TOLL—CCIS DATA LINK CONFIGURATION AND RECOVERY 2-WIRE NO. 1 ELECTRONIC SWITCHING SYSTEM

CONTENTS PAGE

1. GENERAL 2

2. OVERALL DESCRIPTION 3

A. Link Security 3

B. Signaling Link Maintenance Facilities 4

3. DATA TERMINAL (DTRM) AND VOICE FREQUENCY LINK (VFL) STATE DESCRIPTION 6

DATA TERMINAL (DTRM) STATES . . 6

A. Automatic States 11

B. Manual States 12

VOICE FREQUENCY LINK (VFL) STATES . 12

A. Automatic States 14

B. Manual States 15

4. DATA LINK FAILURE REPORTING AND ANALYSIS 15

LS01 OUTPUT MESSAGE 15

LS02 OUTPUT MESSAGE 15

LS03 OUTPUT MESSAGE 16

LS04 OUTPUT MESSAGE 16

5. DTRM STATE CONTROL 16

AUTOMATIC DTRM STATE TRANSITIONS . 16

Normal Link Recovery 16

Emergency Link Recovery 16

MANUAL DTRM STATE TRANSITIONS . 19

A. Removing a DTRM From Service . 19

B. Restoring a DTRM to Service . . . 19

C. Taking a DTRM Out of Service . . 19

D. Making a DTRM Unavailable for Service 20

E. Reinitializing a DTRM 20

MANUAL DTRM DIAGNOSTICS, STATUS CHECKS AND AUDITS 20

A. Diagnosing a DTRM (Normal Printout) 20

B. Diagnosing a DTRM (Raw Data Printout) 20

C. Requesting DTRM Status 20

D. Requesting an Audit of a DTRM . 20

6. VFL STATE CONTROL 21

MANUAL VFL STATE TRANSITIONS . . 21

A. Removing a VFL From Service . . 21

B. Marking a VFL Unavailable for Service 21

C. Operating a VFL Access Circuit . . 21

CONTENTS PAGE

D. Releasing a VFL Access Circuit . . 21

E. Placing a VFL in the Manual Out-of-Service State 22

F. Restoring a VFL to Service . . . 22

MANUAL VFL STATUS CHECKS, TESTS, AND AUDITS 22

A. Requesting VFL Status 22

B. Initiating the Automatic Standby VFL Test 22

7. CCIS TERMINAL PAIR TURNUP PROCEDURES 22

PLACING DATA LINK INTO SERVICE . 23

8. CCIS TERMINAL PAIR TURNDOWN PROCEDURE 24

Figures

1. Redundant CCIS Network Structure . . 4

2. CCIS Data Links (A Links) 5

3. DTRM States 6

4. Automatic DTRM State Transitions, Normal Link Recovery 8

5. Automatic DTRM State Transitions, Double Link Failure (Emergency Restart) . . . 9

6. Manual DTRM State Transitions . . . 10

7. Manually Requested DTRM Diagnostics . 11

8. Automatic VFL State Transitions . . . 14

9. Manual VFL State Transitions 14

Tables

A. Data Terminal (DTRM) States . . 7

B. Voice Frequency Link (VFL) States . 13

CONTENTS PAGE

C. DTRM State Transitions Allowable Form One State to Another 17

1. GENERAL

1.01 This section provides a discription of the various maintenance states which may be established within the toll common channel interoffice signaling (CCIS) data link system. This section also describes how the various state configurations are established. The CCIS feature is available in No. 1 Electronic Switching System (ESS) with 1E5 and later generic programs. An understanding of these states is essential when it becomes necessary to manually manipulate the data link states in order to establish a working configuration or to run tests on a failing system. If automatic data link recovery routines fail to recover a working configuration, then manual procedures become necessary.

1.02 Whenever this section is reissued, the reason for reissue will be given in this paragraph.

1.03 Covered in this section are brief descriptions of each state which can be established in the data terminal (DTRM) and the voice frequency link (VFL). In addition, failure reporting and analysis is covered by including an explanation of the teletypewriter (TTY) output messages generated by the system when the CCIS data link state changes. Also, explanations of the various TTY input messages used to control data link state changes are included. Detailed state diagrams are included which illustrate the restrictions and sequences which must be observed when initiating state changes.

1.04 Abbreviations used in this section are:

ACU	Acknowledgment Signal Unit
ATP	All Tests Pass
CC	Central Control
CCIS	Common Channel Interoffice Signaling
DDD	Direct Distance Dialing

DTRM	Data Terminal
MTTP	Manual Trunk Test Position
OOS	Out-Of-Service
SO	Switching Office
STF	Some Tests Failing
STP	Signal Transfer Point
STTP	Supplementary Trunk Test Position
TLM	Trouble Locating Manual
TLN	Trunk Link Network
TSV	Test-Standby-VFL
TTY	Teletypewriter
VFL	Voice Frequency Link
VLF	VFL Test Failed
VLP	VFL Test Passed

2 OVERALL DESCRIPTION

A. Link Security

2.01 Link security is a module within the toll CCIS program concerned with CCIS data link administration and recovery. A minimum of two CCIS data links (A links) are provided per switching office (SO). Each A link connects the SO with one of the two signal transfer points (STPs) within its direct distance dialing (DDD) region. (For example, A11 and A12 from SO1 in Fig. 1.) Through translation assignment, data link pairs are formed so a link pair provides access to the CCIS signaling network via both STPs. A pair of data links has signaling capacity for up to 2250 CCIS trunks. The components of a data link pair are shown in Fig. 2.

2.02 The primary functions of the link security module are to:

(1) Route outgoing messages from the SO to the CCIS signaling network based on signaling network status tables.

(2) Control maintenance activity on the CCIS data links with emphasis on maintaining a viable signaling path for each CCIS trunk.

2.03 Under central control (CC) program control, a data terminal can be operated in several maintenance states, a modem can be switched between voice frequency link VFLA and VFLB and a VFL access circuit can be used to provide maintenance access to a VFL. The A links of a pair are normally operated in a load sharing mode; that is, each link carries approximately 50 percent of the signaling load directed toward the link pair. The link pairs are engineered so a single link has enough capacity to carry all the assigned signaling load for the link pair should the other member link be removed from active service.

2.04 Five extended maintenance procedures are supported by link security:

(1) Office recovery

(2) Normal link recovery

(3) Emergency link recovery

(4) Manual link recovery

(5) Manual VFL transfer.

2.05 The office recovery procedure is automatically initiated in a SO Phase 6 or higher; the data terminals (DTRMs) are initialized and the data links are placed into service as quickly as possible.

2.06 The normal link recovery procedure is automatically initiated when a single link failure occurs, or when a link is released from an unavailable condition and the mate link is currently active. Before being returned to active service, the recovering link is monitored for 15 seconds to ensure acceptable transmission signaling error rates and to allow a CCIS signaling network status update to be completed.

2.07 The emergency link recovery procedure is automatically initiated when a double link failure occurs or when a link is released from an unavailable condition and the mate link is not currently active. Before being returned to active service, the recovering link is monitored for only three seconds and an abbreviated restoral sequence is followed.

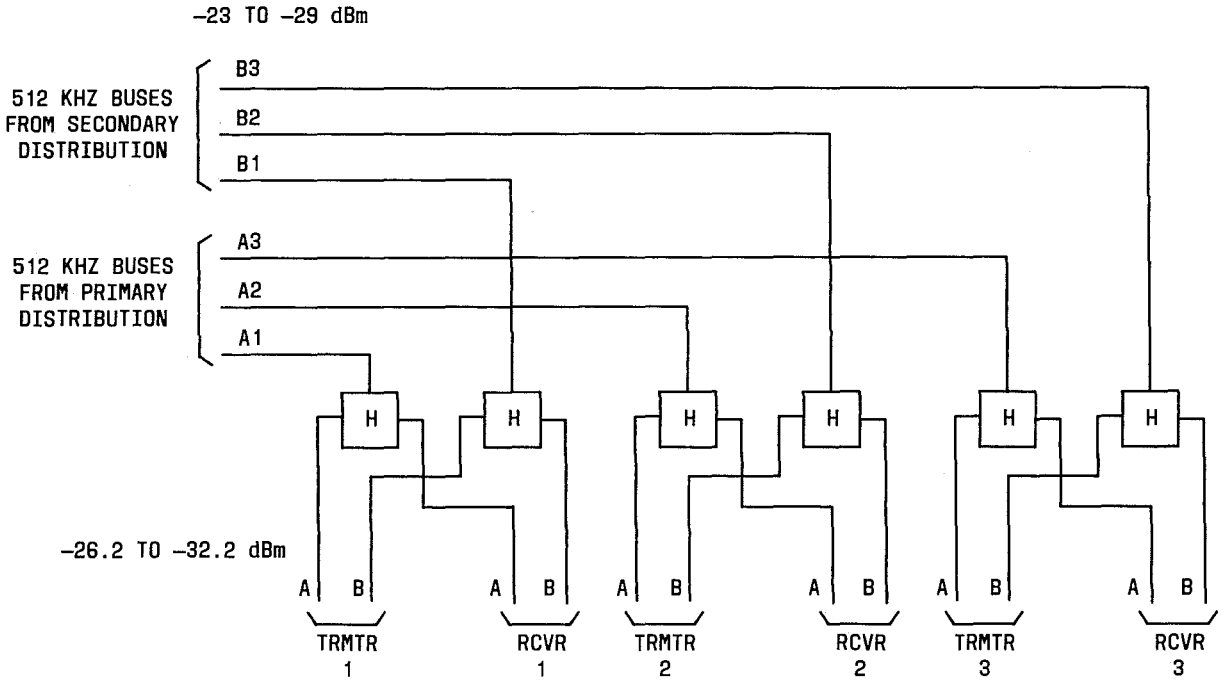

Fig. 1—Redundant CCIS Network Structure

2.08 The manual link recovery procedure, manually initiated from either the SO or STP, supports exercise of the data link without normal signaling traffic.

2.09 The manual VFL transfer procedure is manually initiated from either the SO or STP and supports changing the VFL in service between VFLA and VFLB when the link is active.

2.10 Input message DTRM-REQ- is used for manipulation of the DTRMs. Input message VFLK-REQ- is used for manipulation of the modems, VFLs, and VFL access circuits.

2.11 Output message LS01 informs maintenance personnel of automatically initiated link recovery procedures, the progress of manually initiated procedures, and DTRM status changes. Output message LS02 informs maintenance personnel of high transmission error rates on active links. Output message LS03 is used to print out the contents of the link security data link status tables when requested manually. Output message LS04 is used to print out the contents of link security status and input data when a data link is reinitialized.

B. Signaling Link Maintenance Facilities

2.12 The maintenance control and coordination of the CCIS signaling network and its parts generally follow the plan currently in use in the Bell System and is commonly referred to as the control office plan. Inherent in the plan is a hierarchy of maintenance control and assignment of responsibilities that ensure orderly administration of the network. For No. 1 ESS toll CCIS, as in all toll CCIS applications, the STP has some automatic signaling link testing capabilities; however, the maintenance control office for the signaling link is the No. 1 ESS switching office.

2.13 Automatic procedures are provided to assist in recovery from data link troubles. The

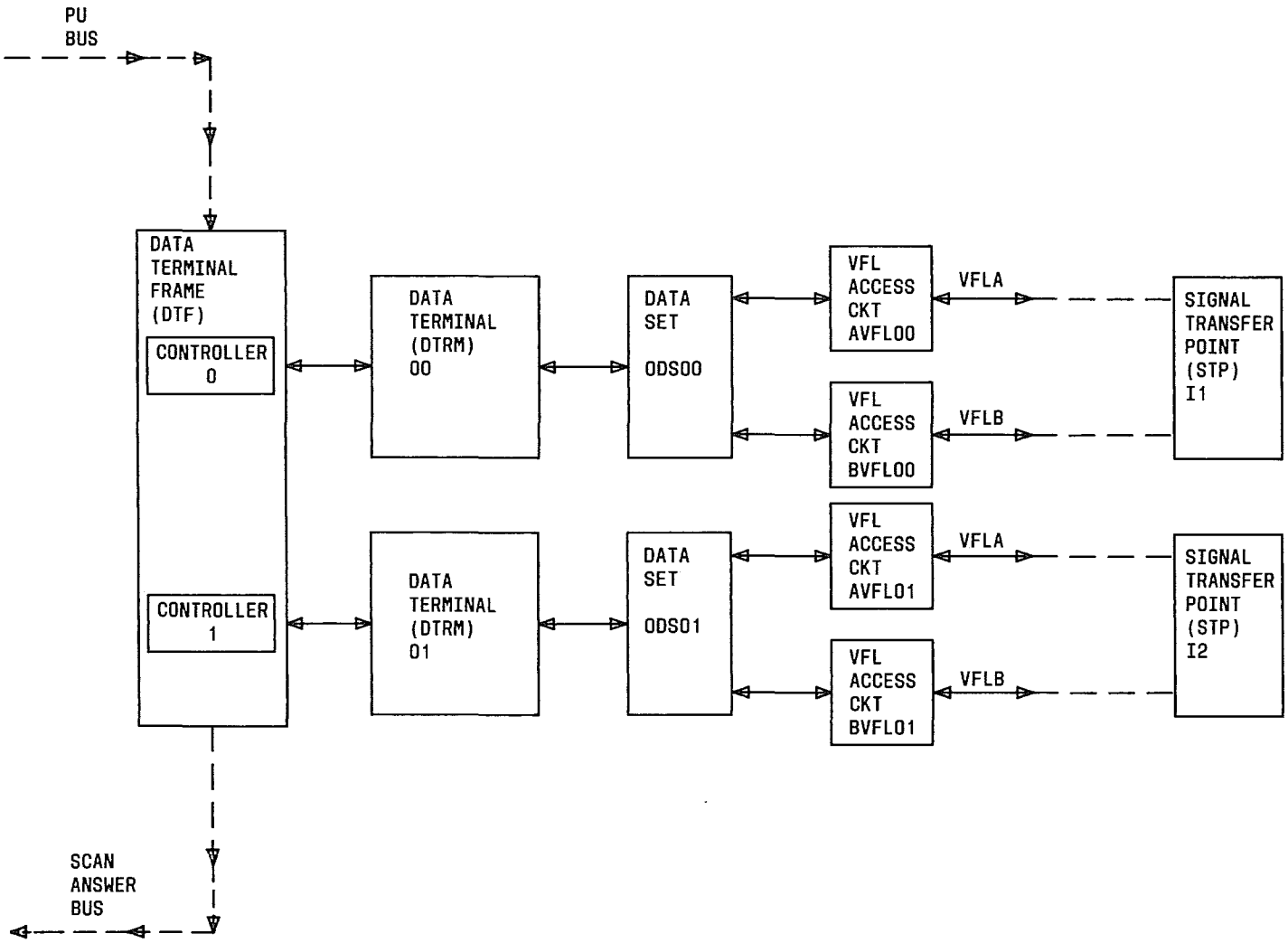

Fig. 2—CCIS Data Link (A Links)

objectives are to sectionalize a failure to the terminal-modem combination at either end or to the interconnecting VFL without manual intervention. This permits repair and return to normal service with a minimum of human interoffice communication.

2.14 A loop-around path is provided at the ESS to allow the STP to perform VFL testing. Also, the VFL access circuit provides switched access from the switching office test panels to the VFL via a shared maintenance bus. Network access circuits (SD-1A176-2-wire or SD-1A397—HILO) are required to interface with the VFL access circuits.

2.15 Periodic testing of the standby VFLs is accomplished on a routine basis from the STP. To initiate this test, the STP sends a test-standby-VFL (TSV) signal to the switching office. In response to this signal, the switching office applies a loop to the standby VFL and transmits a TSV signal to the STP. The STP then performs the test and sends the results to the switching office via a VFL-test-passed (VLP) signal or a VFL-test-failed (VFL) signal. This test can also be initiated from the switching office via TTY input. The link security routine first applies the loop and then sends a TSV signal to the STP. The STP then performs the test and returns the result.

3. DATA TERMINAL (DTRM) AND VOICE FREQUENCY LINK (VFL) STATE DESCRIPTIONS

3.01 The following paragraphs describe the various maintenance states which can be established within the DTRM and/or VFL either under system control (automatically) or via TTY messages (manually).

DATA TERMINAL (DTRM) STATES

3.02 The DTRM may exist in one of five automatically initiated states (including the ACTIVE state) or one of four manually initiated states, as shown in Fig. 3. A summary of these states is given in Table A. These states may be determined via the maintenance TTY by using the DTRM-REQ-STS input message (see paragraph 5.09) to obtain an LS01 STATUS output message which gives the current DTRM maintenance state. A detailed explanation of each of these states is as follows See Figs. 4 through 7 for state diagrams.

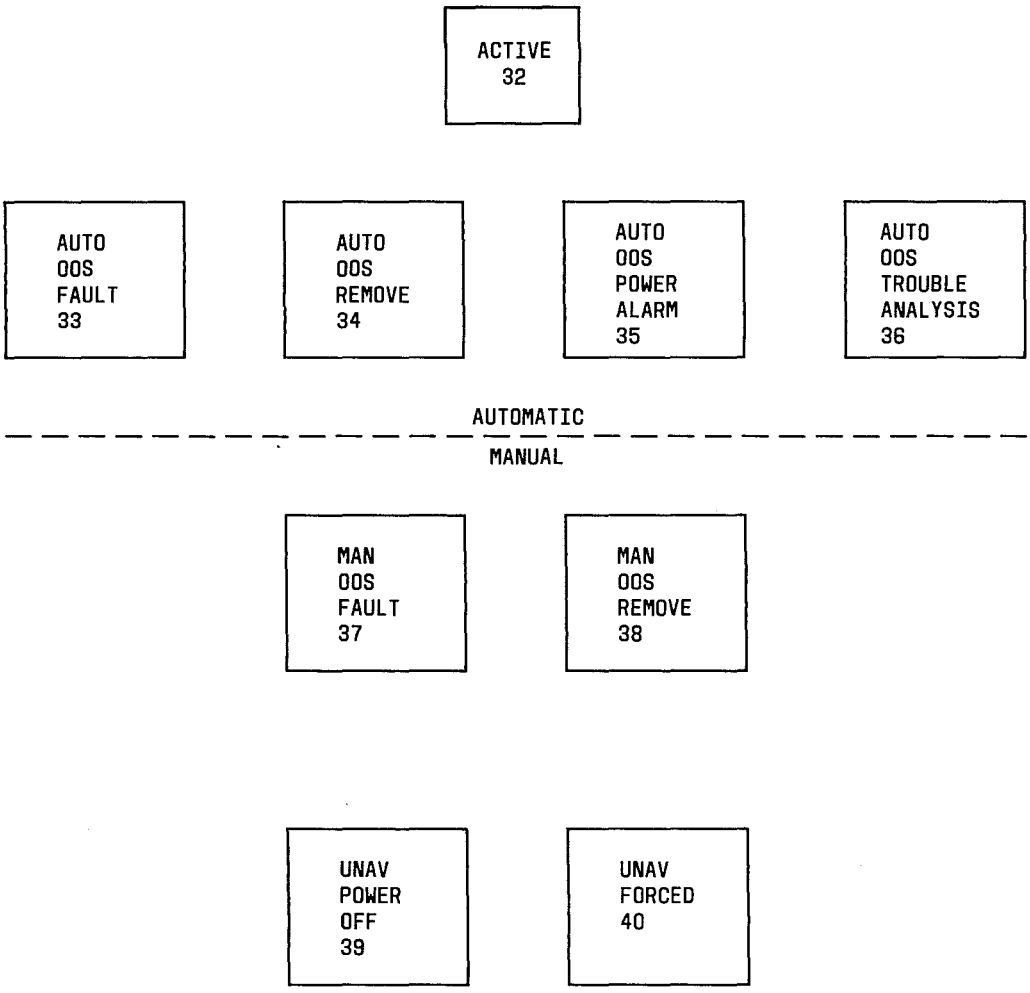

Fig. 3—DTRM States

TABLE A

DATA TERMINAL (DTRM) STATES

T/M STATE NUMBER	NAME	DESCRIPTION
32	ACTIVE	Carrying normal traffic
33	AUTO OOS FAULT	Failed diagnostic (automatic request)
34	AUTO OOS REMOVE	Performing automatic link recovery
35	AUTO OOS POWER ALARM	Fuse alarm
36	AUTO OOS TROUBLE ANALYSIS	Diagnostic request (automatic)
37	MANUAL OOS FAULT	Not operating; but available if mate DTRM fails
38	MANUAL OOS REMOVE	Operating for maintenance only, but available if mate DTRM fails
39	UNAVAILABLE POWER OFF	Power off
40	UNAVAILABLE FORCED	Not operating; *not* available if mate DTRM fails

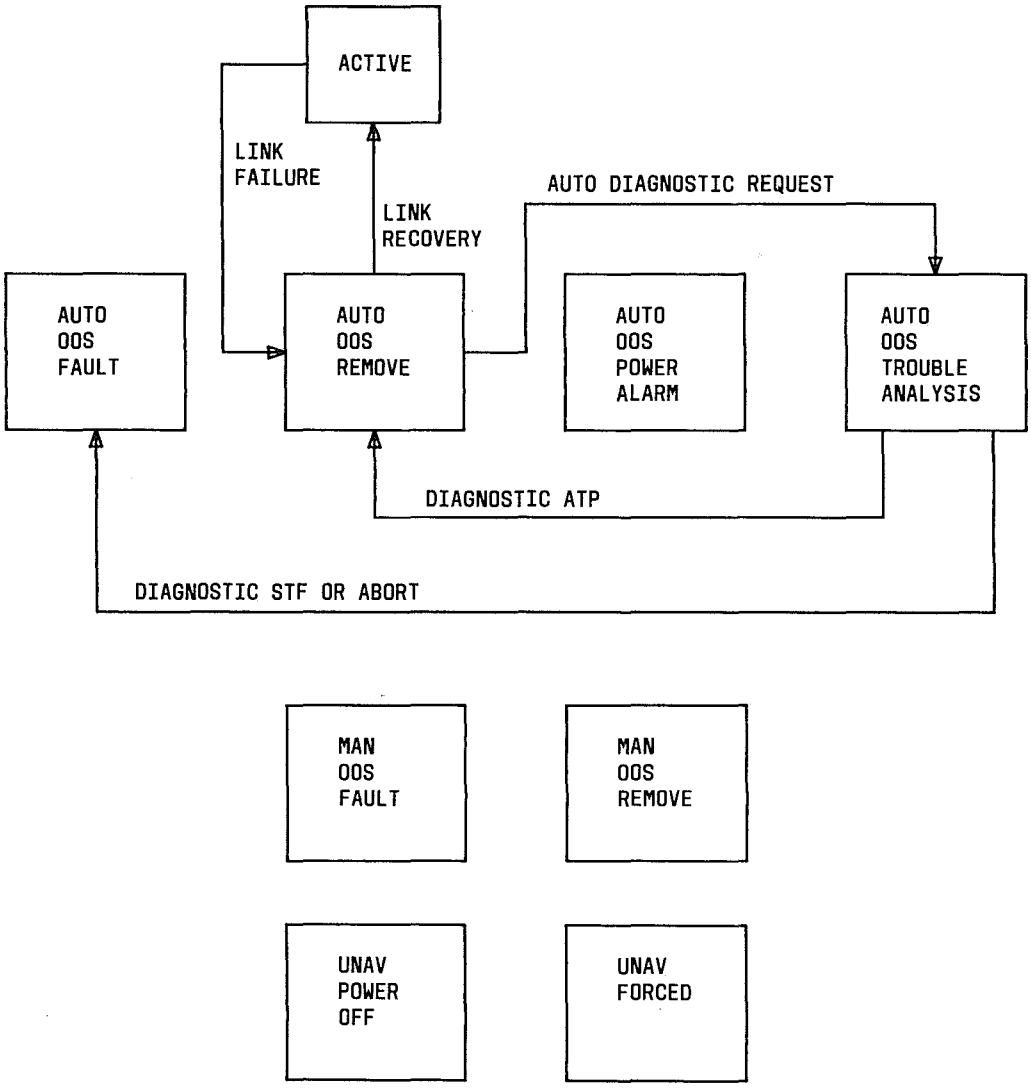

Fig. 4—Automatic DTRM State Transitions, Normal Link Recovery

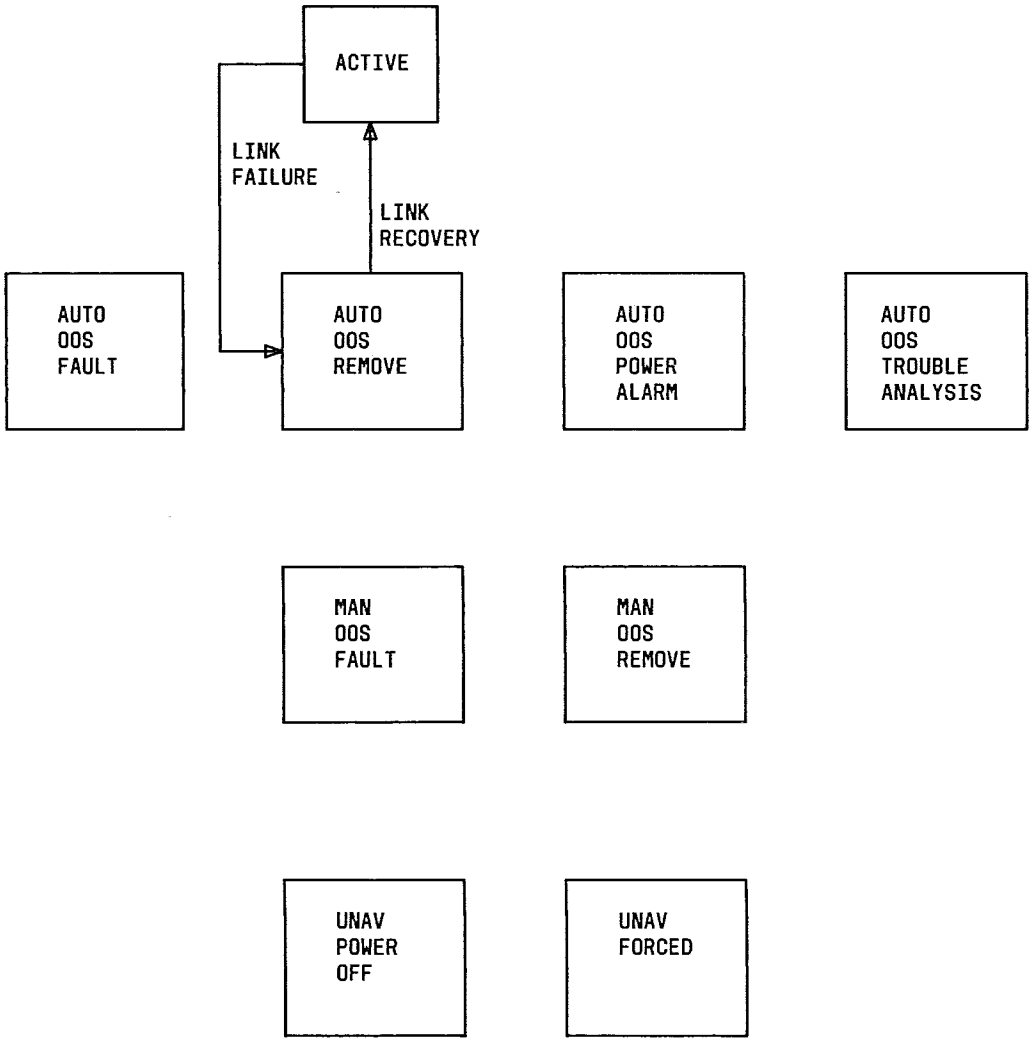

Fig. 5—Automatic DTRM State Transitions, Double Link Failure (Emergency Restart)

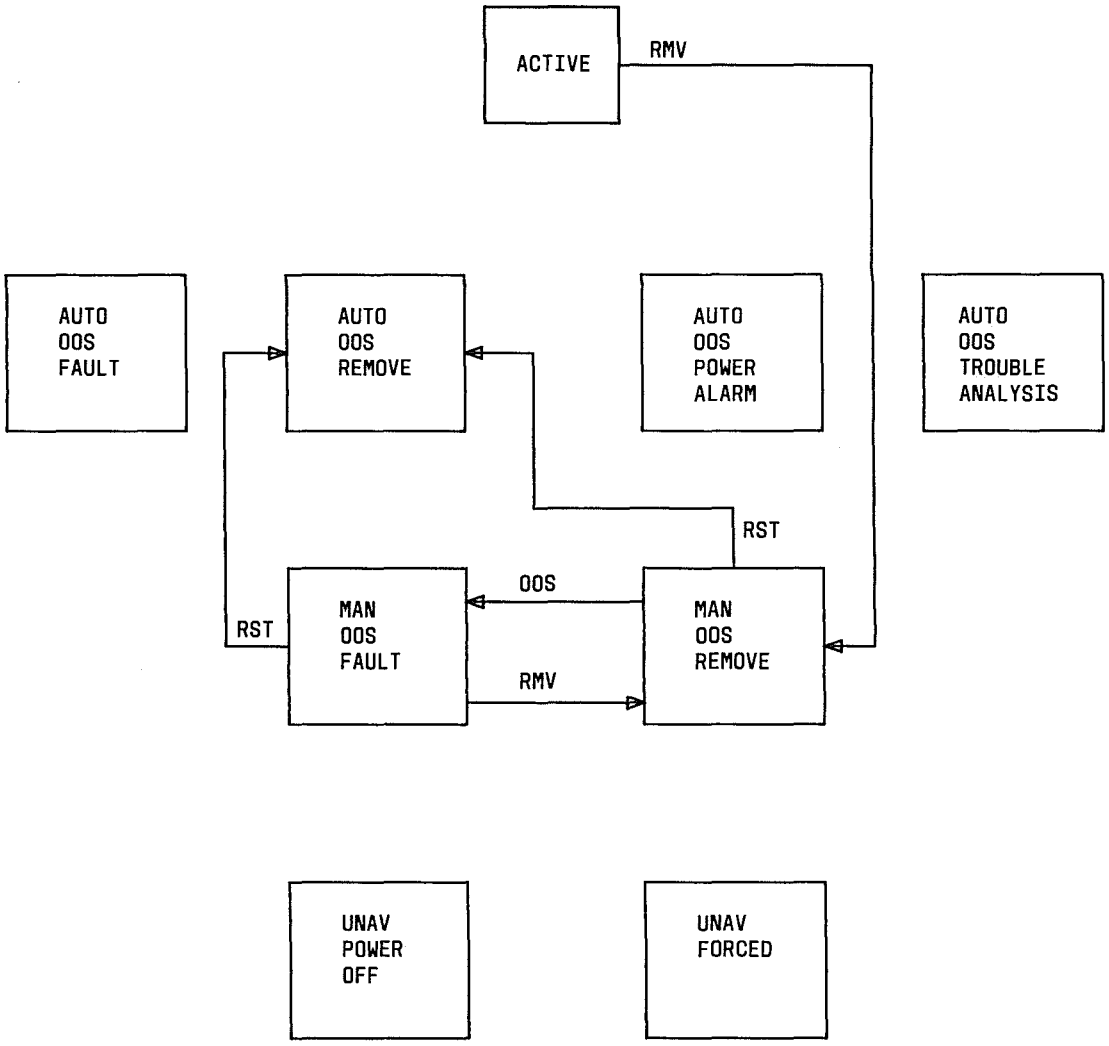

Fig. 6—Manual DTRM State Transitions

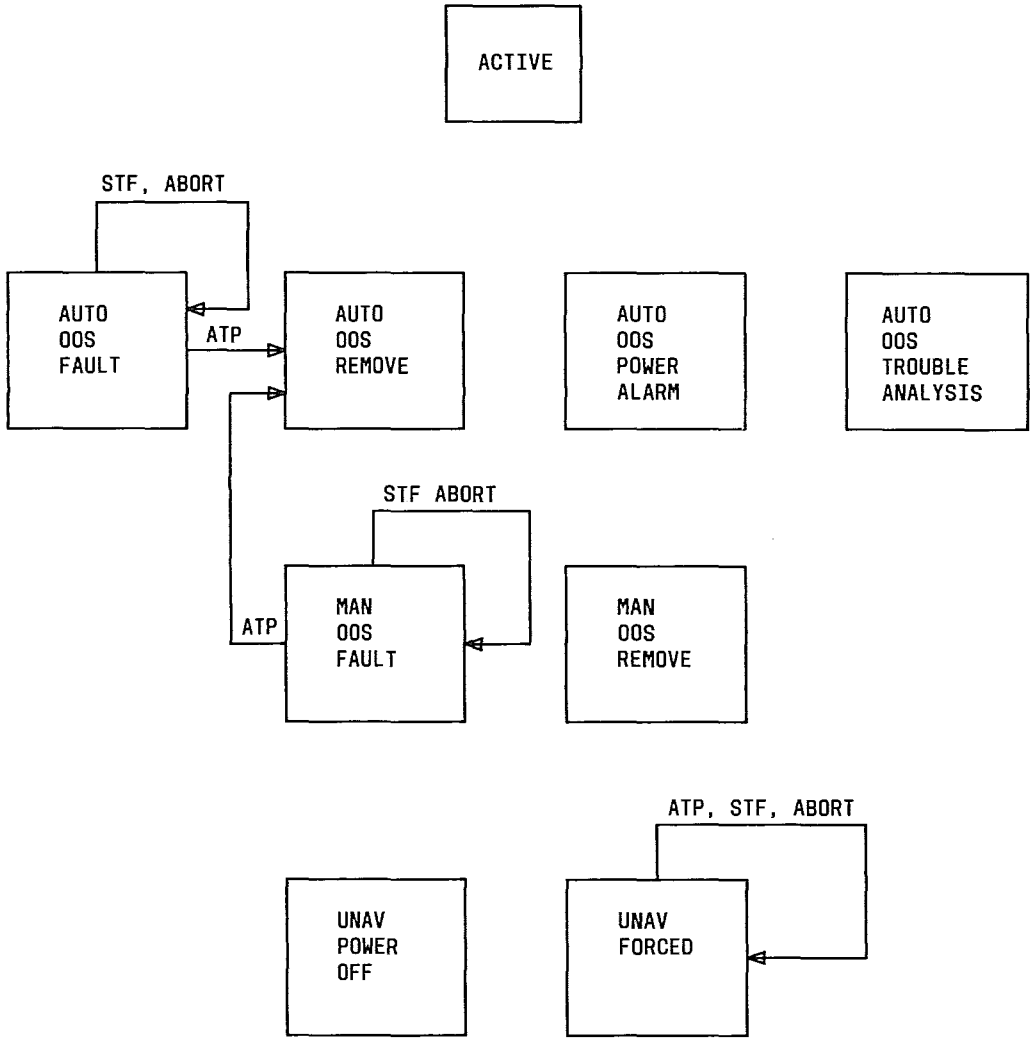

Fig. 7—Manually Requested DTRM Diagnostics

A. Automatic States

3.03 ***Active:*** The DTRM carries normal traffic. The mate DTRM may be either ACTIVE or in one of the other maintenance states.

3.04 ***AUTO OOS FAULT:*** The DTRM failed an automatic (system requested) diagnostic. This state occurs when the system automatically removes a DTRM from the ACTIVE state and attempts a diagnostic which either fails or aborts. Once the system is in this state, if a manually requested diagnostic occurs and passes, the DTRM will be placed into the AUTO OOS REMOVE state from which normal link recovery will be initiated. If the diagnostic fails or aborts, the DTRM will return to the AUTO OOS FAULT state.

3.05 ***AUTO OOS REMOVE:*** This state occurs when the system automatically removes a DTRM from the ACTIVE state, as when a single or double link failure occurs. Also, if the DTRM has been manually removed from the ACTIVE state and a subsequent restoral is requested, it must first go through the AUTO OOS REMOVE state to allow restoral to the ACTIVE state via normal link recovery.

3.06 ***AUTO OOS POWER ALARM:*** This state is reported automatically via the LS01 output message when a fuse alarm occurs on the

DTRM. This state can be initiated from any automatic DTRM maintenance state.

3.07 ***AUTO OOS TROUBLE ANALYSIS:*** The DTRM is placed in this state when an automatic diagnostic request is initiated. If the diagnostic passes, the DTRM is returned to the AUTO OOS REMOVE state; if the diagnostic fails, the DTRM is placed into the AUTO OOS FAULT state.

B. Manual States

3.08 ***MAN OOS FAULT:*** In this state, the DTRM has been manually removed from the ACTIVE state and is not operating but is available if the mate DTRM fails. To reach this state from ACTIVE, the DTRM must first be placed in the MAN OOS REMOVE state (explained in paragraph 3.09). To be restored to ACTIVE from this state, the DTRM must go through the AUTO OOS REMOVE state. From this point the DTRM is restored to ACTIVE via normal link recovery.

3.09 ***MAN OOS REMOVE:*** In this state the DTRM has been manually removed from the ACTIVE state and is operating for maintenance only but is available if the mate DTRM fails. This state can be reached directly from the ACTIVE mode; however, to return to the ACTIVE mode from this state, the DTRM must go through the AUTO OOS REMOVE state and be restored via normal link recovery.

3.10 ***UNAVAILABLE POWER OFF:*** In this state, the power has been removed from the DTRM for major maintenance or other purposes. The DTRM is not available if the mate DTRM fails. From this state the DTRM may be placed in any of the other manual states, and, as before, the DTRM must go through the AUTO OOS REMOVE state before being restored to the ACTIVE state.

3.11 ***UNAVAILABLE FORCED:*** In this state the DTRM is not operating and is not available if the mate DTRM fails. This state is useful for maintenance functions which require power and also the assurance that the system will not attempt to place the DTRM into ACTIVE service. As for all previous manual states, it must go through the AUTO OOS REMOVE state before it can be placed in ACTIVE service via normal link recovery.

VOICE FREQUENCY LINK (VFL) STATES

3.12 There are two VFLs (designated VFLA and VFLB) associated with each DTRM of a DTRM pair. Only one of these VFLs is in service at any time. Interface from the DTRM to both VFLs is accomplished through a data set to which two VFL access circuits are connected. Each VFL access circuit corresponds to a VFL (a or b). To assure a viable signaling path and to provide some automatic maintenance functions, there are several automatic maintenance states and Modem/VFL access circuit/VFL configurations that can be initiated by the system. For maintenance purposes, there are several manually initiated states which can be initiated via the VFLK-REQ-input message. The current status of the VFL, VFL access circuit and modem may be determined by using the VFLK-REQ-STS input message to obtain an LS01 STATUS output message which gives status information. An explanation of each of the states is as follows (see Fig. 8 and 9 for VFL state diagrams). A summary of the VFL states is given in Table B.

TABLE B

VOICE FREQUENCY LINK (VFL) STATES

ACTIVE		Carrying call traffic.
STBY / RDY	Standby:	*Not* carrying call traffic.
	Ready:	Connected to DTRM.
STBY / DLY	Standby:	*Not* carrying call traffic.
	Delayed:	*Not* connected to DTRM.
UNV / REL		*Not* available for service.
		VFL access circuit *released.*
UNV / OPR		*Not* available for service.
		VFL access circuit *operated.*

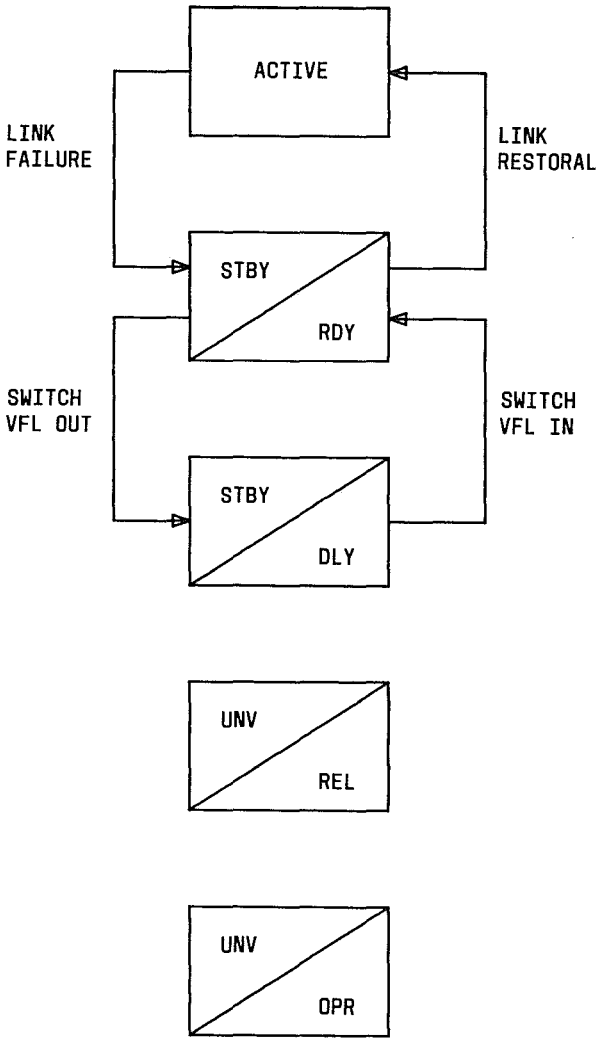

Fig. 8—Automatic VFL State Transitions

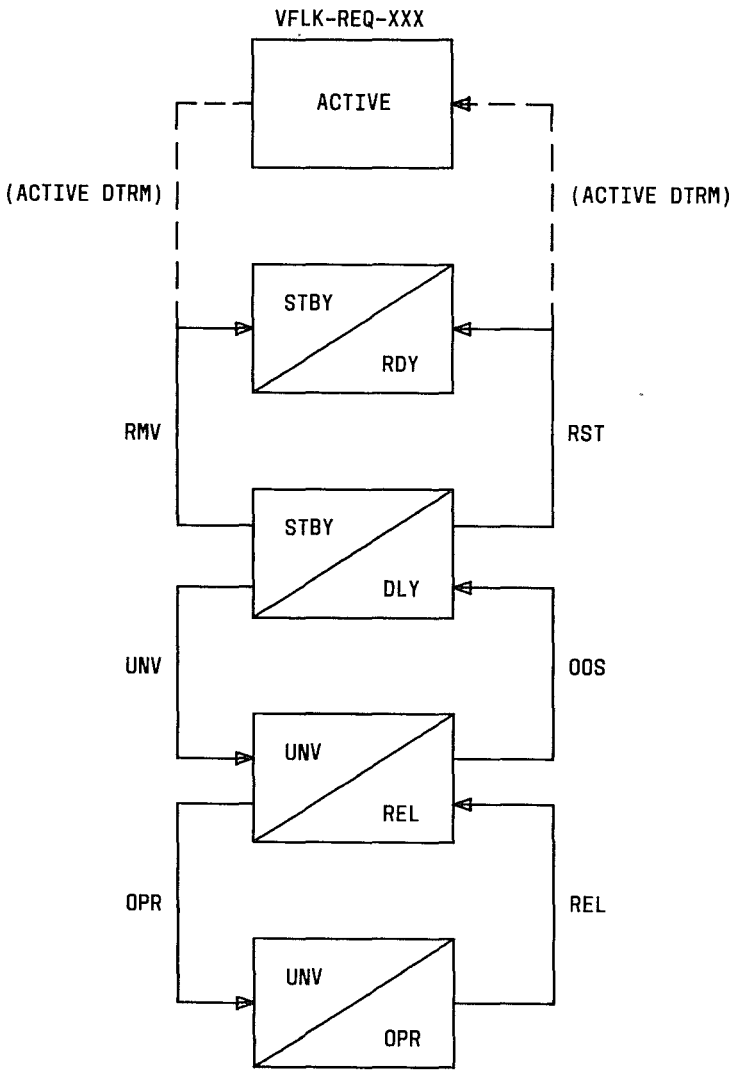

Fig. 9—Manual VFL State Transitions

A. Automatic States

3.13 ***ACTIVE:*** In this state the VFL marked ACTIVE is carrying normal signaling traffic. The mate VFL is in one of the other possible states.

3.14 ***STBY/RDY (STANDBY/READY):*** The VFL identified as being in this state is ***not*** carrying call traffic but is connected to the DTRM. This is the state which a normal nonactive VFL would occupy. The nonactive VFL may be put directly into the ACTIVE state from this state via normal link restoral. Also, to be placed in the ACTIVE state from any other state, a VFL must pass through the STBY/RDY state.

3.15 ***STBY/DLY (STANDBY/DELAYED):*** The VFL identified as being in this state is ***not*** carrying call traffic and ***not*** connected to the DTRM.

B. Manual States

3.16 ***UNV/REL (UNAVAILABLE/RELEASED):*** The VFL identified as being in this state is ***not*** available for service and has its VFL access circuit released. This state is used during the manual test panel transmission test to take down the connection from the VFL to a trunk link network (TLN) appearance, and is initiated by the VFLK-REQ-REL input message.

3.17 ***UNV/OPR (UNAVAILABLE/OPERATED):*** The VFL identified as being in this state is ***not*** available for service and has its VFL access circuit operated. This state is used during the manual test panel transmission test to set up a connection from the VFL to a TLN appearance, and is initiated by the VFLK-REQ-OPR input message.

4. DATA LINK FAILURE REPORTING AND ANALYSIS

4.01 The primary method for reporting failures of the CCIS data link is via TTY output messages. The LS01, 2, 3, and 4 messages are used to report the status of both automatic and manually initiated procedures and configuration changes. These messages are described as follows.

> ***Note:*** For a detailed explanation of the following message formats and associated data fields, see IM-1A001.

LS01 OUTPUT MESSAGE

4.02 The LS01 output message prints the current status and configuration of a CCIS DTRM and its associated voice frequency links (VFLA and VFLB). It is printed in response to a significant manual or automatic status and/or configuration change. It is also printed in response to the DTRM-REQ-STS input message.

4.03 The following information is provided in the LS01 printout:

- Terminal pair to which the DTRM is assigned
- Member of terminal pair to which DTRM is assigned
- Member number of DTRM in DTRM unit type translator
- Which VFL (a or b) is connected through to the DTRM
- Data link maintenance procedure currently being performed or last procedure performed
- Which end of the data link is in control of the maintenance procedure being performed
- Disposition of maintenance procedure(i.e., pass, fail, in-progress, completed, etc.)
- DTRM/MODEM maintenance state
- VFL maintenance state
- VFL to DTRM connection indicator
- VFL transmission test status
- Whether or not VFL is in synchronization
- Whether or not VFL test relay is operated.

4.04 Using the information provided by the LS01 printout it is possible to identify the data link in trouble. All data links should be placed in the ACTIVE state as soon as possible. Any data links out of service should be repaired and rediagnosed.

LS02 OUTPUT MESSAGE

4.05 The LS02 output message is printed each quarter hour when data link errors exceed a predetermined warning level, but are not high enough to cause automatic removal of the link from service.

4.06 The following information is provided in the LS02 printout:

- Terminal pair to which the DTRM is assigned
- Member of terminal pair to which the DTRM is assigned

- Member number of DTRM in DTRM unit type
- Which VFL (a or b) is connected through to the DTRM
- Number of signal units received in error
- Number of received repeated acknowledgment signal units (ACUs)
- Number of retransmission requests received
- Number of received skipped ACUs.

4.07 Based on the information provided by the LS02 printout, appropriate action may be taken. High error rates may indicate impending data link failure. High counts of signal units received in error and/or retransmission requests received indicate transmission problems. High counts of received repeated ACUs and/or received skipped ACUs indicate near end and far end modem clocks are not synchronized.

LS03 OUTPUT MESSAGE

4.08 The LS03 output message is printed in response to the DTRM-REQ-AUD input message. The printout shows those DTRM, VFL, and band status indicators that are currently being used to perform the CCIS data link input/output function in addition to data link maintenance control.

4.09 The data contained in the LS03 printout may be used to provide additional status information if the LS01 printout is not sufficient.

LS04 OUTPUT MESSAGE

4.10 The LS04 output message is printed whenever the CCIS link security bootstrap routine is entered. This can occur via an internal program request or manual request using the DTRM-REQ-FRC input message. The printout shows all the status information and current input data for the DTRM being bootstrapped before all software and hardware for that DTRM is reinitialized.

5. DTRM STATE CONTROL

5.01 Control of the DTRM maintenance states is accomplished automatically or manually. Automatic state control is initiated entirely by the system, without human intervention, based on the results of automatic transmission tests and status checks. Manual state control is initiated via TTY input messages, frame controls, or maintenance data link messages, when configurations must be established for maintenance purposes. Table C shows the DTRM state transitions that are allowed (from one state to another).

AUTOMATIC DTRM STATE TRANSITIONS

Normal Link Recovery

Note: Refer to the state diagram in Fig. 4.

5.02 The normal link recovery procedure is initiated when a single link failure occurs or when a link is released from an unavailable condition and the mate link is currently active. The DTRM must always enter the AUTO OOS REMOVE state before being restored to active service. This allows the recovering link to be monitored for 15 seconds to insure acceptable transmission quality and to allow a CCIS signaling network status update to be completed.

5.03 If transmission quality is found to be unacceptable for 3 minutes, the DTRM is automatically placed in the AUTO OOS TROUBLE ANALYSIS state and a diagnostic is initiated. If an all-test-pass (ATP) occurs, the DTRM is returned to the AUTO OOS REMOVE state, from which the normal link recovery routine will attempt to restore it to the ACTIVE state.

5.04 If the automatically initiated diagnostic has some-tests-failing (STF) or aborts, the DTRM is placed in the AUTO OOS FAULT state. In this state, the DTRM is marked unavailable for service and manual troubleshooting procedures should be initiated as soon as possible. Manually initiated diagnostics can be run from this state. (See paragraph 5.16.)

5.05 Any automatically initiated link recovery procedures are reported on the maintenance TTY via the LS01 output message.

Emergency Link Recovery

Note: Refer to the state diagram in Fig. 5.

5.06 The emergency link recovery procedure is automatically initiated when a double link

TABLE C

DTRM STATE TRANSITIONS ALLOWABLE FROM ONE STATE TO ANOTHER

FROM T/M STATE #	TO T/M STATE #								
	32	33	34	35	36	37	38	39	40
32	DC	N	Y1, 2	Y3	Y2	N	Y4	Y14	Y5
33	N	DC	Y10,11	Y3	N	Y12	Y4	Y6	Y5
34	Y7	N	DC	Y3	Y8	Y12	N	Y6	Y5
35	N	N	Y10,11	DC	N	Y12	Y4	Y6	Y5
36	N	Y9	Y10,11	Y3	DC	Y12	Y4	Y6	Y5
37	N	N	Y10,11	N	N	DC	Y4	Y6	Y5
38	N	N	Y11	N	N	Y12	DC	Y6	Y5
39	N	N	Y10,11	N	Y13	Y12	Y4	DC	Y5
40	N	N	Y11	N	N	Y12	Y4	N	DC

KEY

DC = DON'T CARE
Y = YES (State change allowed)
N = NO (State change not allowed)

The numbers following Y and N refer to the notes given below.

NOTES	ACTIONS OR EVENTS CAUSING STATE CHANGE
1	Automatically initiated because of single link failure
2	Automatically initiated if DTRM becomes inaccessable
3	Blown fuse
4	Manually initiated by the DTRM-REQ-RMV input message
5	Manually initiated by the DTRM-REQ-UNV input message
6	Power has been manually removed
7	Automatically initiated by link recovery routines.

TABLE C (Contd)

DTRM STATE TRANSITIONS ALLOWABLE FROM ONE STATE TO ANOTHER

NOTES	ACTIONS OR EVENTS CAUSING STATE CHANGE
8	Automatically initiated by link recovery routines
9	Automatically initiated if diagnostic aborts or results in STF
10	Automatically initiated if diagnostic results in ATP
11	Manually initiated by the DTRM-REQ-RST input message
12	Manually initiated by the DTRM-REQ-OOS input message
13	Power is manually restored; system automatically initiates diagnostic
14	Normally the DTRM should be in one of the OOS states prior to power being removed.

failure occurs or when a link is released from an unavailable condition and the mate link is not currently active. The DTRM enters the AUTO OOS REMOVE state and, before being restored to ACTIVE service, the recovering link is monitored for only three seconds and an abbrivated restoral sequence is followed.

5.07 As for normal link recovery, emergency link recovery procedures are reported via the LS01 output message.

MANUAL DTRM STATE TRANSITIONS

Note: Refer to the state diagram in Fig. 6.

5.08 Manual control of the DTRM maintenance states is accomplished via the maintenance TTY using the DTRM-REQ-XXXX input message. This message allows maintenance personnel to establish various maintenance states or request some action to be taken on the DTRMs. The use of this message is described in the following paragraphs.

A. Removing a DTRM From Service

5.09 To manually remove a DTRM from ACTIVE service type in:

DTRM-REQ-RMV bbbb.

bbbb = Decimal number between 0 and 1023 identifying the DTRM.

System responds with PF followed by an LS01 output message indicating the request has been implemented. The DTRM is now in the MAN OOS REMOVE state (T/M state 38) and operating for maintenance only but is available if the mate DTRM fails.

5.10 If the problem is solved, the DTRM may be restored to ACTIVE service, using the DTRM-REQ-RST input message. (See paragraph 5.11.) If the problem is of such a nature that manually requested diagnostics are required to obtain further information, the DTRM must first be placed in the MAN OOS FAULT state using the DTRM-REQ-OOS message. (See paragraph 5.12.)

B. Restoring a DTRM to Service

5.11 To manually restore a DTRM to service, type in:

DTRM-REQ-RST bbbb.

bbbb = Decimal number between 0 and 1023 identifying the DTRM to be restored to service.

System response with PF followed by an LS01 output message indicating the request has been implemented. The DTRM is placed in the AUTO OOS REMOVE (T/M state 34) from which the automatic link recovery routine will attempt to restore the unit to the ACTIVE state.

C. Taking a DTRM Out of Service

5.12 To take a unit out of service, type in:

DTRM-REQ-OOS bbbb.

bbbb = Decimal number from 0 through 1023 identifying the DTRM to be taken out of service.

This request is not honored on an active terminal. The system responds with PF followed by an LS01 output message indicating the request has been implemented. The DTRM is now in the MAN OOS FAULT state (T/M state 37). In this state, the DTRM is not operating but is available if the mate DTRM fails. Diagnostics may be run using the DTRM-REQ-DGN (paragraph 5.16) or DTRM-REQ-DGR (paragraph 5.17) input messages.

5.13 The DTRM may be restored to ACTIVE service from this state by using the DTRM-REQ-RST message as explained in paragraph 5.11. If additional maintenance is required with the DTRM operation for maintenance only, but not carrying normal call traffic, the DTRM may be returned to the MAN OOS REMOVE state by using the DTRM-REQ-RMV input message as explained in paragraph 5.09.

D. Marking a DTRM Unavailable for Service

5.14 If major maintenance is required, a DTRM may be marked unavailable for service by typing in:

DTRM-REQ-UNV bbbb.

bbbb = Decimal number from 0 to 1023 identifying the DTRM to be marked unavailable for service.

System responds with PF followed by an LS01 output messages indicating the request has been implemented. The DTRM is now in the UNAV FORCED state (T/M state 40). In this state, the DTRM is not operating and not available if the mate DTRM fails. This state is useful for major maintenance requiring power on the unit but assurance that the system will not attempt to place the unit into service.

E. Reinitializing a DTRM

5.15 If a DTRM must be fully reinitialized, type in:

DTRM-REQ-FRC bbbb.

bbbb = Decimal number between 0 and 1023 identifying the DTRM to be forced active.

System responds with an LS04 output message showing all the status information and current input data for the DTRM being forced before all software and hardware for that DTRM is reinitialized. Repeated LS04 messages may indicate software problems.

MANUAL DTRM DIAGNOSTICS, STATUS CHECKS AND AUDITS

Note: See Fig. 7 for a diagram indicating from which maintenance states diagnostic results will be meaningful.

A. Diagnosing a DTRM (Normal Printout)

Note: Refer to the state diagram in Fig. 7.

5.16 To diagnose a DTRM and obtain a normal printout, type in:

DTRM-REQ-DGN bbbb.

bbbb = Decimal number between 0 and 1023 idetifying the DTRM to be diagnosed.

System responds with a DR01 output message containing diagnostic results for the DTRM. No trouble numbers will be printed if ATP (all tests pass) is printed; otherwise, use the printed trouble numbers to access the appropriate trouble locating manual (TLM) section and follow the procedure indicated.

B. Diagnosing a DTRM (Raw Data Printout)

5.17 To diagnose a DTRM and obtain a raw data printout of the diagnostic results, type in:

DTRM-REQ-DGR-bbbb.

bbbb = Decimal number from 0 to 1023 identifying DTRM to be diagnosed.

System responds with a DR02 message containing the raw data of a diagnostic result in octal form. Refer to the raw data tables given in PK-xxxxx. Trouble numbers are also printed and may be matched with numbers in the appropriate TLM.

C. Requesting DTRM Status

5.18 To request a printout of the status of a DTRM, type in:

DTRM-REQ-STS bbbb.

bbbb = Decimal number between 0 and 1023 identifying the DTRM to be checked.

System responds with an LS01 message containing the current status and configuration of a DTRM and its associated voice frequency links (VFL***a*** and VFL***b***).

D. Requesting an Audit of a DTRM

5.19 To request a copy of the DTRM data base type in:

DTRM-REQ-AUD bbbb.

bbbb = Decimal number between 0 and 1023 identifying the DTRM to be audited.

The system responds with an LS03 message showing those DTRM, VFL and band status indicators

that are currently being used to perform the CCIS data link input/output function in addition to data link maintenance control.

6. VFL STATE CONTROL

6.01 Manual control of the VFL maintenance states is accomplished via the maintenance TTY using the VFLK-REQ input message. This message is functionally similar to the DTRM-REQ message described in Part 5; i.e., it can be used to establish various maintenance states and/or configurations or request some action to be taken on the VFL.

MANUAL VFL STATE TRANSITIONS

6.02 The following paragraphs describe the various VFLK-REQ input messages required to manually change the state of the VFL. There is a definite sequence which must be followed when going from one state to another, as shown in the state diagram in Fig. 9. After determining which state the VFL is in (using the VFLK-REQ-STS input message, as described in paragraph 6.09), start at that state and type in the appropriate VFLK-REQ-xxx messages to allow progression through the required number of states until the desired VFL state is reached. The following descriptions of the various VFLK-REQ-xxx input messages correspond to the sequence given in the state diagram.

A. Removing a VFL From Service

6.03 To remove a VFL from service, type in:

VFLK-REQ-RMV bbbb c.

bbb = Decimal number between 0 and 1023 identifying the DTRM

C = A or B identifying the VFL.

System responds with a PF followed by an LS01 output message indicating the system has implemented the request. The VFL is removed from the ACTIVE state and placed in the STBY/DLY state. In this state, the VFL is ***not*** carrying call traffic and is ***not*** connected to the DTRM. The mate VFL is placed in the ACTIVE state.

B. Marking a VFL Unavailable for Service

6.04 To mark a VFL unavailable for service, type in:

VFLK-REQ-UNV bbbb c.

bbbb = Decimal number between 0 and 1023 identifying the DTRM

c = A or B identifying the VFL

System responds with OK indicating the request has been implemented. The VFL has been changed from the STBY/DLY state to the UNV/REL state. In this state the VFL is ***not*** available for service and cannot be automatically switched into service by the system. Also, the VFL access circuit is released (not connected); however, before the access circuit can be operated (connected), the VFL must be in this state.

C. Operating a VFL Access Circuit

6.05 To operate the VFL access circuit for a specified VFL, type in:

VFLK-REQ-OPR bbbb c.

bbbb = Decimal number between 0 and 1023 identifying the DTRM

c = A or B identifying the VFL

System responds with OK indicating the specified VFL access circuit has been operated. The VFL has been moved from the UNV/REL state into the UNV/OPR state. In this state, the VFL is connected to the network appearance of the shared maintenance bus used for manual VFL testing. In this state, the VFL is ***not*** available for service and transmission tests may be performed.

D. Releasing a VFL Access Circuit

6.06 To release the VFL access circuit for a specified VFL, type in:

VFLK-REQ-REL bbbb c.

bbbb = Decimal number between 0 and 1023 identifying the DTRM

c = A or B identifying the VFL.

The system responds with OK indicating the specified VFL access has been released. The VFL is now in the UNV/REL state and has been disconnected from the maintenance bus.

E. Placing a VFL in the Manual Out-of-Service State

6.07 To place the VFL in the manual out-of-service (OOS) state, type in:

VFLK-REQ-OOS bbbb c.

bbbb = Decimal number between 0 and 1023 identifying the DTRM

c = A or B identifying the VFL.

System responds with OK
indicating the request has been implemented. This causes a transition from the UNV/REL state to the STBY/DLY state. ***The automatic VFL test may be initiated only from this state.*** (See paragraph 6.10.)

F. Restoring a VFL to Service

6.08 To manually restore a VFL to service, type in:

VFLK-REQ-RST bbbb c.

bbbb = Decimal number between 0 and 1023 identifying the DTRM

c = A or B identifying the VFL.

The system responds with PF followed by an LS01 output message indicating that the request has been implemented. The VFL is restored to the ACTIVE state, carrying call traffic. If the associated DTRM is not active, the VFL is restored to the STBY/RDY state. The mate VFL is removed from service.

MANUAL VFL STATUS CHECKS, TESTS, AND AUDITS

A. Requesting VFL Status

6.09 To request a printout of the status of a VFL, type in:

VFLK-REQ-STS bbbb c.

bbbb = Decimal number between 0 and 1023 identifying the DTRM

c = A or B identifying the VFL to be checked.

The system responds with an LS01 message containing information on the current status and configuration of the specified DTRM and associated VFLs.

B. Initiating the Automatic Standby VFL Test

Note: The VFL ***must*** be in the STBY/DLY state to perform this test.

6.10 To initiate the automatic VFL test, type in:

VFLK-REQ-TST bbbb c.

bbbb = Decimal number between 0 and 1023 identifying the DTRM

c = A or B identifying the VFL to be tested.

System responds with an LS01 message giving the results of the test. The switching office (via the link security routine) applies a loop to the VFL and sends a test-standby VFL (TSV) signal to the signal transfer point (STP). The STP then performs the loop-around test and returns the results to the switching office via a VFL-test-passed (VLP) signal or a VFL-test-failed (VLF) signal.

7. CCIS TERMINAL PAIR TURNUP PROCEDURES

7.01 The following procedure is used to connect a pair of data links to the CCIS network via the STPs. The following guidelines should be followed.

- Perform turnup procedure for data links of a pair.
- Perform turnup procedures for data link connected to control STP first, then for data link connected to noncontrol STP.

Alarms and automatic reconfiguration procedures will be fully operational at the conclusion of the VFL turnup procedures.

7.02 Prior to placing a data link in service the following conditions must be met.

(1) All procedures related to the addition or initial installation of DTFs and DTRMs must be completed.

(2) Manual transmission testing (at test panel) of VFLs must be completed. Refer to Section 660-450-507. Coordination between SO and STP personnel is required.

(3) The DTRM must be in the UNAV state.

(a) Type in

DTRM-REQ-STS bbbb.

bbbb = Decimal number between 0 and 1023 identifying DTRM.

LS01 message prints showing T/M 40.

(4) All self loops (jumpers for loop around operation) on the VFLs must be removed.

(5) In the CCIS terminal pair auxiliary block (for this terminal pair) bits 17 and 28 of word 1(SYNCTYP) must be 00 to indicate even sync. Refer to section 231-118-344.

PLACING DATA LINK INTO SERVICE

7.03 After all conditions in paragraph 7.02 are met, use the following procedure to place the data link in service.

(1) Diagnose the DTRM to be placed in service by typing

DTRM-REQ-DGN bbbb.

bbbb = Decimal number between 0 and 1023 identifying the DTRM

System response is a DR01 message containing diagnostics for the DTRM. If the response is not ATP, use the trouble numbers printed and TLM 1A444 to clear the trouble. ***The diagnostic must indicate ATP before proceeding further.***

(2) Activate the DTRM to be placed in service by typing:

DTRM-REQ-RST bbbb.

- If the mate DTRM is not active (this is the first link to be turned up), a major alarm will sound and the emergency recovery procedure will be initiated automatically. The data link should become ACTIVE within approximately 3 seconds. An LS01 message will be printed showing the state of the DTRM (T/M 32) and emergency recovery (PROC 2).

- If the mate DTRM is active (this is the second link to be turned up), the normal recovery routine will be initiated automatically. The data link should become ACTIVE within approximately 15 seconds. An LS01 message will be printed showing the state of the DTRM (T/M 32) and normal recovery (PROC 1).

(3) Type in

DTRM-REQ-STS bbbb.

LS01 output message shows VFLA or VFLB active (See OM-1A001).

(4) Verify by voice contact with maintenance personnel at the STP that the data link is active on the ***same*** VFL (A or B) at the switching office and the STP. If this is not the case, the error should be corrected before proceeding further.

(5) Verify link recovery on the standby VFL by using a patch cord equipped with two No. 310 plugs to short the XMIT and RCV jacks at the active VFL. (Use LS01 from (3) to determine active and standby VFLs). The DTRM should recover automatically by switching to the standby VFL within 15 seconds. The LS01 output message should show the state of the DTRM (T/M=32) and the status of VFLA and VFLB reversed from their status in (3).

(6) Verify recovery on the new standby VFL by repeating (5). System response should show T/M=32 and VFLA and VFLB status reversed again.

(7) Type in VFLK-REQ-TST bbbbA (or B, whichever VFL is standby). LS01 output message should show (in the DISP variable field) that the standby VFL test passed.

(8) If only one DTRM has been turned up, repeat this procedure for the mate DTRM.

8. CCIS TERMINAL PAIR TURNDOWN PROCEDURE

8.01 The following procedure is to be used to disconnect a pair of data links from the CCIS signaling network.

(1) Determine the initial status of both DTRMs of the terminal pair by typing in

DTRM-REQ-STS aaaa.

DTRM-REQ-STS bbbb.

aaaa, bbbb = Decimal numbers from 0 to 1023 identifying both DTRMs of the terminal pair.

LS01 output messages give the status of both DTRMs. If either DTRM is active (T/M=32), verify that CCIS traffic has been removed from TMPR (terminal pair) N by placing the following traffic measurements on the selected quarter hour (DA15) schedule.

TMPR N Mem 0 and TMPR N Mem 1

TMC 109 TCN 0 and TMC 109 TCN 1

(Refer to Section 231-210-301 for procedure.)

Low traffic counts indicate that only link maintenance is using the terminal pair.

(2) Notify STP maintenance personnel (control and noncontrol STPs) that data links will be turned down.

(3) Turndown data links to STPs.

(a) Turndown DTRM connected to noncontrol STP by typing

DTRM-REQ-UNV bbbb.

bbbb = Decimal number from 0 to 1023 identifying the DTRM connected to the noncontrol STP.

LS01 output message shows T/M=40.

(b) Request noncontrol STP maintenance personnel to mark DTRM in growth.

(c) Turn down DTRM connected to control STP by typing

DTRM-REQ-UNV aaaa.

aaaa = Decimal number from 0 to 1023 identifying the DTRM connected to the control STP.

LS01 output message shows T/M = 40.

(d) Request control STP maintenance personnel to mark DTRM in growth.

8.02 If it is desired that the DTRMs be left in the optional self-loop mode, the following procedure should be followed.

(1) Attach wire jumpers to VFLs for loop around operation.

(2) In the CCIS terminal pair auxiliary block (for this terminal pair) bits 17 and 18 of word 1 must be 10 or 11 to signify loop around operation. Refer to Section 231-118-344.

(3) Activate the first DTRM by typing

DTRM-REQ-RST aaaa.

aaaa = Decimal number from 0 to 1023 identifying the first DTRM LS01 output message indicates T/M = 32

(4) Deactivate the first DTRM by typing

DTRM-REQ-UNV aaaa.

LS01 output message indicates T/M = 40.

(5) Activate the second DTRM by typing

DTRM-REQ-RST bbbb.

bbbb = Decimal number from 0 to 1023 identifying the second DTRM

LS01 output message indicates T/M = 32

(6) Deactivate the second DTRM by typing

DTRM-REQ-UNV bbbb.

LS01 output message indicates T/M = 40.

8.03 At the end of the turndown procedure, both DTRMs will be in the unavailable forced state (T/M=40). If the optional procedure in paragraph 8.02 was performed, both DTRMs will be in unavailable forced state (T/M=40), all VFLs for both DTRMs will be in the self-loop mode, and the translations for this terminal pair will indicate loop around operation.