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ITU-T G.7042/Y.1305

TELECOMMUNICATION
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OF ITU

Corrigendum 1
(06/2002)

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Digital terminal equipments – General

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Link capacity adjustment scheme (LCAS) for virtual concatenated signals

Corrigendum 1

ITU-T Recommendation G.7042/Y.1305 (2001) – Corrigendum 1

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ITU-T Recommendation G.7042/Y.1305

Link capacity adjustment scheme (LCAS) for virtual concatenated signals

Corrigendum 1

Summary

The corrections shown in this corrigendum are for clarifying the LCAS procedures to avoid ambiguities and are based on feedback received from users of this standard.

All figures and tables in the Appendix I have been updated.

Source

Corrigendum 1 to ITU-T Recommendation G.7042/Y.1305 was prepared by ITU-T Study Group 15 (2001-2004) and approved under the WTSA Resolution 1 procedure on 13 June 2002.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

ITU-T Recommendation G.7042/Y.1305

Link capacity adjustment scheme (LCAS) for virtual concatenated signals

Corrigendum 1

1) Figure 1 in 6.2

Add above Figure 1 in 6.2, Control packet, the following:

NOTE – To allow consistent timing relationships, it is assumed that the LCAS control packets are processed at the Sk after differential delay compensation.

2) Clause 6.2.2

Replace the second paragraph in 6.2.2 as follows:

~~At initiation of a VCG source all member SQ shall be set to the highest possible value.~~

NOTE **–** The SQ is not valid for members sending IDLE in the control field.

The SQ of a member removed from the VCG shall be assigned a sequence number larger than the currently highest sequence number that has EOS in the control field.

3) Clause 6.2.3

Change the paragraph below Table 1 in 6.2.3 as follows:

At initiation of a VCG source all members shall send CTRL = IDLE until they are added to the VCG (and send CTRL = ADD).

4) Clause 6.2.4

Change the Note of 6.2.4 as follows:

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

5) Clause 6.2.5

Add subclauses to 6.2.5:

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^n and then division (modulo 2) by the application specific generator polynomial. The remainder is a polynomial of at most degree (n – 1).

When representing the contents of the block as a polynomial, the first bit in the block, bit 1, should be taken as being the most significant bit. Consequently, C_1 is defined to be the most significant bit of the remainder and C_n the least significant bit of the remainder.

6.2.5.2 CRC Encoding procedure

The control packet is considered to be static. This means that the CRC-n checksum can be calculated *a priori* over the control packet.

The encoding procedure is as follows:

i) The CRC-n bits in the control packet are replaced by binary 0s.

ii) The control packet is then acted upon by the multiplication/division process referred to in 6.2.5.1.

iii) The remainder resulting from the multiplication/division process is inserted into the CRC-n location in the control packet.

The CRC-n bits generated do not affect the result of the multiplication/division process because, as indicated in i) above, the CRC-n bit positions are initially set to 0 during the multiplication/division process.

6.2.5.3 CRC Decoding procedure

The decoding procedure is as follows:

i) A received control packet is acted upon by the division process referred to in 6.2.5.1.

ii) If the remainder calculated in the decoder is zero, it is assumed that the checked control packet is error free.

6) Clause 6.2.6

Change 6.2.6 as follows:

6.2.6 Member status field (MST)

Information from Sk to So about the status of all members of the same VCG.

It reports the member status from Sk to So with two states: OK or FAIL (1 status bit per member). OK = 0, FAIL = 1. Since each control packet contains only a limited number of bits for communicating the MST field, this information is spread across multiple control packets.

The quantity of members in the VCG ~~can~~ may be any number in the allocated range (e.g. 0-255 for High Order in SDH), and can be changed. Each member is identified by the number in the sequence identification field of the LCAS overhead. For each member, the SK uses the SQ number ~~assigned to it by~~ it receives from the SO as the MST number for its response to the SO. In this manner the MST values received by the SO will always correspond directly to the SQ values that it assigned.

NOTE – In the non-LCAS mode, the receiver function is provisioned to expect a fixed number of members.

To allow the receiver to determine the number of members in the VCG, the highest numbered member is indicated by the use of a last (EOS) value in the control word. All other members have a normal (NORM) or do-not-use (DNU) value in the control word, see Table 1.

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). ~~a~~All unused MST and members that have a control field of IDLE shall be set to FAIL.

7) Clause 6.2.7

Change 6.2.7 as follows:

6.2.7 Re-Sequence Acknowledge bit (RS-Ack)

Any changes detected at the Sk regarding the member sequence numbers is reported to the So per VCG by toggling (i.e. change from '0' to '1' or from '1' to '0') the RS-Ack bit, i.e. the RS-Ack bit can only be toggled after the status of all members of the VCG has been evaluated and the sequence change has taken place. The toggling of the RS-Ack bit will validate the MST in the preceding multiframe. The So can use this toggling as an indication that the change initiated by the So has been accepted and completed, and will start accepting new MST information.

8) Clause 6.3

Change the first paragraph of 6.3 as follows:

6.3 Addition of Member(s)

When a member is added it shall always be assigned a sequence number ~~greater~~ one larger than the currently highest sequence number that has EOS 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 requesting member.

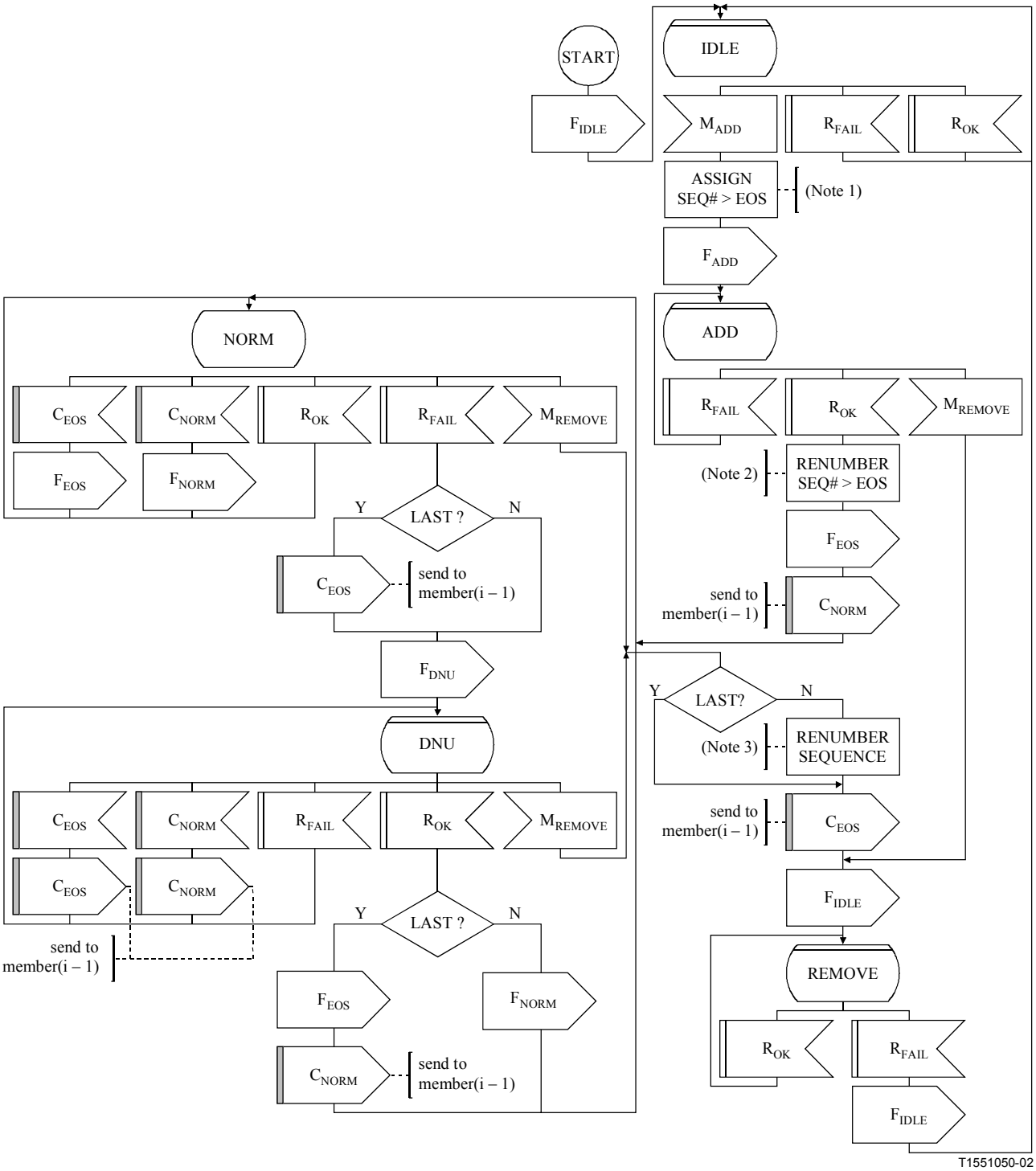
9) Annex A

a) Change the last bullet in A.1 as follows:

- R_{RS_ACK} is a bit used to acknowledge the detection at the sink side of a renumbering of the sequence or a change in the number of members of the VCG. This acknowledgement is used to synchronise source and sink and to eliminate the influence of network delays. Due to the renumbering of the sequence at the time of an add or remove request the received member status cannot be used for a time period that is determined by transmission delays and framing delays.

b) Replace Figure A.1, Source side state diagram, and change Note 3 as follows:

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



NOTE 1 – The SQ of the member to be added shall be set to a value greater than the SQ value of the member sending F_{EOS}.

NOTE 2 – The SQ of the added member shall be set to n + 1 if the SQ of the member sending F_{EOS} equals n.

NOTE 3 – The SQ of the removed member x ($0 \leq x < n$) shall be set to a value > n if the SQ of the member sending F_{EOS} equals n and the SQ of members with numbers x + 1, ... n will be renumbered to x, ... n – 1.

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

10) Appendix I

Replace Appendix I completely by the following:

Appendix I

LCAS Time Sequence Diagrams (TSD)

I.1 Nomenclature

Cmnd	Command
Cnfm	Confirm
Dec	Decrease
LCASC	Link Capacity Adjustment Scheme Controller
NMS	Network Management System
Sk	Sink, receiving end
So	Source, transmitting end

I.2 Numbering system

Members in a virtually concatenated group shall be numbered 0 to (n – 1), where n = total number of members in the group.

I.3 Provisioning

When a new container is provisioned to be a member of the group, it must be allocated the following:

a) CTRL = IDLE (this code indicates that it is not yet in service).

b) 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).

c) GID = The group ID for that virtually concatenated group.

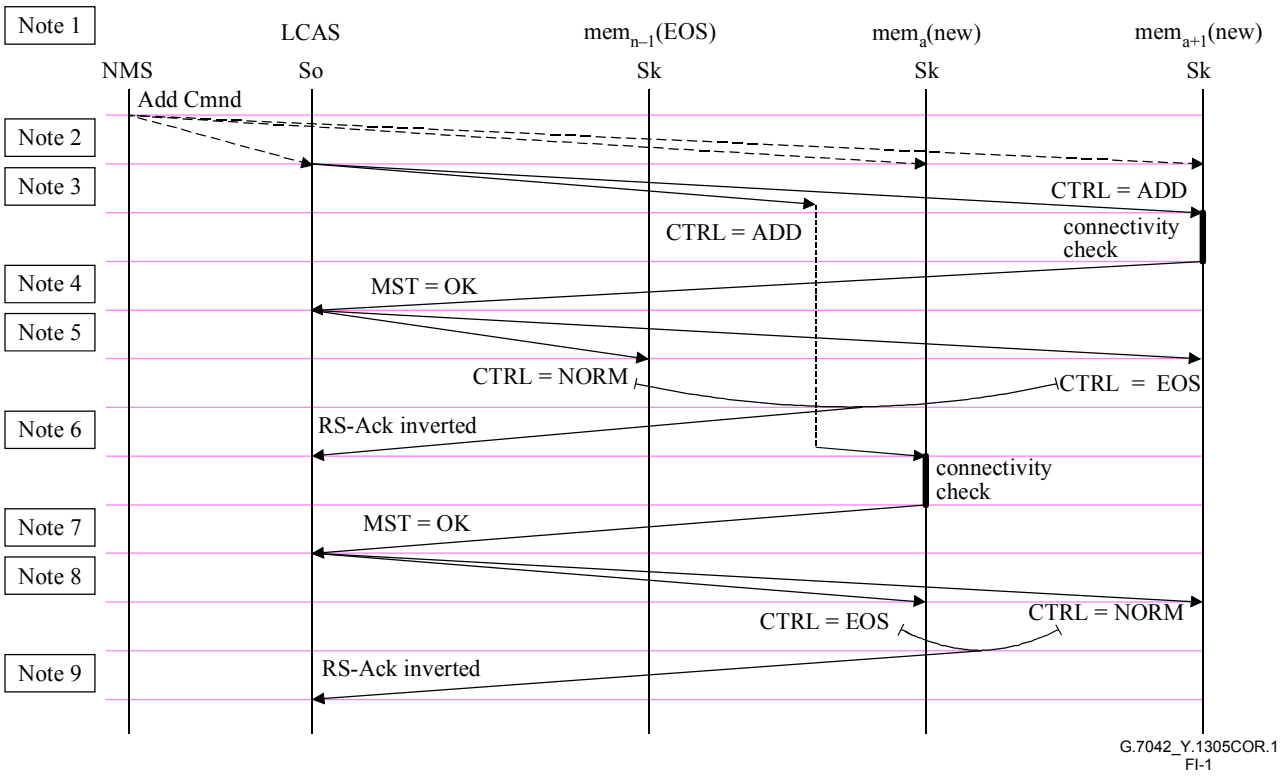
d) MST = 1 (FAIL = 1; OK = 0).

I.4 Commands

I.4.1 Increase bandwidth of VCG (ADD command)

I.4.1.1 Add: (ADD) multiple after last member

Example: Add two members after last one in the group of n.



Note		Member n			Member a (new)			Member a + 1 (new)		
		CTRL	SQ	MST	CTRL	SQ	MST	CTRL	SQ	MST
1	Initial Condition	EOS	n – 1	OK	IDLE	FF	FAIL	IDLE	FF	FAIL
2	NMS issues Add Cmnd to So and Sk LCASC	EOS	n – 1	OK	IDLE	FF	FAIL	IDLE	FF	FAIL
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
4	Sk (a + 1) sends MS = OK to So	EOS	n – 1	OK	ADD	n	FAIL	ADD	n + 1	OK
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
6	RS-Ack bit inverted due to change in sequence	NORM	n – 1	OK	ADD	n + 1	FAIL	EOS	n	OK
7	Sk (a) sends MST = OK to So	NORM	n – 1	OK	ADD	n + 1	OK	EOS	n	OK
8	So (a) sends CTRL = EOS; So (a + 1) sends CTRL = NORM	NORM	n – 1	OK	EOS	n + 1	OK	NORM	n	OK
9	RS-Ack bit inverted due to change in sequence	NORM	n – 1	OK	EOS	n + 1	OK	NORM	n	OK

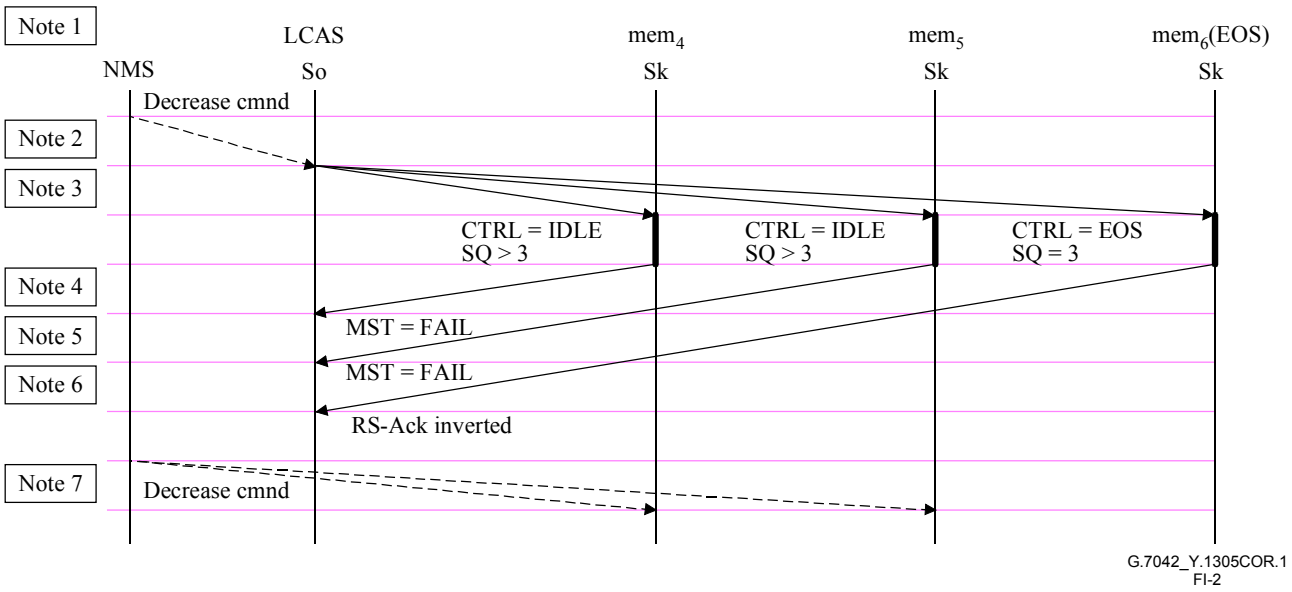
Figure I.1/G.7042/Y.1305 – ADD multiple members

NOTE – The example shows new member (a + 1) responding with MST = OK before new member (a). This is arbitrary and the first member to respond with MST = OK shall be allocated the SQ = n, then the next new member to respond with MST = OK shall be allocated SQ = n + 1, etc. If for any reason a member being added does not respond with MST = OK within the time-out period, then the So LCASC shall report a fail for that member.

I.4.2 Decrease bandwidth of VCG (REMOVE command)

I.4.2.1 Decrease: (REMOVE) planned multiple NOT including last member

Example: Remove members 4 and 5 from a VGC with n = 6 members.



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

Figure I.2/G.7042/Y.1305 – Planned removal of members 4 and 5 out of 6

The So LCASC sets CTRL = IDLE on all members to be removed.

NOTE 1 – CTRL does not change on the other members of the group.

The example above shows two members being removed with a simultaneous IDLE command from the So LCASC. Reassembly at the Sk ceases to use the 'removed' members immediately upon receipt of the IDLE command.

The response however from the Sk may not be simultaneous. This does not affect the Sk since the IDLE commands will have the same MFI value. The response from the Sk to the So is of course simply acknowledgement that the member is no longer in use at the Sk end and the NMS may proceed with de-provisioning of that member if desired.

NOTE 2 – The removed members could be de-provisioned as indicated in Note 7 of Figure I.2.

General rule for SQ adjustment in REMOVE function:

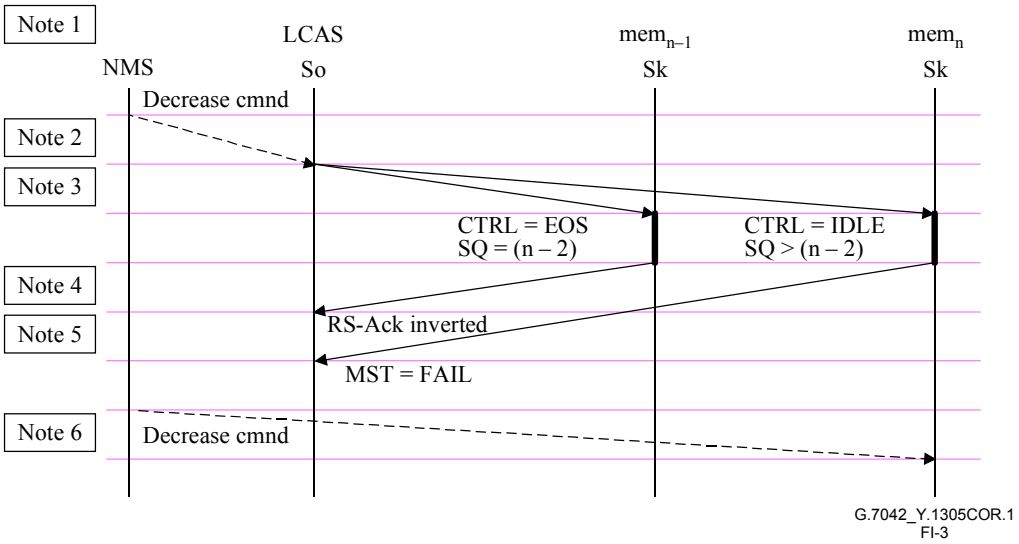
1) All unwanted member are re-allocated an SQ greater than the SQ of the member sending the EOS control word, i.e. the highest possible value (SQ = FF).

2) All remaining required members re-allocated consecutive SQs (starting from SQ = 0).

This is best described by the following example:

	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	> 3	2	3	> 3

I.4.2.2 Decrease: (REMOVE) planned single last member



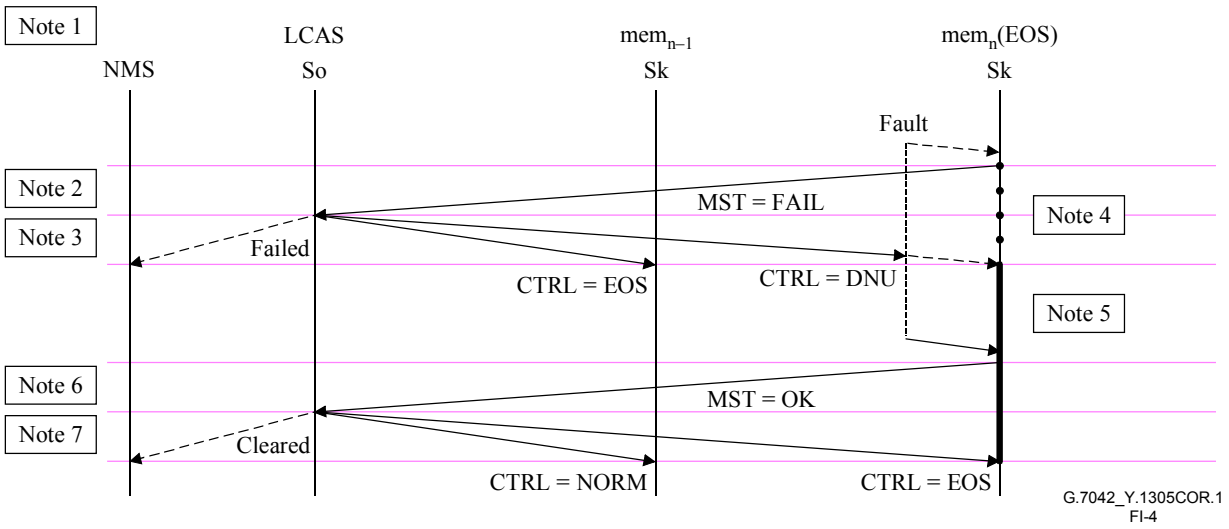
Note		Member n – 1			Member n		
		CTRL	SQ	MST	CTRL	SQ	MST
1	Initial Condition	NORM	n – 2	OK	EOS	n – 1	OK
2	NMS issues Decrease Cmnd to So LCASC	NORM	n – 2	OK	EOS	n – 1	OK
3	So (unwanted) sends CTRL = IDLE, SQ > (n – 2), So (n – 2) sends CTRL = EOS	EOS	n – 2	OK	IDLE	> (n – 2)	OK
4	RS-Ack bit inverted, due to a change in the sequence	EOS	n – 2	OK	IDLE	> (n – 2)	OK
5	Sk (unwanted) sends MST = FAIL	EOS	n – 2	OK	IDLE	> (n – 2)	FAIL
6	NMS issues Decrease Cmnd to Sk LCASC	EOS	n – 2	OK	IDLE	> (n – 2)	FAIL

Figure I.3/G.7042-Y.1305 – Planned decrease single (last) member

NOTE – The removed member could be de-provisioned as indicated in Note 6 of Figure I.3.

I.4.3 Decrease bandwidth of VCG due to fault (DNU command)

I.4.3.1 Decrease (DNU) due to fault single last member



Note		Member n – 1			Member n (EOS)		
		CTRL	SQ	MST	CTRL	SQ	MST
1	Initial Condition	NORM	n – 2	OK	EOS	n – 1	OK
2	Sk (fault_mem) sends MST = FAIL to So	NORM	n – 2	OK	EOS	n – 1	OK
3	So (fault_mem) sends DNU; So (fault_mem – 1) sends EOS	EOS	n – 2	OK	DNU	n – 1	OK
4	See text below table	EOS	n – 2	OK	DNU	n – 1	OK
5	See text below table	EOS	n – 2	OK	DNU	n – 1	FAIL
6	Network Fault cleared MST = OK sent to So	EOS	n – 2	OK	DNU	n – 1	FAIL
7	CTRL changed from DNU to NORM	NORM	n – 2	OK	EOS	n – 1	FAIL

Figure I.4/G.7042/Y.1305 – Decrease due to network fault, single (last) member

The So LCASC sets CTRL = DNU on faulty member, and sets CTRL = EOS on preceding member.

Text referring to Note 3 of Figure I.4:

Even though a change has been made to the bandwidth and to which member contains the EOS, this change is a temporary change and does not trigger an RS-ACK.

Text referring to Note 4 of Figure I.4:

As soon as 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.

Text referring to Note 5 of Figure I.4:

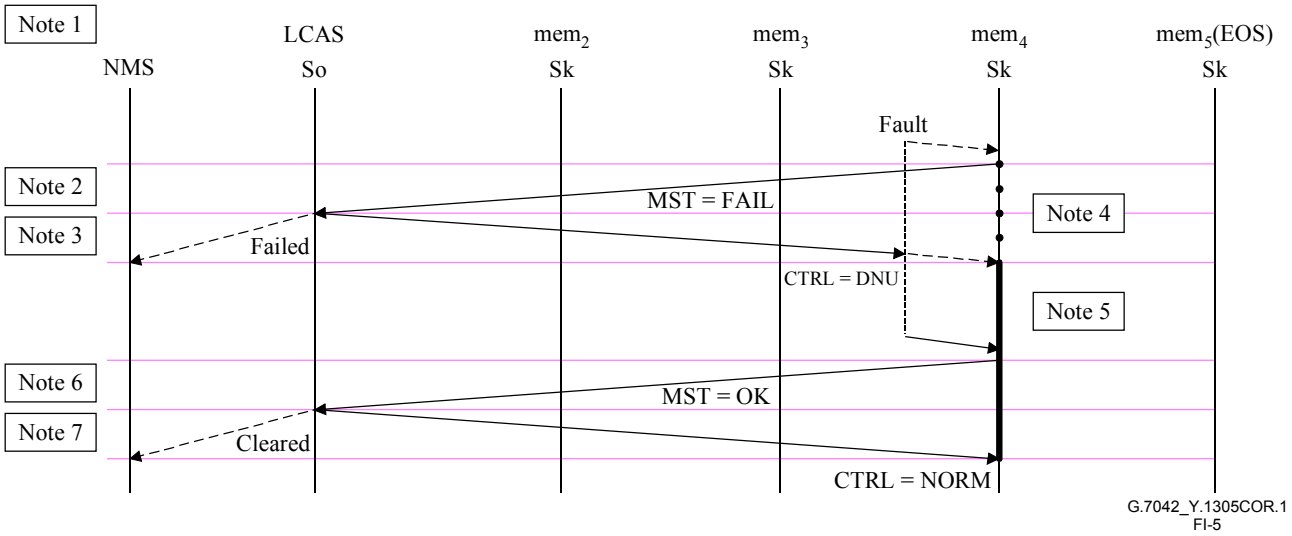
However, the So will stop sending data on the erroneous members (since they will have been reported back as MST = FAIL and consequently set the failed member to DNU), and send data only on the remaining NORM and EOS members. From the time the CTRL = DNU would have arrived at the Sk until the CTRL = NORM is received again, the bandwidth of the VCG is reduced. The Sk LCASC does not know when the data integrity has been re-established. This is dealt with at the data layer.

Text referring to Note 7 of Figure I.4:

When the failed member is repaired the CTRL is changed to NORM from DNU. The Sk will then use this member's payload again to re-assemble the data.

NOTE – If the failed channel is subsequently deleted through a planned decrease prior to the fault clearing, the Sk will not be able see the change in the failed member's control packet. As a result, RS-Ack will be not be inverted by this planned decrease. The bandwidth of the VCG is not affected.

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



Note		Member 2			Member 3			Member 4			Member 5 (EOS)		
		CTRL	SQ	MST	CTRL	SQ	MST	CTRL	SQ	MST	CTRL	SQ	MST
1	Initial Condition	NORM	1	OK	NORM	2	OK	NORM	3	OK	EOS	4	OK
2	Sk (fault mem) send MST = FAIL to So	NORM	1	OK	NORM	2	OK	NORM	3	FAIL	EOS	4	OK
3	So (fault mem) send CTRL = DNU	NORM	1	OK	NORM	2	OK	DNU	3	FAIL	EOS	4	OK
4	See text below table	NORM	1	OK	NORM	2	OK	DNU	3	FAIL	EOS	4	OK
5	See text below table	NORM	1	OK	NORM	2	OK	DNU	3	FAIL	EOS	4	OK
6	Network Fault cleared MST = OK sent to So	NORM	1	OK	NORM	2	OK	DNU	3	OK	EOS	4	OK
7	CTRL changed from DNU to NORM	NORM	1	OK	NORM	2	OK	NORM	3	OK	EOS	4	OK

Figure I.5/G.7042/Y.1305 – Decrease due to network fault, single (not last) member

Text referring to Note 4 of Figure I.5:

As soon as 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.

Text referring to Note 5 of Figure I.5:

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. 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. The Sk LCASC does not know when the data integrity has been re-established. This is dealt with at the data layer.

Text referring to Note 7 of Figure I.5:

When the failed member is repaired the CTRL is changed to NORM from DNU. The Sk will then use this member's payload again to re-assemble the data.

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