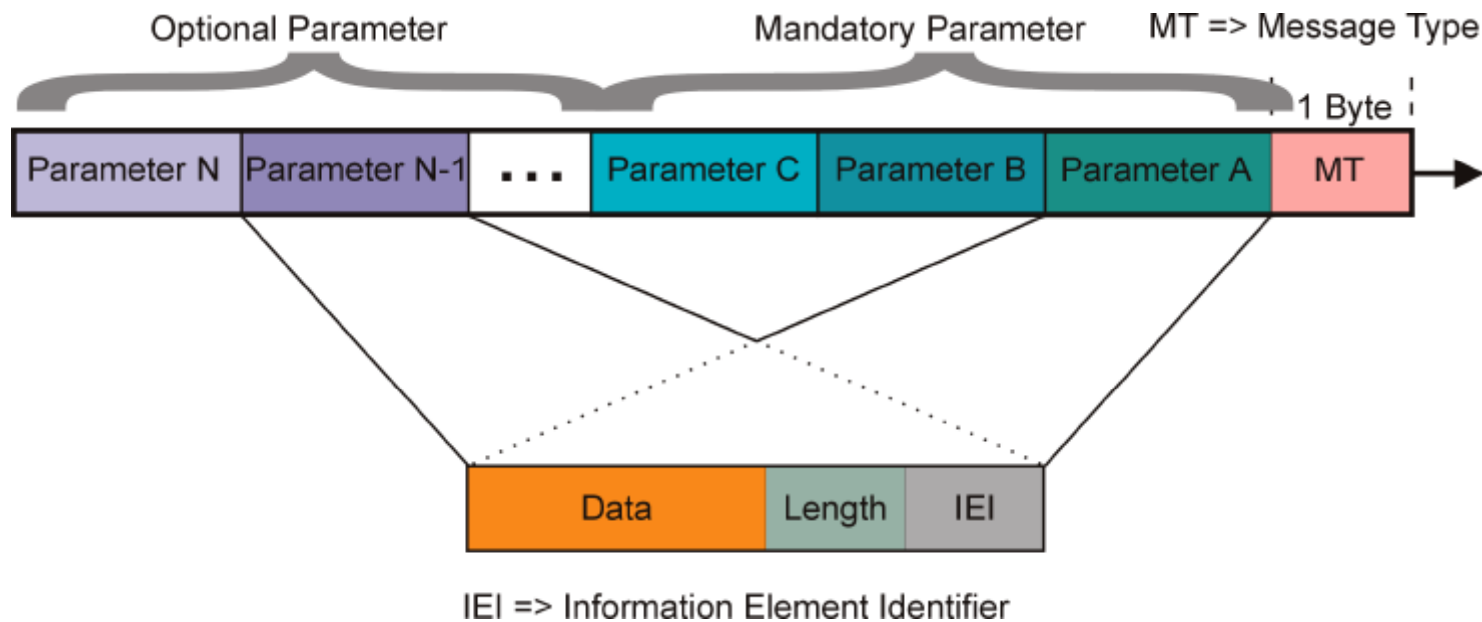
BSSMAP (Base Station System Mobile Application Part):

The BSSMAP is part of BSSAP but includes all non-transparent information exchange between the MSC and the BSS. This relates in particular to all message that the BSC needs to interpret and to all messages that manage the A-Interface itself.

(1) Message Format on the A-Interface:



(2) Message Format on the A-Interface:



(1) Failure Analysis / Information Interpretation:

Wanted Information	Interface / Protokoll	Parameter / Message Type
Identity of the BTS	A / Abis	<i>Cell Identity</i> (CI) in CM_SERV_REQ , PAG_RSP , LOC_UPD_REQ
Subscriber Identity	A / Abis	IMSI / TMSI in CM_SERV_REQ , PAG_RSP , LOC_UPD_REQ .
Location Area Identity (current)	only A	LAI parameter in the Complete Layer 3 Information message (CL3I)
Former LAI during Location Update	A / Abis	LAI-Parameter in the LOC_UPD_REQ message
Sender / receiver of a SCCP message	SCCP	<i>Called / Calling Party Address parameter</i> (Cd / CgPA) in the header of a SCCP message. The Cd / CgPA consists of a combination of a point code, a subsystem number (HLR, VLR, MSC, etc.), and a Global title.
Are there any SCCP problems?	SCCP	Look for CREF messages and UDTS messages. If either message can be found, problems are certain (overload?). Check also if all CR's (Connection Request) are answered with CC (Connection Confirm).
Are there any SS7 problems?	SS7	Look for LSSU's and COO's (change over orders). If LSSU's (SIPO or SIB) are detected, then severe SS7 problems on one of the two ends of the SS7 link exist.
Are there any SS7 problems because of high bit error rates?	SS7 / OMC	Check if there have been frequent link failures recently. If so, find out if the cause SUERM threshold exceeded is indicated. Look for LSSU's (SIO and SIOS) in the trace file.
Are there any problems in the VLR / HLR ?	A / Abis	Look for LOC_UPD_REJ, CM_SERV_REJ, and AUTH_REJ messages. Suspicious causes are: IMSI unknown in HLR, IMSI unknown in VLR, and LAC not allowed. If this occurs frequently, then data errors in the NSS database are likely.

(2) Failure Analysis / Information Interpretation:

Wanted Information	Interface / Protokoll	Parameter / Message Type
Is there any MS activity in a BSC or BTS?	A / Abis	Look for CM_SERV_REQ, PAG_RSP, and LOC_UPD_REQ. Detection of CHAN_RQD or IMM_ASS_CMD is not sufficient.
Are there Layer 1 problems on the Air-interface?	Abis	Look for CONN_FAIL messages (cause: '1' = Radio Interface Failure). If this occurs frequently, then further investigation is necessary (e.g., identify affected TRX).
Are there Layer 2 problems on the Air-interface?	Abis	Look for ERR_IND messages (frequent cause: '1' = timer T200 expired (N200+1) times; 'C _{hex} ' = frame not implemented).
Is there interference in the uplink or downlink?	Abis	The RX_QUAL values are poor despite good or acceptable RX_LEV values in the uplink/downlink, frequent intra BTS handover. Check assignment rate.
Are there problems when sending TRAU frames between transcoder, BTS and MS?	A / Abis	Abis-interface : Look for CONN-FAIL messages (cause: '28 _{hex} ' = Remote Transcoder Alarm). A-interface : Look for CLR_REQ messages (cause: '20' = Equipment Failure).
Are there problems during incoming handover?	A / Abis	Abis-Interface : Look for CONN_FAIL messages (cause: '2' = Handover Access Failure). A-Interface : Look for CLR_REQ messages (cause: '0' = Radio Interface Failure).
Are there problems during outgoing handover?	A / Abis	Abis- und Air-Interface : Look for HND_FAIL messages.
Errors in the neighborhood relations? Poor coverage?	A / Abis	Check if there is hardly any outgoing handover. Check if the number of CLR_REQ cause: '1' = Radio Interface Failure (A) and CONN_FAIL (cause: '1' = Radio Link Failure (Abis)) is higher than normal (location dependent).
Are there problems related to interworking between MSC and BSC?	A	High ASS_FAI rate. Causes: Requested Terrestrial Resource unavailable, Terrestrial Circuit already allocated, Protocol Error BSC/MSC. Check trunk assignment and other settings in MSC and BSC. Were the BLO messages, possibly after a reset procedure, not repeated?

(3) Failure Analysis / Information Interpretation:

Wanted Information	Interface / Protocol	Parameter / Message-Type
Are there any PLMN interworking problems?	MAP	Many ABT messages from the affected PLMN (cause: Application Context Name not supported).
Are there any BSC problems?	A	Though the related BTS's do not suffer overload, there are many ASS_FAI messages Cause: '33' = Radio Resource unavailable.
Is a BTS blocked?	Abis	Check the RACH control parameters in the SYS_INFOS BCCH_INFOS 1-4. Is the Cell Barr Access bit = 1 or the Access Control Class not equal 0?
MSISDN / IMSI combination of a subscriber	MAP	The BEG / provide Roaming Number message possibly contains both parameters. Another possibility is the BEG / send Routing Information message contains the MSISDN and the END / send Routing Information contains the IMSI.
IMSI / TMSI combination of a subscriber	A only	PAGING message (works on the A-interface, only)
Signaling Point Codes	SS7	Routing Label in every message signal unit (MSU)
Distance between MS and BTS	Abis	Access delay in CHAN_RQD, timing advance (TA) in CHAN_ACT and all MES_RES.
Target cell during handover	A	Cell Identity in HND_RQD messages
MS power class (Handy, ...)	A / Abis	Mobile Station Classmark X (RF Power Capability) parameter in CM_SERV_REQ, PAG_RSP, LOC_UPD_REQ
Called directory number in case of a MOC	A / Abis	Parameter Called Party BCD Number in SETUP message
Is DTX active?	Abis	DTX (Uplink): Downlink Measurements (MEAS_REP) DTX (Downlink): Uplink Measurements (MEAS_RES)

(1) Failure Analysis / Statistic Information:

Wanted information	Interface / Protocol	Parameter / Message Type
Total of all MOC attempts (BTS / BSC)	Abis / A	$\Sigma (\text{CM_SERV_REQ})$
Total of all MTC attempts (BTS / BSC)	A / Abis	$\Sigma (\text{PAG_RSP})$
Total of the successful incoming handover	A only	$\Sigma (\text{HND_CMP})$
Total of the outgoing handover	A only	$\Sigma (\text{CLR_CMD} [\text{Cause: '0B' = Handover successful}])$
Success rate for MOC's (BSS / BTS)	A / Abis	$\frac{\Sigma (\text{ALERT} [\text{from MSC} \rightarrow \text{MS}]) + \Sigma (\text{PROGRESS})}{\Sigma (\text{CM_SERV_REQ} [\text{Establishm. Cause = MOC}])}$
Error rate for MOC's (BSS / BTS)	A / Abis	$1 - \frac{\Sigma (\text{ALERT} [\text{from MSC} \rightarrow \text{MS}]) + \Sigma (\text{PROGRESS})}{\Sigma (\text{CM_SERV_REQ} [\text{Establishm. Cause = MOC}])}$
Success rate for MTC's (BSS / BTS)	A / Abis	$\frac{\Sigma (\text{ALERT} [\text{from MS} \rightarrow \text{MSC}])}{\Sigma (\text{PAG_RSP})}$
Error rate for MTC's (BSS / BTS)	A / Abis	$1 - \frac{\Sigma (\text{ALERT} [\text{from MS} \rightarrow \text{MSC}])}{\Sigma (\text{PAG_RSP})}$

(2) Failure Analysis / Statistic Information:

Wanted Information	Interface / Protocol	Parameter / Message Type
Success rate for incoming handover	A only	$\frac{\sum (\text{HND_CMP})}{\sum (\text{HND_REQ})}$
Error rate for incoming handover	A only	$1 - \frac{\sum (\text{HND_CMP})}{\sum (\text{HND_REQ})}$
Success rate for outgoing handover	A only	$\frac{\sum (\text{CLR_CMD} [\text{Cause: '0B' = Handover successful}])}{\sum (\text{HND_CMD})}$
Error rate for outgoing handover	A only	$1 - \frac{\sum (\text{CLR_CMD} [\text{Cause: '0B' = Handover successful}])}{\sum (\text{HND_CMD})}$