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ITU-T G.7042/Y.1305

TELECOMMUNICATION
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Corrigendum 1

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SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

Digital terminal equipments – General

SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT GENERATION NETWORKS

Internet protocol aspects – Transport

Corrigendum 1 to the Recommendation G.7042/Y.1305

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Corrigendum 1 to the Recommendation G.7042/Y.1305

Summary

This document contains a corrigendum both normative text and Appendix I to the ITU-T recommendation G.7042/Y.1305 (02/04).

4 Abbreviations

~~LOM Loss of Multiframe~~

MSU Member ~~status~~ signal unavailable

MSU_L Member ~~status~~ signal unavailable, LCAS enabled criteria

~~TSF Trail Signal Fail~~

6 ~~6~~ LCAS for virtual concatenation

6.1 Methodology

LCAS in the virtual concatenation source and sink adaptation functions provides a control mechanism to hitless increase or decrease the capacity of a VCG link to meet the bandwidth needs of the application. It also provides the capability of temporarily removing member links that have experienced a failure. The LCAS assumes that in cases of capacity initiation, increase or decrease, the construction or destruction of the end-to-end path of each individual member is the responsibility of the Network and Element Management Systems. A VCG capacity increase or decrease~~The adding or removal of a member~~ can be initiated at either end. However, the initiation of a VCG capacity decrease~~removal~~ at the Sk may result in temporary loss of data, see section 6.5.

6.2.1 MultiFrame Indicator (MFI) field

At the So side the MFI is equal for all members of the VCG~~ and it will be incremented each frame~~. At the Sk side the MFI shall be used to realign the payload for all the members in the group. The MFI is used to determine the differential delay between members of the same VCG.

6.2.2 Sequence Indicator (SQ) field

The SQ of a member ~~removed from~~of the VCG sending IDLE in the control field shall be set to the highest possible value.

6.2.4 Group Identification (GID) bit

Used for identification of the VCG. The GID bit of all members of the same VCG has the same value in the ~~frames~~ control packets with the same MFI.

~~NOTE The GID is not valid for members sending IDLE in the control field.~~

6.2.5.1 CRC Multiplication/division process

The bits of the control packet can be regarded the coefficients of a polynomial where the first bit of the control packet to be transmitted is the most significant bit. A particular CRC-n block is the remainder after multiplication of all bits in a control packet by x~~X~~^{n} and then division (modulo 2) by the application specific generator polynomial. The remainder is a polynomial of at most degree (n-1).

6.2.6 Member Status (MST) field

At initiation of a VCG sink all members shall report MST FAIL. A transition to MST=OK occurs when a control packet is received for that member with a control field of ADD (or NORM or EOS after it has been added, or DNU after recovery from a network failure). All unused MST and members that have a control field of IDLE, shall be set to FAIL.

6.2.7 Re-Sequence Acknowledge (RS-Ack) bit

The expiration of the time-out is equivalent to the detection of a ~~toggling~~ toggled ~~of the~~ RS-Ack bit at So (~~see~~ refer to SDL protocol description, shown in figures A.1 and A.4, for details).

NOTE - No new change in the VCG should be ~~committed~~ executed, i.e. no member should be added or removed from the VCG, until the RS-Ack is received or the RS-Ack time-out has expired for the currently active change request.

6.3 VCG capacity increase (Addition of member(s))

When a member is added it shall always be assigned a sequence number one larger than the currently highest sequence number that has EOS or DNU in the CTRL code. When multiple members are added, they must each use a unique sequence number so there will be a unique MST response for each additional~~requesting~~ member.

In case more than one member (e.g. x) is being added, and MST □OK is being simultaneously received for ~~more than one~~ those members, then the allocation of sequence indicators is arbitrary provided they are the next x sequence numbers after the currently highest sequence number (~~with CTRL code EOS or DNU~~which has CTRL code EOS or DNU). The newly added members will have CTRL code NORM or EOS.

~~6.4 Temporary removal of member~~

~~When a member sending a NORM or EOS experiences a failure in the Network this is detected at the Sk (aTSF, aTSD, dLOM) the Sk will send in the MST of that particular member the status FAIL. The So will then either replace the NORM condition by a DNU condition, or replace the EOS condition with an DNU condition and the preceding member will send EOS in the CTRL field.~~

~~When the defect causing the temporary removal is cleared this is detected at the Sk. The Sk will send in the MST of that particular member the status OK. The So will then either replace the DNU condition by an NORM condition, or replace the DNU condition with an EOS condition and the preceding member will send NORM in the CTRL field.~~

~~6.4.1 Temporary removal of member payload~~

~~The final step for temporary removal of a member is to remove the payload area of that particular member from the VCG. The last container frame that contains payload of the removed member shall be the container frame containing the last bit(s) of the control packet containing the first DNU control field. The following container frames will contain all ZEROes in the payload area. Upon reception at the Sk of the DNU control field the payload of this particular member shall not be used to reconstruct the original VCG payload.~~

~~The final step after recovering from a temporary removal is to start using the payload area of that member again. The first container frame to contain payload data for the member shall be the container frame immediately following the container frame that contained the last bit(s) of the control packet containing the first NORM or EOS control field for that member.~~

6.4 VCG Capacity Decrease: Member(s) temporary removed by the LCAS procedure (due to failure)

6.4.1 Temporary removal of a member

When a member sending a NORM or EOS experiences a failure in the Network this is detected at the Sk (MSU_L, TSD) and the Sk will send MST = FAIL for that particular member. The reporting of the MST = FAIL can be delayed by a Hold-Off time to limit the number of switch actions in case of nested protection mechanisms. Upon detection of the MST = FAIL the So will either replace the

NORM condition by a DNU condition, or replace the EOS condition with an DNU condition. The active member with the highest sequence number will send EOS in the CTRL field.

6.4.1.1 Temporary removal of member payload

There are two reasons for a temporary removal of a members payload:

- In case of a received MSU_L the final step for temporary removal of a member is to remove that particular member from the VCG. At the Sk side the removal shall start immediately after detection of the MSU_L defect. At the So side the last container frame that contains payload of the removed member shall be the container frame containing the last bit(s) of the control packet containing the first DNU control field. The following container frames will contain all ZEROes in the payload area. Upon reception at the Sk of the DNU control field, the payload of this particular member shall not be used to reconstruct the original VCG payload.
- In case of a received TSD the final step for temporary removal of a member is to remove that particular member from the VCG. At the Sk side the payload area of that particular member will continue to be used for the reconstruction of the original VCG payload. The bit errors in the payload area of the member have to be handled by the server to client adaptation function at the sink side of the VCG. At the So side the last container frame that contains payload of the removed member shall be the container frame containing the last bit(s) of the control packet containing the first DNU code in the control field. The following container frames will contain all ZEROes in the payload area. Upon reception at the Sk of DNU in the control field the payload area of that particular member is removed from the VCG.

6.4.2 Reinstatement of temporarily removed member

When the defect causing the temporary removal is cleared this is detected at the Sk. The Sk will send MST=OK for that particular member. The reporting of the MST = OK can be delayed by a Wait-To-Restore time to avoid unwanted effects due to intermittent defects. Upon detection of the MST = OK the So will either replace the DNU condition by an NORM condition, or replace the DNU condition with an EOS condition and the preceding member, that was sending CTRL code EOS,will send NORM in the CTRL field.

6.4.2.1 Reinstatement of temporarily removed members payload

The final step after recovering from a temporary removal is to start using the payload area of that member again. The first container frame to contain payload data for the member shall be the container frame immediately following the container frame that contained the last bit(s) of the control packet containing the first CTRL code NORM or EOS in the control field for that member.

6.5 VCG Capacity Decrease: Removal (permanent) ~~Deletion~~ of member(s)

When members are deleted, the sequence numbers ~~and corresponding member status number of the other members~~ shall be renumbered. If the ~~deleted~~ permanently removed member ~~contains~~ contained the highest sequence number of that group, the active member containing the next highest sequence number shall change its control field to EOS in its control packet coinciding with the permanently removed ~~deleted~~ member's control packet with the IDLE control field. If the permanently removed ~~deleted~~ member ~~contains~~ contained the highest sequence number of that group and sends DNU in the control field, the sequence numbering and control fields of the other members in the group will not change. If the ~~member deletion~~permanent removal of a member occurs somewhere other than at the highest end of the sequence, then the other members with sequence numbers between the newly ~~deleted~~ permanently removed member and the highest sequence number shall update their sequence indicators in their control packets coinciding with the control packet changing the status of the permanently removed ~~deleted~~ member.

Note that if permanent removal of members is initiated at the sink end first and the removed members were not the ones receiving signals with the highest SQ numbers, some of the remaining sink end members will receive SQ numbers higher than the new provisioned size at the sink end (until the members are removed at the source, too); this is not a fault condition.

Note, if a permanent removal of an active member is initiated at the Sk, this will result in a hit to the reconstructed data. The duration of this hit will be from the time the member is removed (starts sending MST = FAIL) until the DNU would have been received from the So.

Annex A

A.1 LCAS Protocol

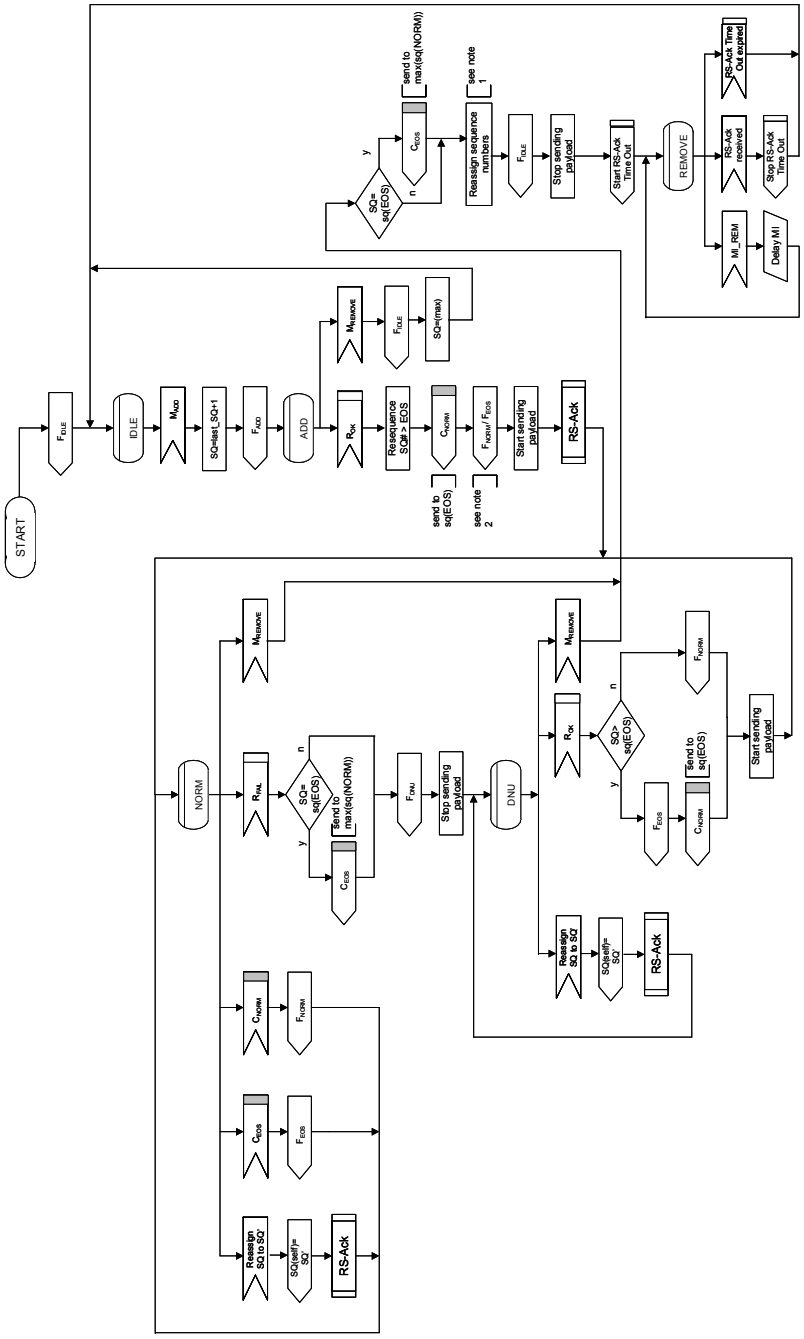
2) the parameter X_P, which indicates the number of provisioned members in the virtual concatenated group. Each completed ADD[i] command will increment X_P by 1, each completed REMOVE[i] command will decrement X_P by 1. Furthermore, the relationship $0 \leq X_P \leq X_M$ holds;

2) OK: The incoming signal for this member experiences no failure condition (i.e. MSU_L~~e.g. aTSF, or dLOM~~) or has received and acknowledged a request for addition of this member. When the incoming signal is degraded (i.e. TSD) the member remains in the OK state.

To avoid possible misalignment between So and Sk regarding the sequence numbers and the corresponding received far-end statuses, the number of provisioned members X_P in the VCG is only changed under management command.

The sequence number received just before an MSU_L~~TSF~~ will be used for the reporting of the member status, but the payload will not be used to reconstruct the original signal. If the failed member is removed (by manager action) there will be a renumbering of the remaining sequence numbers. Replacement of a failed member (in the state DNU) because the failure in the Network cannot be repaired has to be performed via a REMOVE – ADD sequence.

A.2 State diagram of member(i) in the Virtual Concatenated Group



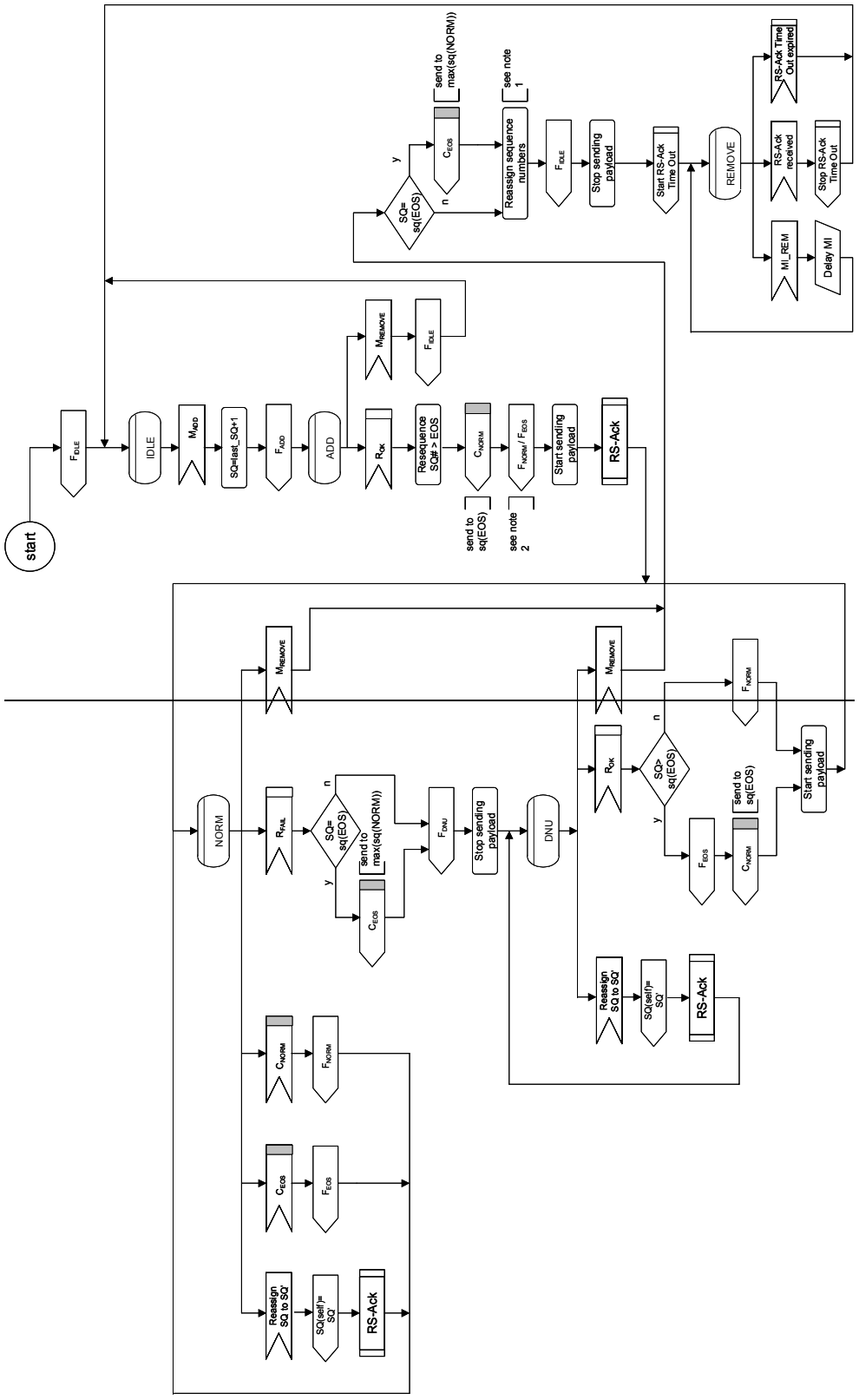
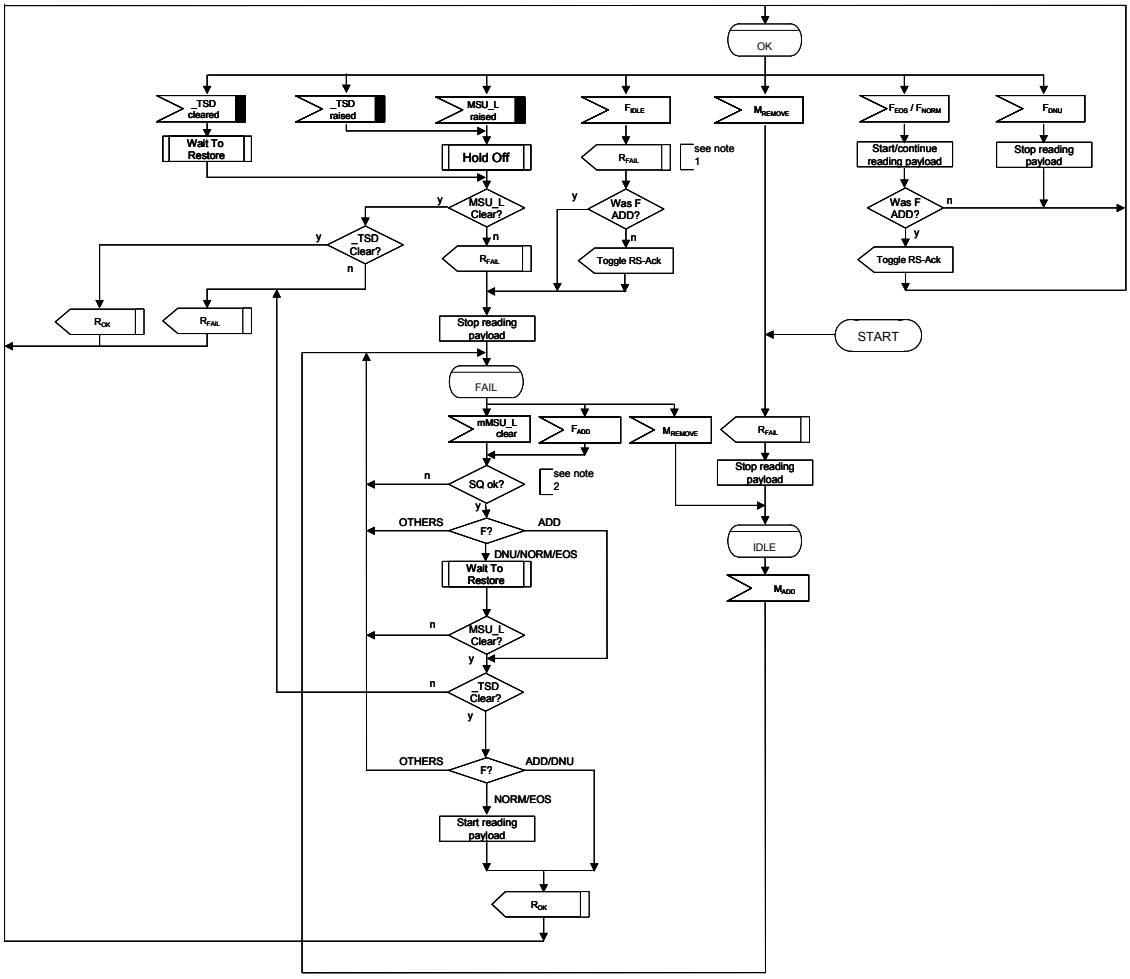


Figure A.1/G.7042/Y.1305 – Source side state diagram

Note 1	The SQ of the removed member $\underline{i}$~~x~~ ($0 \le \underline{i}$~~x~~ $< \underline{X_P}$~~n~~) shall be set to the highest possible value and the SQ of members with numbers ~~x~~$\underline{i}$+1, … ~~n-1~~$\underline{(X_P-1)}$ will be renumbered to ~~x~~$\underline{i}$, …~~n-1~~$\underline{(X_P-2)}$


OK
_TSD cleared
_TSD raised
MSU_L raised
F_IDLE
M_REMOVE
F_EOS / F_NORM
F_DNU
Wait To Restore
Hold Off
R_FAIL
see note 1
Start/continue reading payload
Stop reading payload
MSU_L Clear?
Was F ADD?
_TSD Clear?
Toggle RS-Ack
R_OK
R_FAIL
Stop reading payload
START
FAIL
mMSU_L clear
F_ADD
M_REMOVE
R_FAIL
Stop reading payload
SQ ok?
see note 2
OTHERS
F?
ADD
DNU/NORM/EOS
IDLE
M_ADD
Wait To Restore
MSU_L Clear?
TSD Clear?
OTHERS
F?
ADD/DNU
NORM/EOS
Start reading payload
R_OK

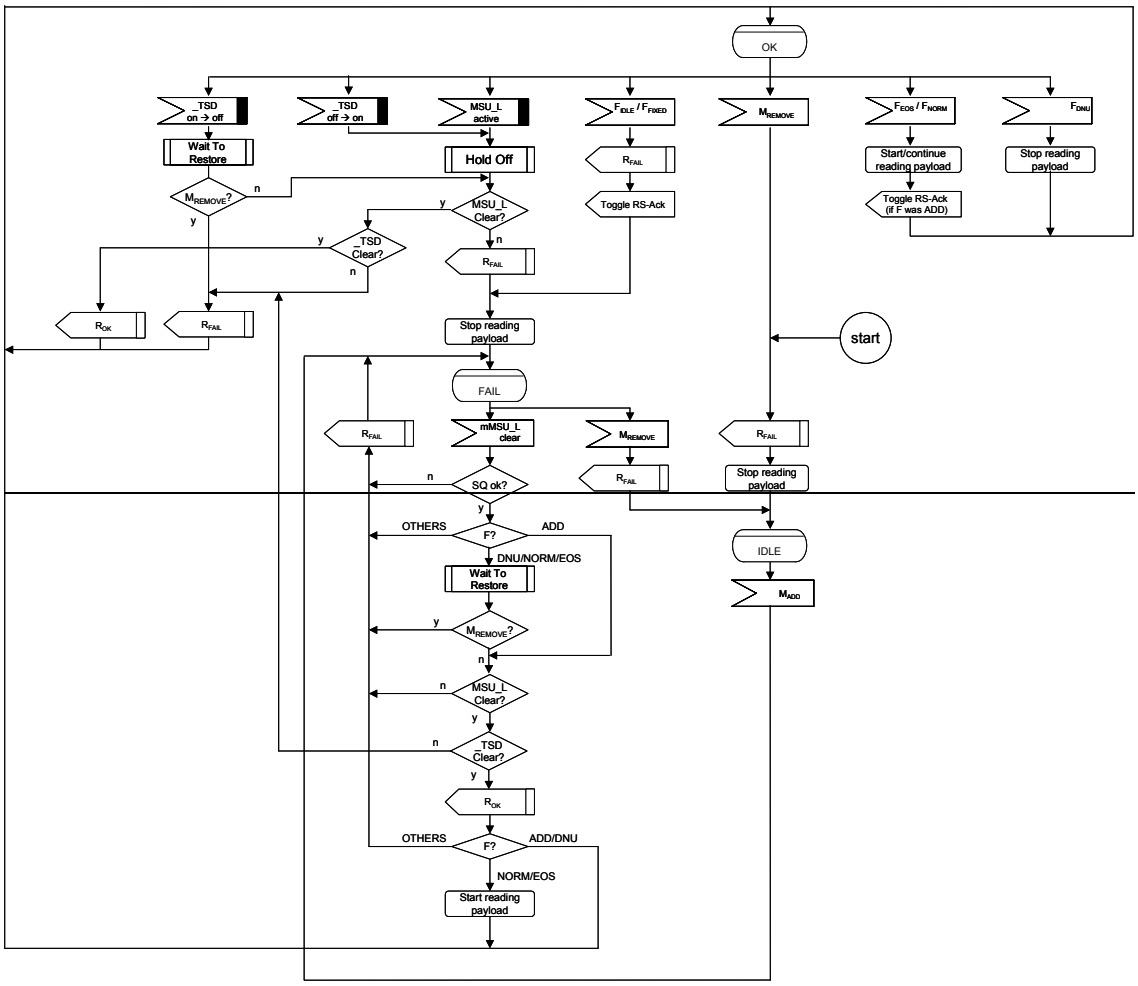


Figure A.2/G.7042/Y.1305 – Sink side state diagram

Note 1	As per clause 6.2.2, no specific SQ is available at the sink after receiving a control word of "IDLE" for a member. MST=FAIL is generated here according to the general rule in Annex B/G.806 for members without validated SQ.
Note 2	This check verifies whether the SQ received for the present member is unique compared to those of the members in the OK state. If the received SQ is unique (i.e. not in use by any member among those in the OK state), the "y" branch is followed. Otherwise the "n" branch is followed.
Note 3	For a particular member(i), "hold off" and "wait to restore" procedures are never simultaneously active.

A.3 Procedures state diagrams

A.3.1 RS-Ack procedure

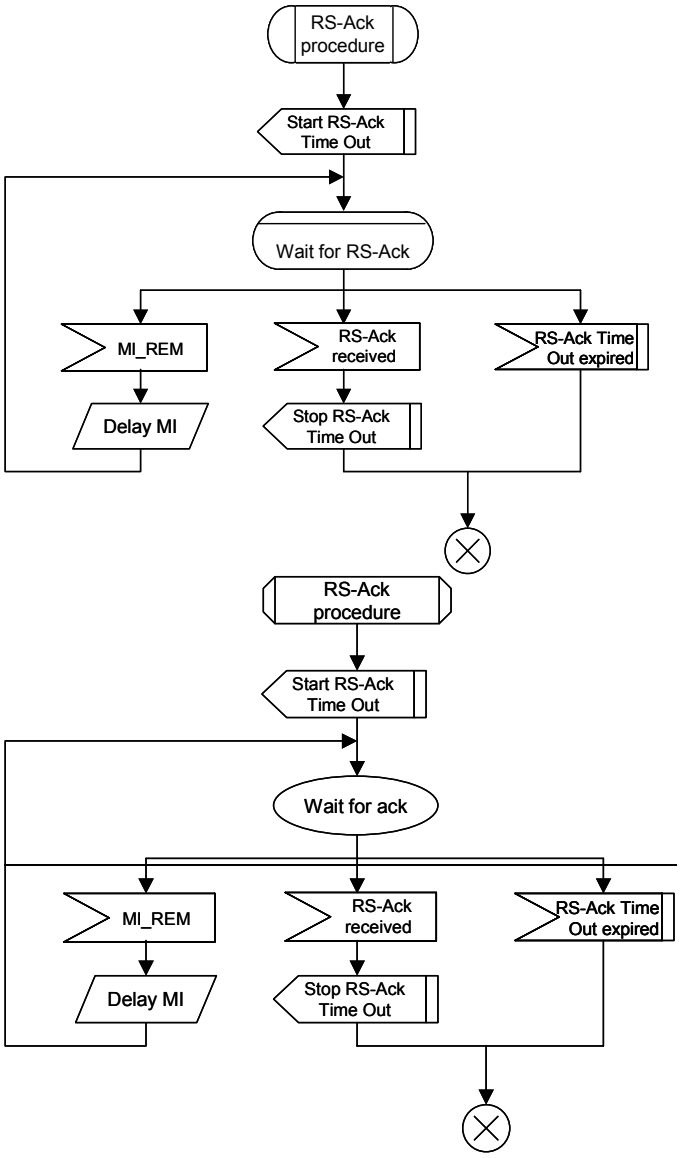


Figure A.4/G.7042/Y.1305.- RS-Ack procedure

A.3.2 WTR procedure

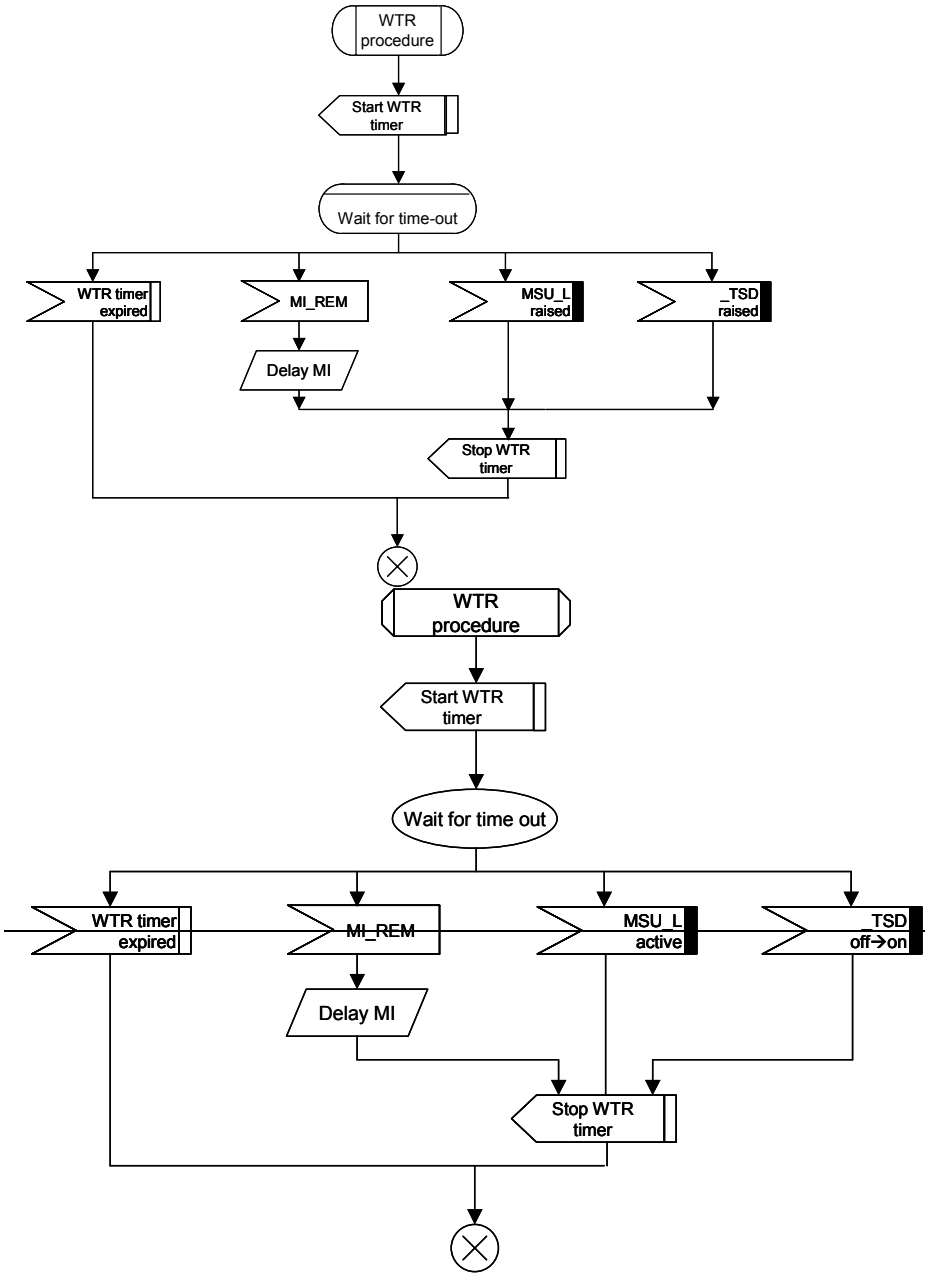


Figure A.5/G.7042/Y.1305 –WTR procedure.

A.3.3 HO procedure

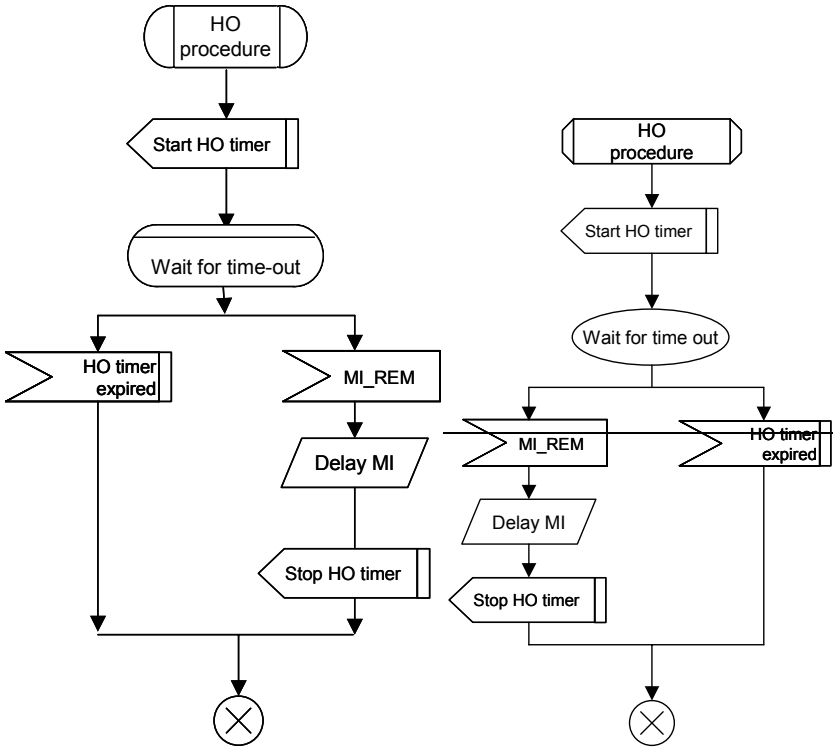


Figure A.6/G.7042/Y.1305 – HO procedure.

Appendix I

I.3 Provisioning

When a new container(s) is ~~initiated or~~ provisioned to be a member of the group it must be allocated the following:

SQ = Set to a value larger than the currently highest sequence number that has EOS in the CTRL code. The SQ shall not be interpreted while CTRL = IDLE (not yet in service). It is recommended to set SQ to the highest possible value. Because this highest value is technology dependent, it is not possible to indicate a precise value. In the following examples the value (max) is used to indicate this highest value.

GID = The group ID for that virtually concatenated group.

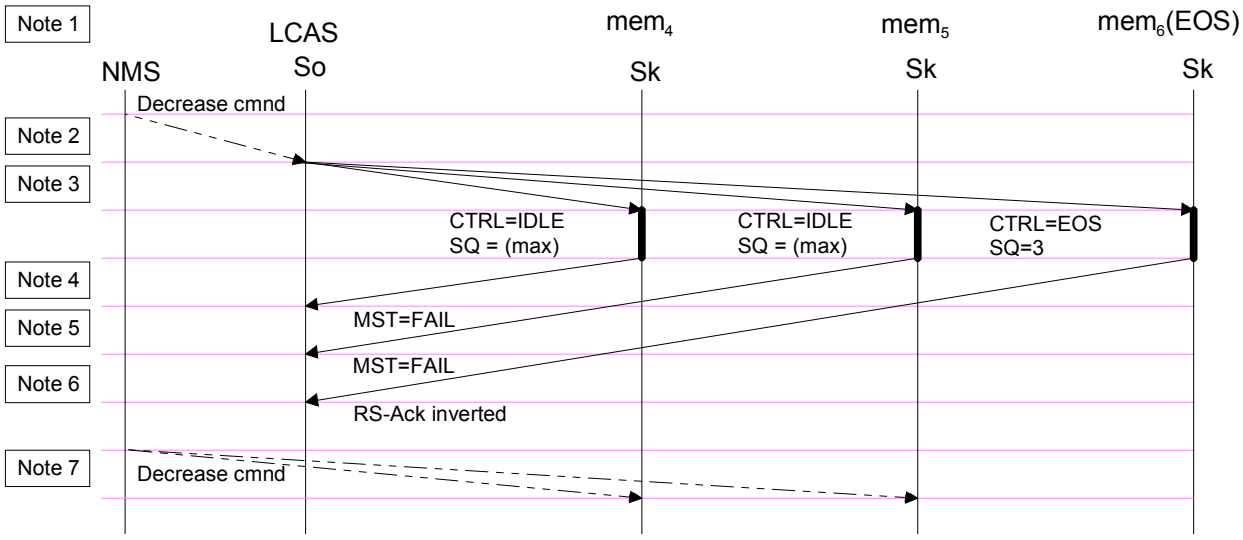
I.4.1.1 Add: (ADD) Multiple After last member.

Note		Member n			member a (new)			Member a+1 (new)			RS-Ack
		CTRL	SQ	MST	CTRL	SQ	MST	CTRL	SQ	MST	
1	Initial Condition	EOS	n-1	OK	IDLE	~~FF~~(max)	FAIL	IDLE	~~FF~~(max)	FAIL	0
2	NMS issues Add command to So and Sk LCASC	EOS	n-1	OK	IDLE	~~FF~~(max)	FAIL	IDLE	~~FF~~(max)	FAIL	0

3	So (a) sends CTRL = ADD and SQ = n; So (a+1) sends CTRL = ADD and SQ =n+1	EOS	n-1	OK	ADD	n	FAIL	ADD	n+1	FAIL	0
4	Sk (a+1) sends MS=OK to So	EOS	n-1	OK	ADD	n	FAIL	ADD	n+1	OK	0
5	So (n-1) sends CTRL = NORM; So (a+1) sends CTRL = EOS and SQ = n	NORM	n-1	OK	ADD	n+1	FAIL	EOS	n	OK	0
6	RS-Ack bit inverted due to change in sequence	NORM	n-1	OK	ADD	n+1	FAIL	EOS	n	OK	1
7	Sk (a) sends MST=OK to So	NORM	n-1	OK	ADD	n+1	OK	EOS	n	OK	1
8	So (a) sends CTRL = EOS; So (a+1) sends CTRL = NORM	NORM	n-1	OK	EOS	n+1	OK	NORM	n	OK	1
9	RS-Ack bit inverted due to change in sequence	NORM	n-1	OK	EOS	n+1	OK	NORM	n	OK	0

~~*Note 3*: The initial value of SQ=FF indicates that members in IDLE state have highest possible SQ value. This value is technology dependent.~~

I.4.2.1 Decrease: (REMOVE) Planned Multiple NOT including last. member.



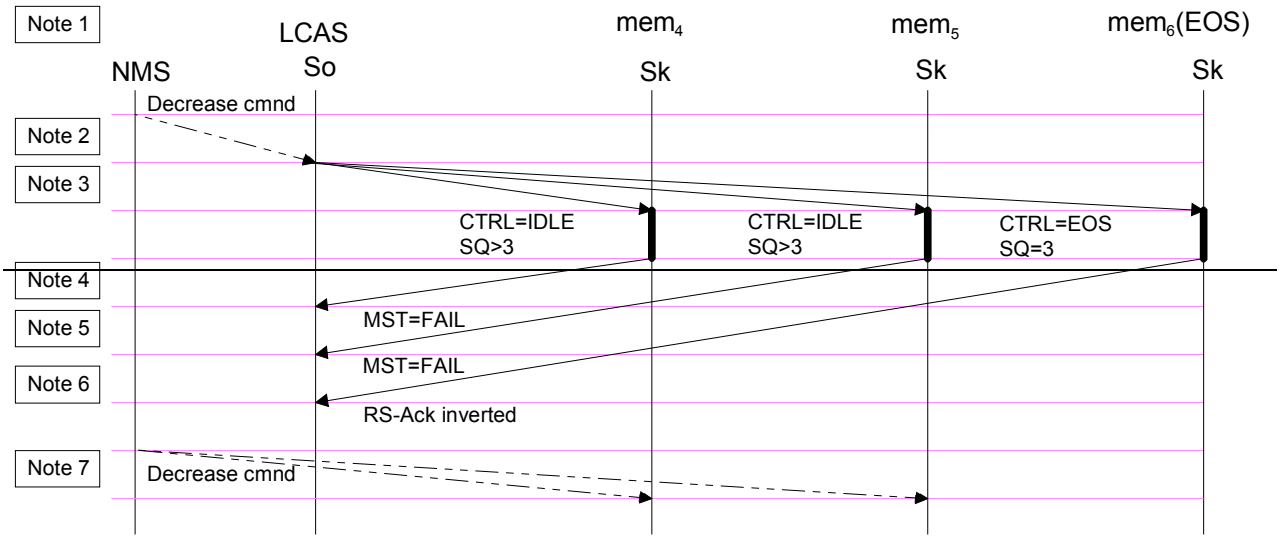


Figure I-2/G.7042: Planned removal of members 4 and 5 out of 6

Note		member 4			member 5			Member 6			RS-Ack
		CTRL	SQ	MST	CTRL	SQ	MST	CTRL	SQ	MST	
1	Initial Condition	NORM	3	OK	NORM	4	OK	EOS	5	OK	0
2	NMS issues Decrease command to So LCASC	NORM	3	OK	NORM	4	OK	EOS	5	OK	0
3	So (3) sends CTRL = IDLE, SQ ~~> 3~~= (max) So (4) sends CTRL = IDLE, SQ ~~> 3~~= (max) So (5) sends SQ = 3	IDLE	~~>~~ 3)max)	OK	IDLE	~~>~~ 3(max)	OK	EOS	3	OK	0
4	Sk (un-wanted) sends MST = FAIL to So	IDLE	~~>~~ 3(max)	FAIL	IDLE	~~>~~ 3(max)	OK	EOS	3	OK	1
5	Sk (un-wanted) sends MST = FAIL to So	IDLE	~~>~~ 3(max)	FAIL	IDLE	~~>~~ 3(max)	FAIL	EOS	3	OK	1
6	RS-Ack bit inverted due to change in sequence	IDLE	~~>~~ 3(max)	FAIL	IDLE	~~>~~ 3(max)	FAIL	EOS	3	OK	1
7	NMS issues Decrease command to Sk LCASC	IDLE	~~>~~ 3(max)	FAIL	IDLE	~~>~~ 3(max)	FAIL	EOS	3	OK	1

All un-wanted member are re-allocated an SQ greater than the SQ of the member sending the EOS control field, i.e. the highest possible value (max).

	VC	A	B	C	D	E	F	G
Before	SQ	0	1	2	3	4	5	6
				U	U			U
After	SQ	0	1	~~> 3~~(max)	~~> 3~~(max)	2	3	~~> 3~~(max)

~~*Note 4*: The assignment of SQ > 3 indicates that the SQ number to be assigned is the highest possible. Due to the fact that this highest value is technology dependent, it is not possible to indicate a precise value.~~

I.4.2.2 Decrease: (REMOVE) Planned Single Last member.

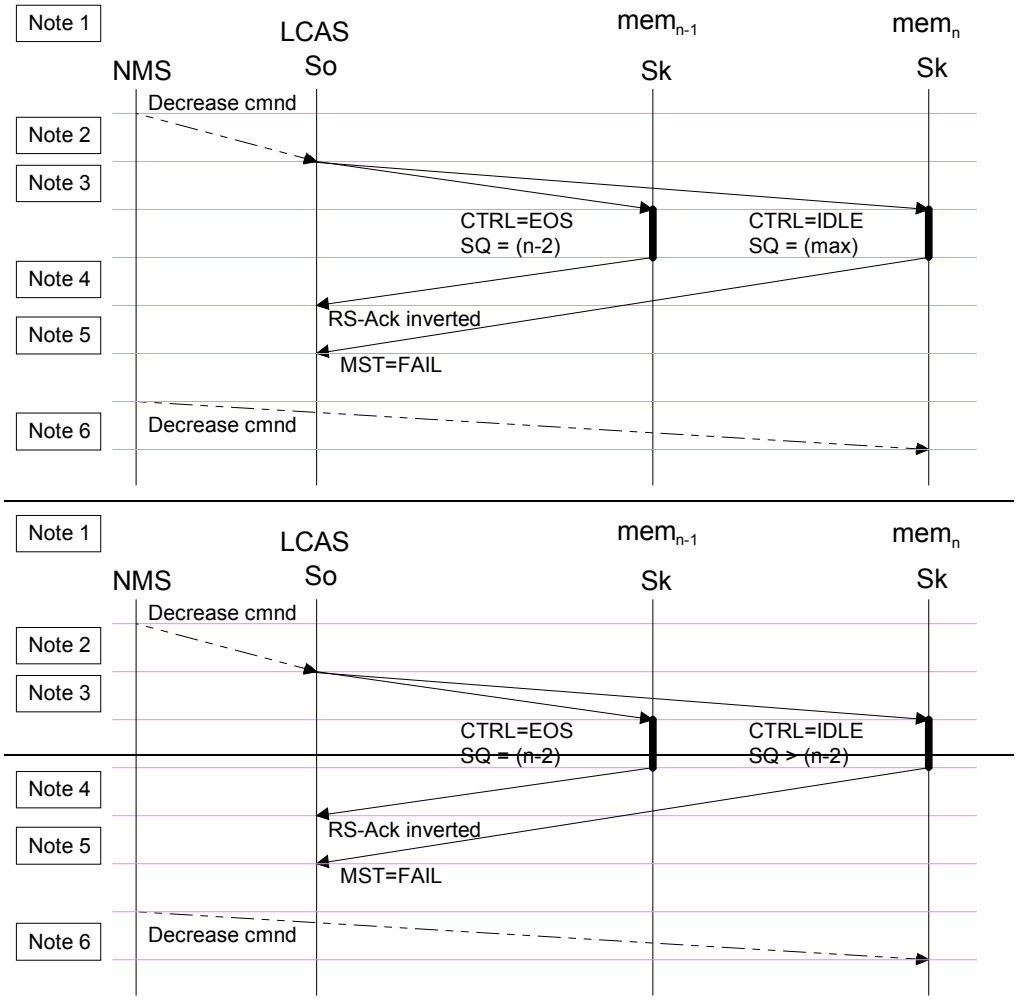


Figure I-3/G.7042: Planned decrease single (last) member

Note		Member n-1			Member n			RS-Ack
		CTRL	SQ	MST	CTRL	SQ	MST	
1	Initial Condition	NORM	n-2	OK	EOS	n-1	OK	0

2	NMS issues Decrease command to So LCASC	NORM	n-2	OK	EOS	n-1	OK	0
3	So (un-wanted) sends CTRL = IDLE, SQ ~~> (n-2)~~= (max), So (n-2) sends CTRL = EOS	EOS	n-2	OK	IDLE	~~> (n-2)~~(max)	OK	0
4	RS-Ack bit inverted, due to a change in the sequence	EOS	n-2	OK	IDLE	~~> (n-2)~~(max)	FAIL	1
5	At the same time Sk (un-wanted) sends MST=FAIL	EOS	n-2	OK	IDLE	~~> (n-2)~~(max)	FAIL	1
6	NMS issues Decrease command to Sk LCASC	EOS	n-2	OK	IDLE	~~> (n-2)~~(max)	FAIL	1

~~*Note 4*: The assignment of SQ > (n-2) indicates that the SQ number to be assigned is the highest possible. Due to the fact that this highest value is technology dependent, it is not possible to indicate a precise value.~~

I.4.3.1 Decrease (DNU) Due to fault Single Last member.

Text referring to Note 4 of the table above:

- As soon as an MSU_L ~~the fault~~ is detected the Sk will immediately begin re-assembly of the concatenated group using only the NORM and EOS members. For a time (propagation time from Sk to So + re-action time of the So + propagation time from So to Sk) the re-assembled data will be erroneous because it is sent on all members as per pre-fault.
- If a TSD is detected the Sk continues to use the payload of this member. The bit errors in the payload area of the member have to be handled by the server to client adaptation function at the sink side of the VCG. For a time (propagation time from Sk to So + re-action time of the So + propagation time from So to Sk) the re-assembled data will be erroneous because it is sent on all members as per pre-fault.

Text referring to Note 5 of the table above:

However the So will stop sending data on the erroneous members (since they will have been reported back as MST = FAIL and consequently set the failed member to DNU), and send data only on the remaining NORM and EOS members.

- In case of MSU_L: ~~From~~ from the time the CTRL = DNU would have arrived at the Sk until the CTRL = NORM is received again the bandwidth of the VCG is reduced.
- In case of TSD: from the time the CTRL = DNU arrives at the Sk the bandwidth of the VCG is reduced

Note1: – If the failed channel is subsequently deleted through a planned decrease prior to the fault clearing, the Sk will not be able to see the change in the failed member's control packet. As a result, RS-Ack will be not be inverted by this planned decrease and the So has to rely on the RS-Ack timeout to continue processing MST. The bandwidth of the VCG is not affected.

I.4.3.2 Decrease: (DNU) Due to fault NOT last member.

Text referring to Note 4 of the table above:

- As soon as an MSU_L ~~the fault~~ is detected the Sk will immediately begin re-assembly of the concatenated group using only the NORM and EOS members. For a time (propagation time from Sk to So + re-action time of the So + propagation time from So to Sk) the re-assembled data will be erroneous because it is sent on all members as per pre-fault.
- If a TSD is detected the Sk continues to use the payload of this member. The bit errors in the payload area of the member have to be handled by the server to client adaptation function at sink side of the VCG. For a time (propagation time from Sk to So + re-action time of the So + propagation time from So to Sk) the re-assembled data will be erroneous because it is sent on all members as per pre-fault.

Text referring to Note 5 of the table above:

However the source will stop sending data on the erroneous members (since they will have been reported back as MST = FAIL and consequently set the failed member to DNU), and send data only on the remaining NORM and EOS members.

- In case of MSU_L: ~~From~~ from the time the CTRL = DNU would have arrived at the Sk until the CTRL=NORM is received again the bandwidth of the VCG is reduced.
- In case of TSD: from the time the CTRL = DNU arrives at the Sk the bandwidth of the VCG is reduced.