APPENDIX F

DEPLOYABLE RED SWITCH

Introduction. This appendix provides information on the Deployable Red Switch (DRS). The appendix is divided into three annexes. Annex A describes the DRS. Annex B is a DRS interface planning guide. Annex C describes an interface using the AN/FCC-100(V)7.

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ANNEX A TO APPENDIX F

INTRODUCTION

1. Deployable Red Switch (DRS) Description

a. Introduction. The Defense Red Switch Network (DRSN) (Figure F-1) is comprised of government-owned Red switching systems, multichannel ISTs, and the Red Switch Network Operations Center (RSNOC). The network includes more than 40 Red switching systems operated by the Services and other government agencies. The DRSN is an integral part of the near-term architecture for the DISN. It supports secure conferencing requirements not supported by STU-IIIs. The DRSN serves command and control secure voice users located within a physically securable (RED) enclave. It uses secure ISTs to provide secure communications capability among the secure enclaves.

b. Red Switch Configuration. The DRS consists of the following major items.

(1) Digital Small Switch (DSS-1). The DSS-1 consists of a control and matrix unit (CMU) that provides redundant processor and matrix switching.

(2) Trunk Interface Multiplexer (TIM-1). The TIM-1 is a card cage assembly that provides interface capability for a variety of cryptographic equipment assets and other special devices. The TIM-1 interfaces to the DSS-1 by means of an ESI proprietary limited bandwidth T1 (LBT1) digital link operating at 1.344 Mbps. The LBT1 provides up to 20 digital switch channels and utilizes X.25 packet signaling protocol to ensure message integrity through error detection and correction.

(3) D4 Channel Bank. The D4 channel bank provides an interface capability to a deployed tactical (TRI-TAC or MSE) communications network. The channel bank interfaces with the DSS-1 by means of a standard 1.544 Mbps T1 signal. The ADNX breaks down the T1 format to individual E&M circuits. It is then sent to the tellab cards that change it from E&M to SF. The LTU is populated with MFLTU cards which does the handshaking with the SF tellab cards. The LTU and one KG-194 is remoted with the Red switch and is used to encrypt the group to the switch.

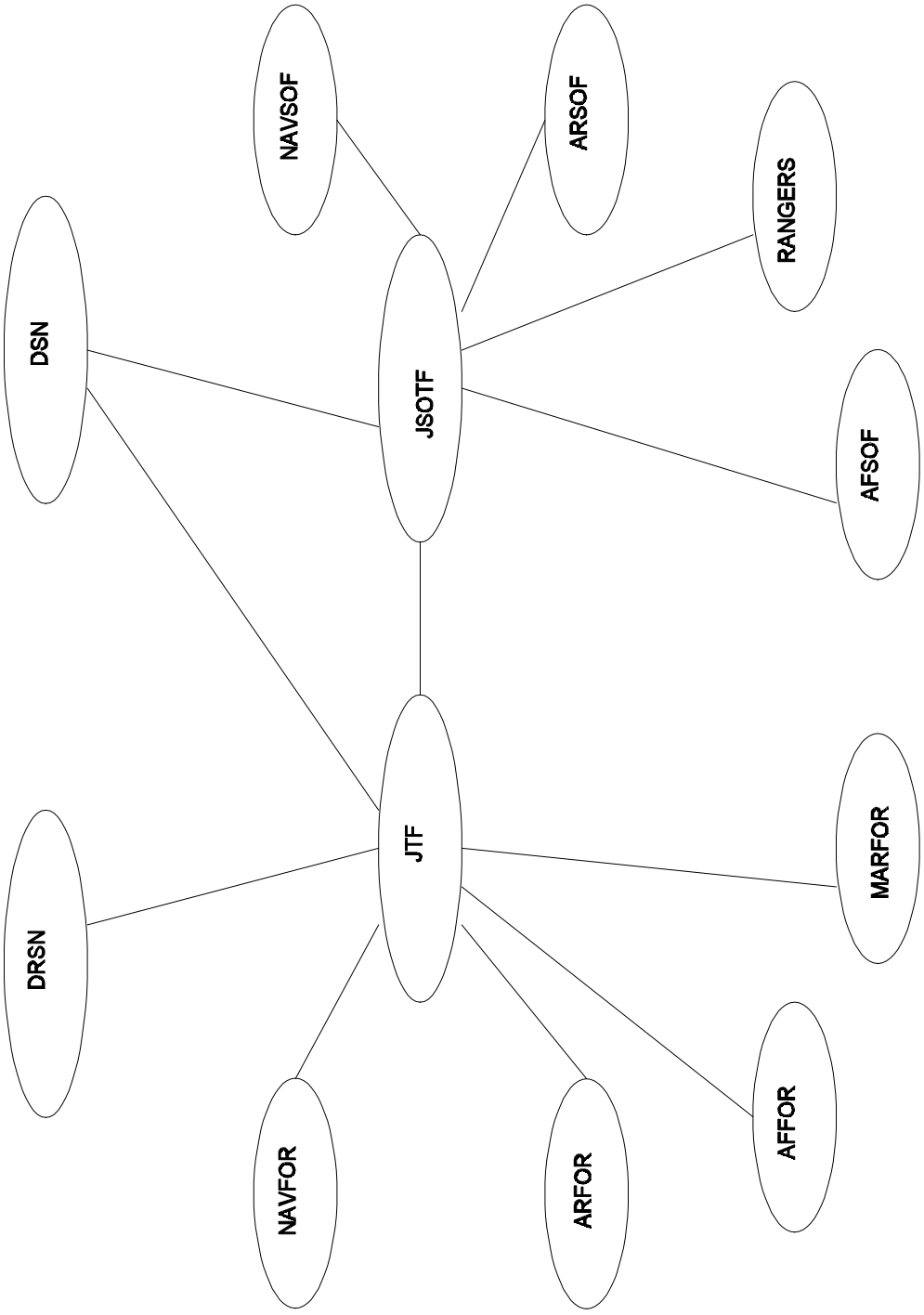


Figure F-1. Notional JTF and JSOTF DSN and DRSN Connectivity

(4) Integrated Digital Network Exchange (IDNX) Micro-20 Multiplexer. The IDNX multiplexer allows the DRS to connect into the DRSN at a fractional T1 rate. The IDNX accepts a standard T1 from the CMU and provides voice compression. The IDNX maps the compressed group to a KG-194 TED and then to a modem. The IDNX may also provide the CDΦ interface to pass this fractional T1 signal over military satellite systems. KG-84As provide encryption for this link.

(5) Dual Trunk Adapters (DTA). The DTA provides two switch-to-switch trunk channels. For switch-to-switch operation, a DTA is installed at both switch locations. KG-84As provide encryption for this link. For switch-to-phone operation, a DTA is installed at a switch end and a dual phone adapter (DPA) is installed at the remote phone location. KG-84As provide encryption for this link.

(6) Dual Phone Adapters (DPA). The DPA provides the capability to remote two telephones out of the PDS or over some transmission media. The DPA can be extended locally up to 6,000 feet using modems.

(7) STU-III/R. The STU-III/R is a remote-controllable secure voice/data terminal that provides the necessary interfaces and capabilities for Red switch/enclave applications, conferencing bridges, and BLACK digital networking.

(8) Digital Phone Multiplexer (DPM). The DPM-1 is a microprocessor-based device that extends SDS-1 subscriber services for up to 16 SDS-1 product line telephones.

c. DRS Connectivity Requirements

(1) DRSN. Connectivity to the DRSN may be accomplished at the channel level or as a fractional T1 rate. Typically, the DRS will connect back to two DRSN switches providing redundancy. Figure F-2 shows an example of single channel connectivity to two DRSN switches. Figure F-3 shows an example of connectivity into the DRSN by way of a fractional T1 rate.

(2) Tactical Network. The DRS will connect to deployed tactical communications assets at the channel level. Only DSVTs will be allowed to place calls to the DRS and into the DRSN at the SECRET level. Figure F-4 shows the connectivity to a deployed AN/TTC-39A(V)3. An LKG is seized

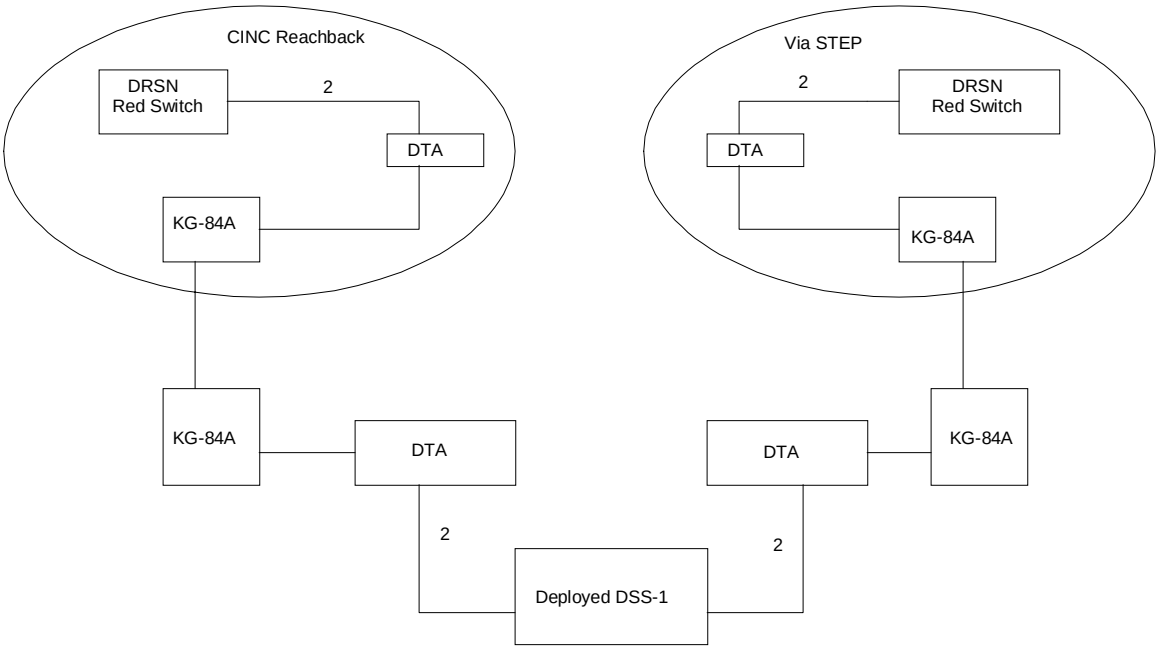


Figure F-2. Connectivity to DRSN at Channel Level

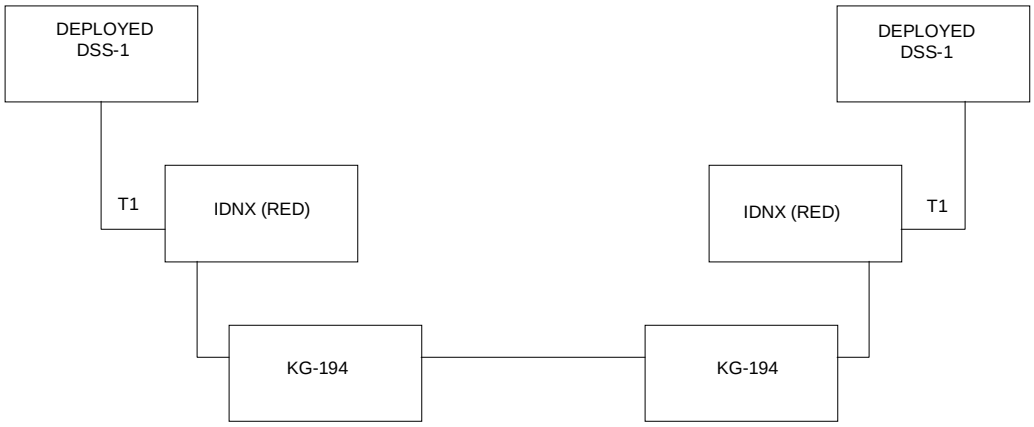


Figure F-3. Connectivity to DRSN at Fractional T1

and held to encrypt the traffic to the DSVT. The AN/TTC-39A(V)3 provides a DTG to an LTU at the DRS. A TED provides security for this group.

(3) Telephone Connectivity. Integrated Services Telephones (IST) provide service to loop subscribers. The IST is a 40-line key telephone that can operate with both a RED and BLACK switch by virtue of a built-in isolator.

(a) Local Loop Within the PDS. A local telephone that is located within the same PDS as the DRS, and in which the entire wireline path is located within the PDS as the DRS, is not encrypted. The summing telephone interface (STI) card in the DSS-1 is used to terminate the instrument.

(b) Local Loop Outside the PDS. A local telephone that is not located within the same PDS as the DRS, or in which the entire wireline path is not located within the same PDS as the DRS, is encrypted using a KG-84A. A DTA is used at the switch location to change the data format from the ESI proprietary format to an RS-422 format which the KG-84A accepts. At the subscriber end, a KG-84A is used to decrypt the information and a DPA is used to convert the RS-422 output of the KG-84A to ESI proprietary format for the phone. This equipment string allows remoting of two ISTs, see Figure F-5.

(c) Long Local Loop. A long local telephone is remoted by means of some transmission means to a distant site. This interface is handled like the local loop outside the PDS.

2. RED ISTs. Figure F-6 depicts the end-to-end connectivity of the RED ISTs between the AN/TTC-39A(V)1 at USCENTCOM Forward and the DRS at USCENTCOM Rear during Operations DESERT SHIELD and DESERT STORM. Multiple rate voice cards (MRVC) were installed in the AN/TTC-39A(V)1 at USCENTCOM Forward and used for A/D conversion, signaling and supervision, and multiplexing. The ISTs were encrypted by a KG-84A also located in the AN/TTC-39A(V)1. The 32 kbps conditioned diphase output of the KG-84A was inputted to a LRM in an AN/TSC-85B GMF assemblage. The AN/TTC-39A(V)1 to MRVC interfaces were 4-wire, using 2,600 Hz SF wink-start supervision and MF signaling. At the USCENTCOM Rear, the DSS-1 interfaced to MRVCs via 6-wire trunks utilizing E&M supervision and MF signaling. The KG-84A and GMF arrangements were mirror images of the Forward end.

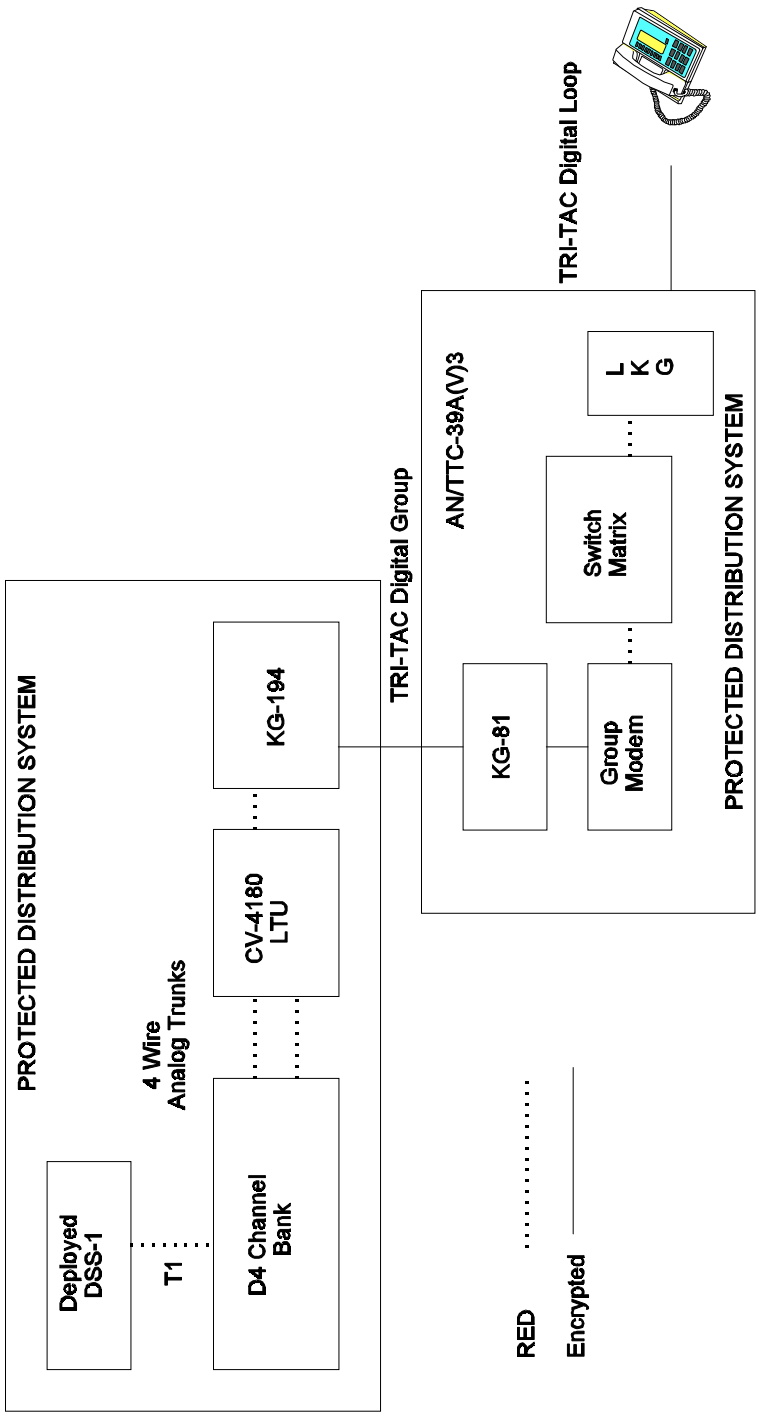


Figure F-4. Connectivity to a Deployed Switch

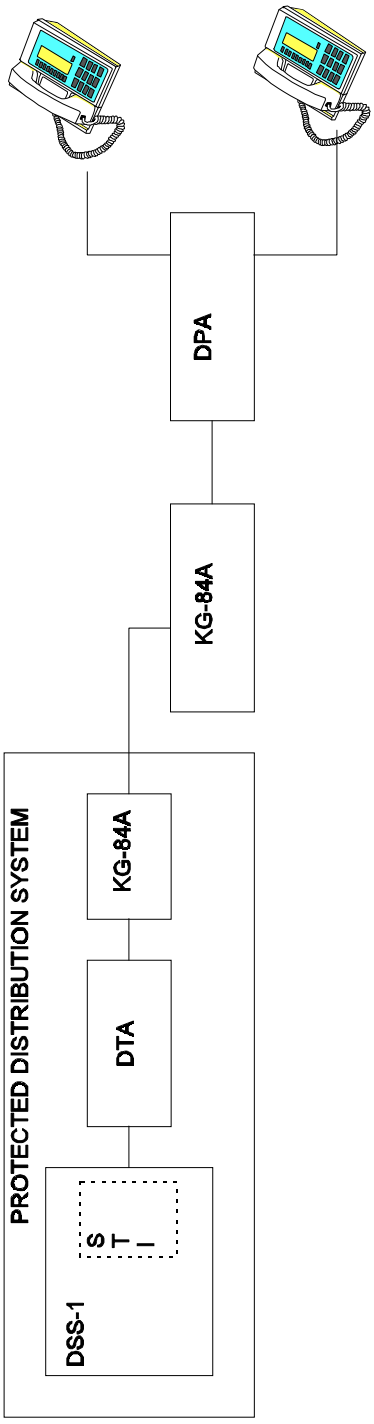


Figure F-5. Remote Telephone

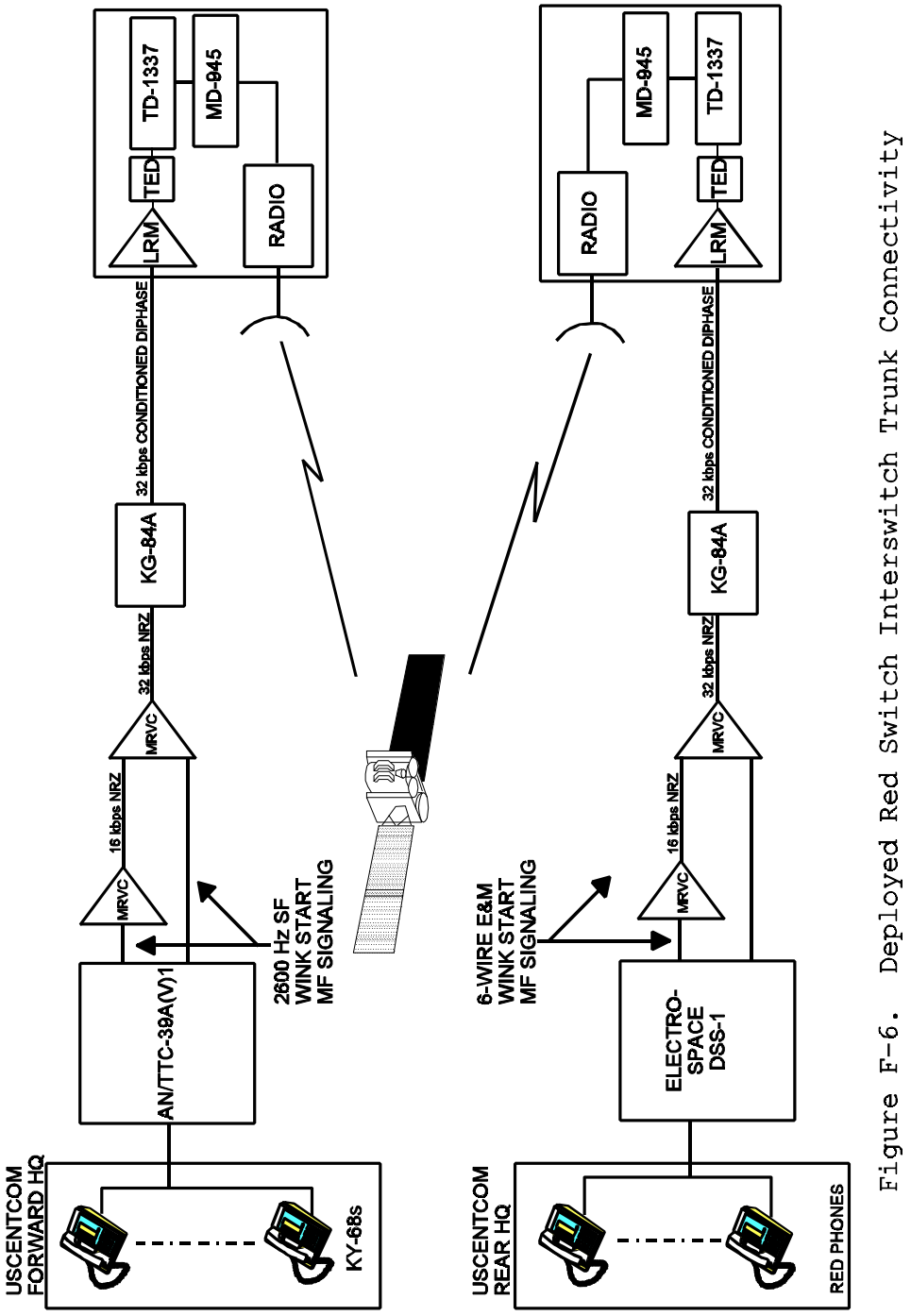


Figure F-6. Deployed Red Switch Interswitch Trunk Connectivity

3. Multiple Rate Voice Card

a. The MRVC is a single card vocoder-multiplexer-echo canceler that operates off a nominal 48 Vdc source.

b. The MRVC provides multiple rate digital voice compression from 2.4 to 64 kbps. The rates are automatically selected to track changes in the aggregate clock rate. Any of the following A/D voice algorithms are used, depending on the voice compression rate.

(1) Mu (μ)-law pulse code modulation (PCM).

(2) Adaptive differential PCM (ADPCM).

(3) Residual excited linear modulation (RELP).

(4) Linear predictive coding (LPC).

c. A zero-overhead two-channel multiplexer allows the multiplexing of voice and data concurrently with no overhead bandwidth or framing information from the transmission equipment. The MRVC user exercises complete control over bandwidth allocation of the composite aggregate data stream (voice or data).

ANNEX B TO APPENDIX F

DRS INTERFACE PLANNING GUIDE

1. Introduction. The following information describes the physical connections necessary for telephone trunks between a DRS and a forward-deployed AN/TTC-39(V). For the purposes of the following discussion, USCENTCOM is used in the example. The interface is 6-wire, analog with E&M supervision an MF signaling at the DRS. At the AN/TTC-39A the interface is 4-wire, analog, SF supervision, and MF nonconfirmation signaling. MRVC cards are used at both the DRS and AN/TTC-39A to provide signaling conversion.

2. Supervision and Signaling Description

a. Idle State. In an idle condition, the following applies:

(1) DRS Side

(a) M-Lead: 0 volts.

(b) E-Lead: -48 volts from the DRS.

(2) AN/TTC-39A Side

(a) TX Pair. 2,600 Hz @ -20 dB from the MFLTU.

(b) RX Pair: 2,600 Hz @ -20 dB from the AN/TTC-39A MRVC.

b. Call Setup (Seize)

(1) USCENTCOM Initiates Call. The DRS initiates a call by sending -48V on the M-lead to the USCENTCOM MRVC. Upon sensing the voltage on the M-lead, the USCENTCOM MRVC sends a digital codeword (seize) to the AN/TTC-39A MRVC. Upon receipt of the codeword, the AN/TTC-39A MRVC removes the 2,600 Hz from its transmit pair. The AN/TTC-39A prepares to receive digits and returns a "wink start" signal to the MRVC by sending an off-hook command (absence of SF) for 200 ms (± 20%), then sending on-hook (2,600 Hz). The AN/TTC-39A MRVC sends a seize acknowledge codeword back to the USCENTCOM MRVC. Upon receipt of this codeword, the UCSCENTCOM MRVC sends -48 V on the E-lead to ground and the

DRS begins to send digits in the following sequence: **KP P X NYX NNXXXXX ST**. (See Table F-1).

Table F-1. AN/TTC-39A(V) Digits

Digit	Definition
KP	Key Pulse: Indicates start of signaling
P	Precedence (FO, F, I, P, R)
X	Transmission Media 0 = Voice Call, Digital Transmission Preferred 1 = Data Call, analog Transmission Media Required
NYX	Area Code: N = 2-9 Y = 0, 1 X = 0-9
NNX	Office Code: N = 2-9 X = 0-9
XXXX	Directory Number: X = 0-9
ST	Indicates the end of digits

(2) AN/TTC-39A Initiates Call. The AN/TTC-39A determines that it must route the call by way of a RED IST and seizes a trunk by sending that trunk a seize (absence of SF) to the AN/TTC-39A MRVC. When the AN/TTC-39A MRVC detects the absence of SF, it sends a receipt of this codeword to the USCENTCOM MRVC. Upon receipt of this codeword, the USCENTCOM MRVC grounds the E-lead, thereby, sending the -48V on the M-lead (seize acknowledge). Then the USCENTCOM MRVC sees the -48V on the M-lead, it generates a digital codeword to the AN/TTC-39A MRVC. When the AN/TTC-39A receives the "wink start," it sends MF digits to the DRS IST in the form: **KP P X NYX NNXXXXX ST**.

c. Call Release

(1) USCENTCOM Releases the Call. Upon call completion, the DRS will stop sending the -48V on the M-lead. When the USCENTCOM MRVC senses this condition, it sends a disconnect codeword to the AN/TTC-39A MRVC. Upon receipt of this codeword, the AN/TTC-39A MRVC sends a release (2,600 Hz @ -8 dB) to the AN/TTC-39A. The

AN/TTC-39A breaks down the connection and sends 2,600 Hz to the AN/TTC-39A MRVC. The AN/TTC-39A MRVC sends an acknowledge codeword to the USCENTCOM MRVC. The USCENTCOM MRVC, upon receipt of this codeword, disconnects the -48V to return, which restores the circuit to an idle condition.

(2) AN/TTC-39A Releases Call. The AN/TTC-39A releases the call by sending 2,600 Hz to the AN/TTC-39A MRVC, which in turn sends a release codeword to the USCENTCOM MRVC.

3. Hardware Requirements for the DRS IST Interface

a. Interface Cable Between the DRS and the USCENTCOM MRVC (Low or High) (Telephony Port). See Table F-2.

Table F-2. DRS Cable Interface

Telephony Port DB-15 (Male)	Connected to:	Description
4	Transmit Patch Cord Tip	Audio Transmit
5	Receive Patch Cord Tip	Audio Receive
7	"E" Patch Cord Tip	E-Lead
8	"M" Patch Cord Tip	M-Lead
12	Transmit Patch Cord Ring	Audio Transmit
13	Receive Patch Cord Ring	Audio Receive
14	"E" Patch Cord Ring	Station Ground
15	"M" Patch Cord Ring	Station Battery

b. Interface Cable Between the AN/TTC-39A and AN/TTC-39A MRVC (Low or High) (Telephony Port). See Table F-3.

Table F-3. Interface Cable AN/TTC-39A and AN/TTC-39A MRVC

Telephony Port DB-15 (Male)	Connected to:	Description
4	Transmit Patch Cord Tip	
5	Receive Patch Cord Tip	
12	Transmit Patch Cord Ring	
13	Receive Patch Cord Ring	

c. Interface Cable Between the Lower MRVC (Aggregate Port) and the Upper MRVC (Data Port) (USCENTCOM or AN/TTC-39A). See Table F-4.

Table F-4. Interface Cable Lower MRVC (Aggregate Port) and Upper MRVC (Data Port)

Data Port (Upper) DB-25 (Male)	System Port (Lower) DB-15 (Female)	Description
2	2	
3	3	
7	25, 14, 18, and 16 Jumpered	
15	24	
17	17	

d. Interface Cable Between the Lower MRVC (System Port) and the Upper MRVC (System Port) (USCENTCOM or AN/TTC-39A). See Table F-5.

e. Interface Cable Between the Upper MRVC (USCENTCOM or AN/TTC-39A) and the Red Switch. See Table F-6.

f. Interface Cable Between the (BLACK Side) and the AN/TTC-39A or USCENTCOM Patch Panel. See Table F-7.

g. KG-84A Setup

(1) Internal Strapping. See Figure F-7.

Table F-5. Lower MRVC and AN/TTC-39A Interface Cable

System Port DB-15 (Female)	System Port (Lower) DB-15 (Female)	Description
3	5	
7	14	
11	9	
12	5	

Table F-6. Upper MRVC and Interface Cable

RED Connector	DB-25 (Female)	Description
1	7 & 1	
6	16	
7	3	
15	25	
16	24	
17	14	
18	2	
20	18	
21	17	
29 and 38 Connected		

Table F-7. AN/TTC-39A and Patch Interface Cable

BLACK Connector	Terminal Strip	Description
4	1	Wire Line Transmit
5	2	Wire Line Transmit Return
7	3	Wire Line Receive
8	4	Wire Line Receive Return
12	3	Receive Data
13	4	Receive Data Return
14	1	Transmit Data
15	2	Transmit Data Return
27, 51, and 52 Connected		

(2) Front Panel Settings. See Figure F-8.

(a) Clock. Set at 2 = Slave.

(b) Data Mode. Set at 3 = DP. Cond (Conditioned diphase).

(c) Data Rate

1. RX. Set at 6B.

2. TX. Set at 6B.

(d) Step Pulse Interval. Set at 1 = Off.

(e) TTY Mode. Set at 1 = Automatic.

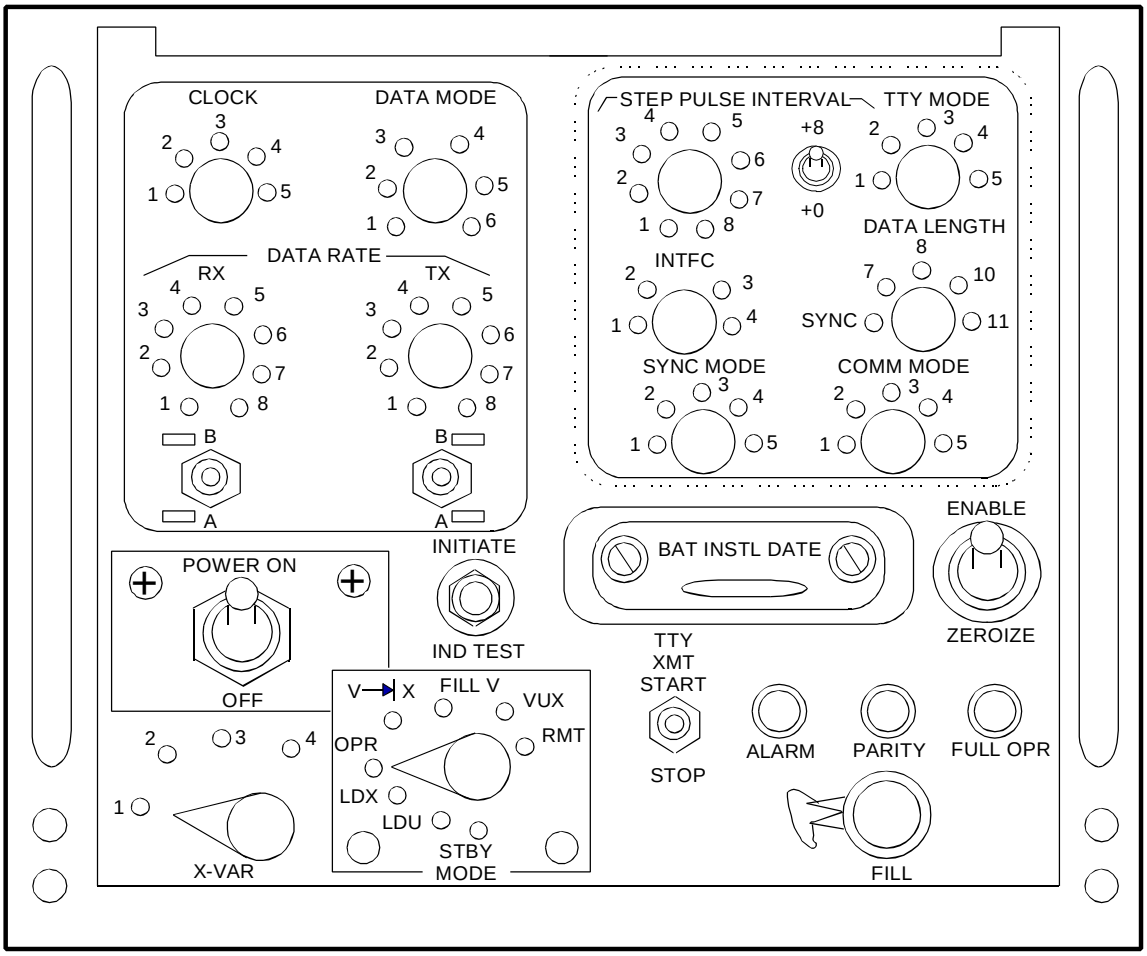
(f) INTFC. Set at 3 = CA-CB.

(g) Data Length. Set at Sync Synchronous.

(h) SYNC Mode. Set at 5 = OP2.

BD Plug		FUNCTION	STRAPPING			
A1	P2 P3	ETCT	□ BAL	J6-J7 J8-J9	■ UNBAL	J6-J7 J9-J10
	P4 P5 P6	XMT CTRL CTTR INTERFACE	□ BAL ■ KG-84A	J12-J13 J15-J16 J17	■ UNBAL □ KG-84	J11-J12 J14-J15 J17B
A2	P2 P3	TCTC	□ BAL	J6-J7 J9-J10	■ UNBAL	J5-J7 J8-J10
	P4	CLKLOCK	□ DSBL	J20-J22	■ ENBL	J21-J22
	P5 P7	CTCD/CTRS	□ BAL	J15-J16 J12-J13	■ UNBAL	J14-J16 J11-J13
	P6	CTCD/CTRS	■ KG-84A	J11-J12	□ KG-84	J17-J18
A5	P2	TIME OUT	□ DSBL	J8-J9	■ ENBL	J9-J10
	P3	VUX	□ DSBL	J5-J7	■ ENBL	J5-J6
	P4	FILL SELECT	■ KG-84A	J11-J12	□ KG-84	J12-J13
A6		UPDATE	■ ENBL	J7-J8	□ DSBL	J8-J9
A9	P2 P3	RED I/O	□ BAL	J14 J15	■ UNBAL	J6 J7
	P4	STEP PULSE	□ SGL	J8-J9	■ DBL	J9-J10
	P5	TX CLOCK	■ CONT	J11-J12	□ GATED	J12-J13

Figure F-7. KG-84 Internal Strapping



CLOCK
- 1 - MASTER
- 2 - SLAVE
- 3 - STA SLAVE
- 4 - STA MA 1
- 5 - STA MA 2

DATA MODE
- 1 - BB. COND
- 2 - BB. NONCOND
- 3 - DP. COND
- 4 - DP. NONCOND
- 5 - WL COND
- 6 - WL NONCOND

STEP PULSE INTERVAL

+0	+8
1 - OFF	9
2 - 2	10
3 - 3	11
4 - 4	12
5 - 5	13
6 - 6	14
7 - 7	15
8 - 8	16

TTY MODE
- 1 - AUTO
- 2 - MAN
- 3 - UNFR.
- 4 - SPLX (INT)
- 5 - SPLX (EXT)

INTFC
- 1 - OFF
- 2 - CA
- 3 - CA- CB
- 4 - CB

RX/TX DATA RATE

A	B
1 - 50	2.4K
2 - 75	4.8K
3 - 100	8.0K
4 - 110	9.6K
5 - 150	16K
6 - 300	32K
7 - 600	EXT 32DR
8 - 1200	EXT DR

TX 6B
RX 6B

DATA LENGTH
- SYNC - SYNCHRONOUS DATA
- 7 - BAUDOT
- 8 - BAUDOT
- 10 - ASC II
- 11 - ASC II

SYNC MODE
- 1 - RED
- 2 - RED (A/S)
- 3 - N.R.
- 4 - N.R. (A/S)
- 5 - OP2

COMM MODE
- 1 - DX
- 2 - INDEP.
- 3 - TX
- 4 - RX
- 5 - SPLX

Figure F-8. KG-84A Front Panel Settings

(i) COMM Mode. Set at 1 = DX (duplex).

(j) X-Var. Set at 1.

(k) STBY Mode. Set at OPR.

h. MRVC Programming

(1) General. The MRVC cards are used to convert the 6-wire E&M signaling that the DRS uses to produce a digital signal suitable for transmission and then convert the digital signal back to a 4-wire SF signal suitable for interface with the AN/TTC-39A. The MRVC cards and the KG-84As used to secure trunks must be kept at the switches to ensure the security of the trunk.

(2) AN/TTC-39A Programming

(a) Lower MRVC Programming. This MRVC takes a single Red Switch IST from the AN/TTC-39A and converts it from 4-wire to RS-232, see Figure F-9.

(b) Upper MRVC Programming. This MRVC takes a single Red Switch IST from the AN/TTC-39A, converts it from 4-wire SF into RS-232, and combines it with the output of the lower MRVC to produce a 32 kbps/RS-232 output, see Figure F-10.

(3) DRS MRVC Programming

(a) Lower MRVC Programming. This MRVC takes a single Red Switch IST from the DRS and converts it from 6-wire into RS-232, see Figure F-11.

(b) Upper MRVC Programming. This MRVC takes a single Red Switch IST from the DRS and converts it from 6-wire into RS-232 and combines it with the output of the lower MRVC to produce a 32 kbps/RS-232 output, see Figure F-12.

4. AN/TTC-39A Interface and Programming. (See Appendix D for details on the planning commands and worksheets.)

a. MFLTU. Terminate the DRS trunks on an MFLTU (2 circuits per card).

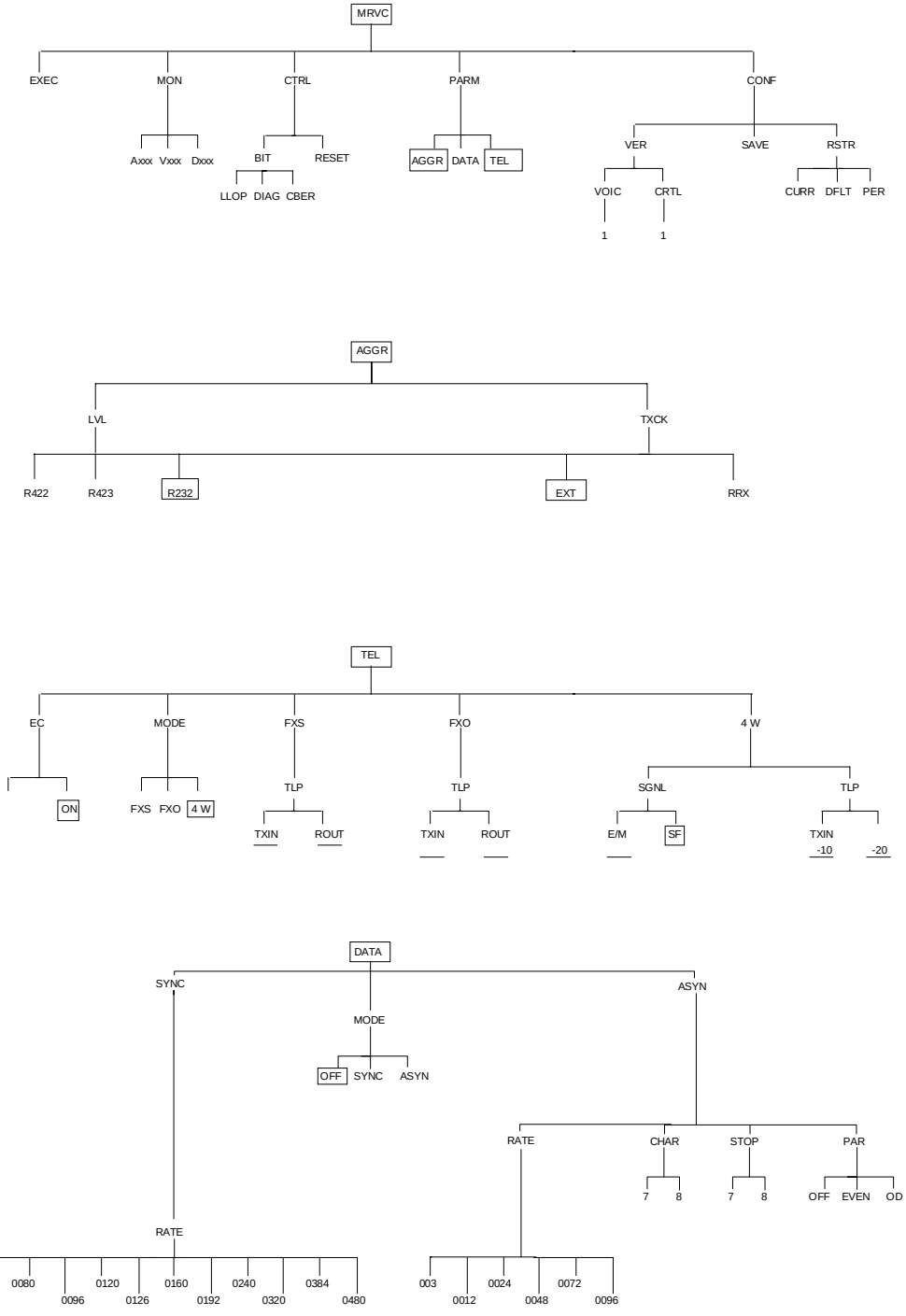


Figure F-9. MRVC Programming, AN/TTC-39A Lower MRVC

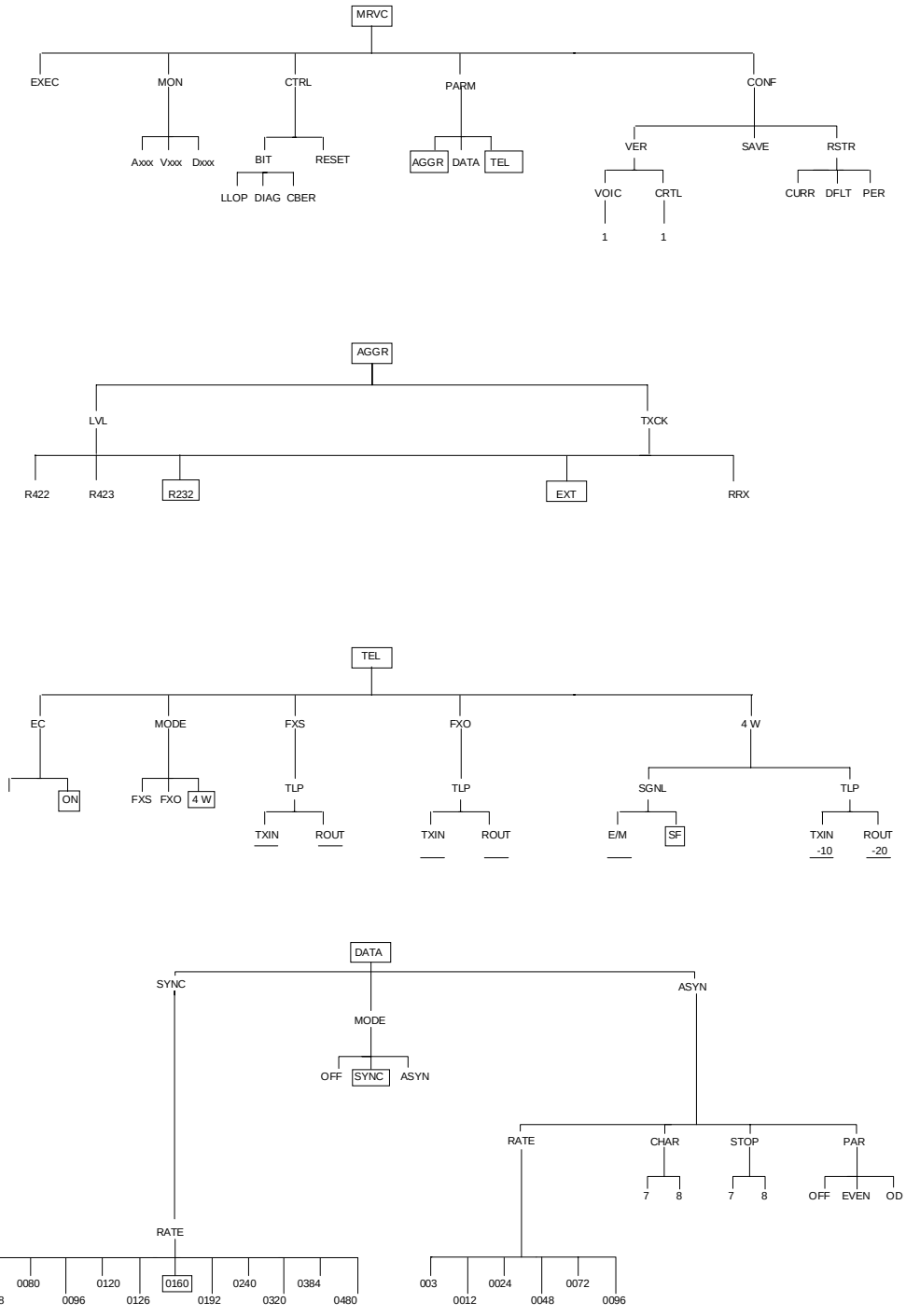


Figure F-10. MRVC Programming, AN/TTC-39A Upper MRVC

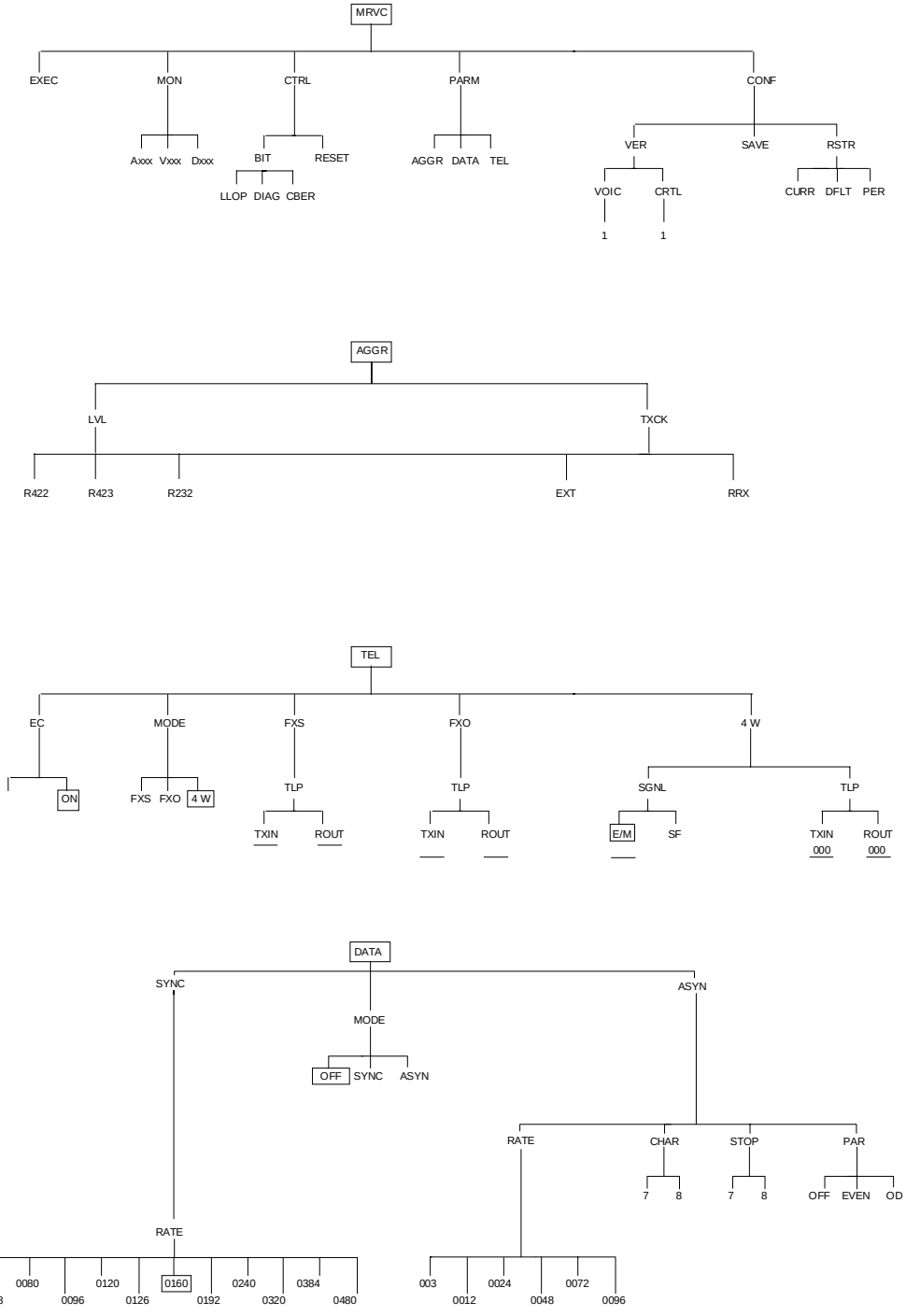


Figure F-11. MRVC Programming, Red Switch Lower MRVC

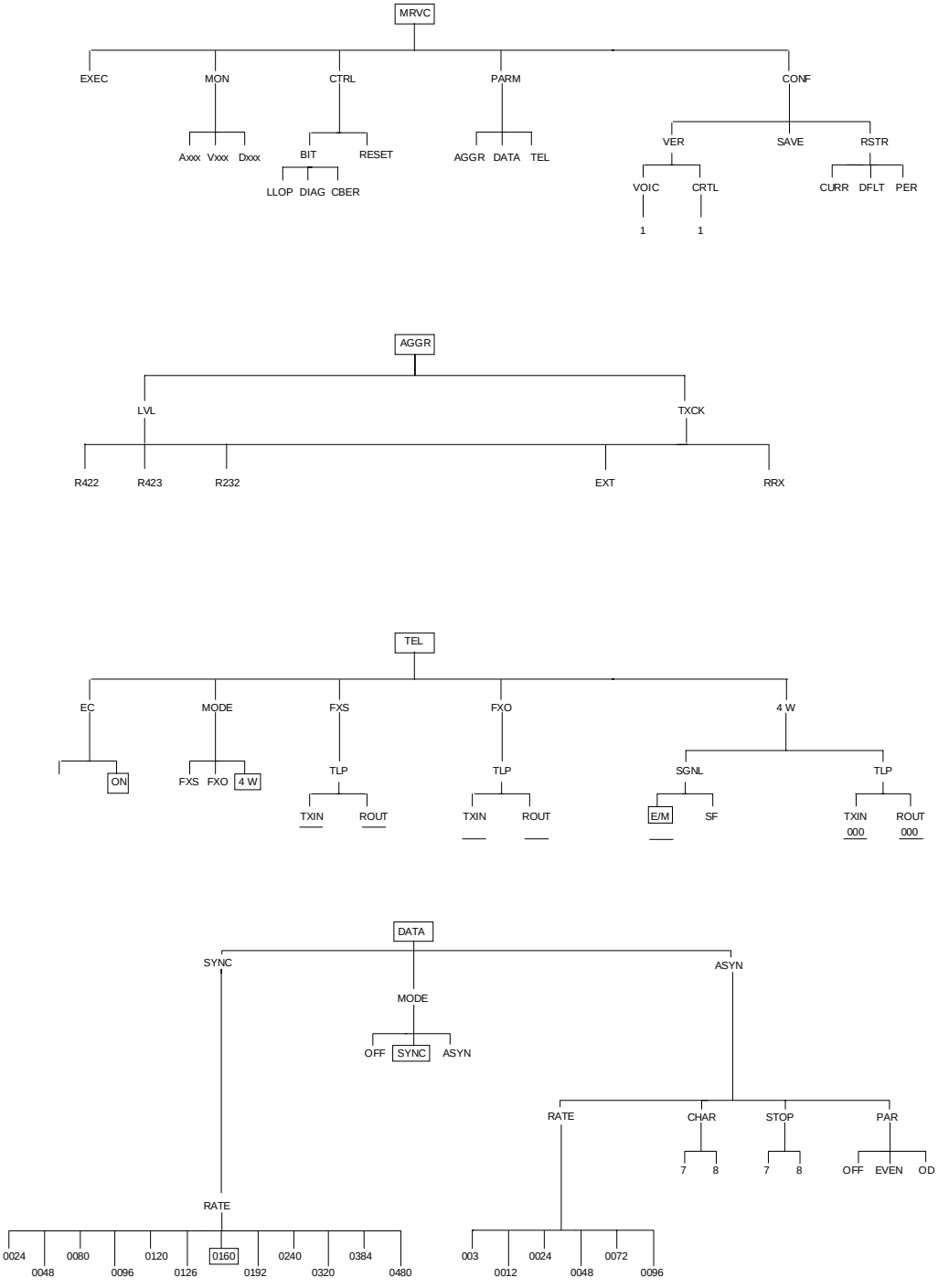


Figure F-12. MRVC Programming, Red Switch Upper MRVC

b. Assign Trunk Group Cluster

(1) Action. Enter A = Add for a new TGC.

(2) Trunk Group Cluster Number. Enter 1-127 from OPORD.

(3) Type of TGC. Enter O = Other.

(4) Spill Foward. Enter Y = Yes.

(5) Destination NYX. Enter 800.

(6) Zone Restriction. Enter 0.

(7) Access Trunk Group. Enter Y = Yes if only one route into the Red Switch.

(8) Traffic Limitations. Enter Y = Yes or N = No.

(9) Flash, Immediate, Priority, and Routine. Entry only if Traffic Limitations is set to Y.

c. Assign Terminal Service (ATS)

(1) Action. Enter A = Add.

(2) Terminal Address. Enter XX-XX of first channel in TGC.

(3) Terminal Type. Enter 36.

(4) TGC Number. Enter TGC number defined in ATG.

(5) Path Delay. Enter 0.

(6) Satellite Trunk. Enter Y = Yes or N = No.

(7) In/Out of Service. Enter I = In.

(8) Adapter Number. Enter 1-36.

(9) Dedicated Echo Suppressor. Enter 0.

(10) Transmission Type. Enter AS = Analog Secure.

d. AVL

(1) Mode. Enter A = Add.

(2) COMSEC ID. Enter 2-10.

(3) Dir No. Enter 800.

(4) Type. Enter AIRV.

e. ANY

(1) Mode. Enter A.

(2) NYX Code. Enter 812.

(3) Home/Foreign Classmark. Enter F = Foreign.

(4) TGC Number. Enter TGC number of Red Switch ISTs.

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ANNEX C TO APPENDIX F

TACTICAL SWITCH TO DEFENSE RED SWITCH NETWORK VIA AN/FCC-100(V)7 ADPCM CARD

1. Background. During the recent Deployed Internetworking Test (DIT) conducted by the Joint Interoperability Test Command (JITC), tests were conducted on the interface between a tactical switch and a Defense Red Switch Network (DRSN) switch via AN/FCC-100(V)7s using Adaptive Differential Pulse Code Modulation (ADPCM) cards. This annex provides an overview of the ADPCM algorithm, diagrams the test configuration, lists equipment settings and strapping options, provides cabling information, and discusses test methodology and results.

2. ADPCM Overview. ADPCM encompasses a family of speech compression and decompression algorithms. As opposed to Pulse Code Modulation (PCM), which quantizes speech signals directly, the ADPCM algorithm quantizes the difference between the speech signal and a prediction that has been made of the speech signal. If the prediction is accurate then the difference between the real and predicted speech samples will have a lower variance than the real speech samples, and will be accurately quantized with fewer bits than would be otherwise needed. The "adaptive" portion of ADPCM refers to the action of the circuit components in adapting to the changing statistics of the prediction residual, resulting in greater accuracy. The ADPCM module available for the AN/FCC-100(V)7 uses 32 kbps ADPCM techniques, converting 64 kbps A- or μ-law PCM channels to 32 kpbs and vice-versa. The ADPCM process generates 4-bit words; therefore, 16 specific bit patterns are generated. Figure F-13 is a simplified block diagram of the ADPCM process at the transmitting end.

3. Test Configuration

a. The end-to-end test configuration is depicted in Figure F-14. A Tellabs 6047A 4-wire single frequency (SF) to E&M converter was between the DRSN switch and the AN/FCC-100(V)7. This unit provides, in addition to bi-directional signal conversion, impedance matching, level control, and amplitude equalization. The 6047A converted the E&M signaling on the DRSN switch interface to SF signaling on the AN/FCC-100(V)7 interface.

b. The ADPCM card utilized port 5 of the AN/FCC-100(V)7. Each ADPCM module is capable of handling two ADPCM voice channels. Although the ADPCM encoding is at 32 kbps, the aggregate bandwidth of the module is 64 kbps even if one channel is not utilized. The ADPCM module may be placed into any desired port slot in the AN/FCC-100(V)7 chassis.

4. Detailed Connectivity. Figures F-15 and F-16 illustrates the cable connectivity between the DRSN switch and the Tellabs 6047A, and between the 6047A and the AN/FCC-100(V)7. Figures F-17 and F-18 show the back-to-back cable connectivity between the two AN/FCC-100(V)7s, and between the AN/FCC-100(V)7 and the AN/TTC-39D.

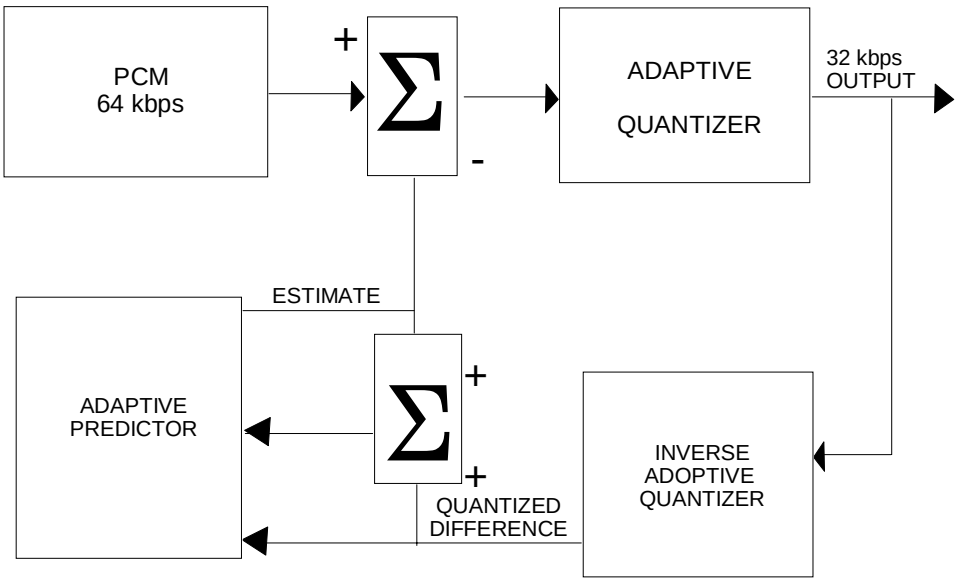

Figure F-13. Block Diagram of ADPCM Process

5. Equipment Configurations. Figure F-19 shows the switch settings used for the Tellabs 6047A, for Type I/III E&M operation. The ADPCM card settings are shown in Table F-8.

6. Test Procedures and Results

a. Testing of the interface consisted of making ten call attempts in each direction (DRSN subscriber to tactical subscriber and tactical subscriber to DRSN subscriber).

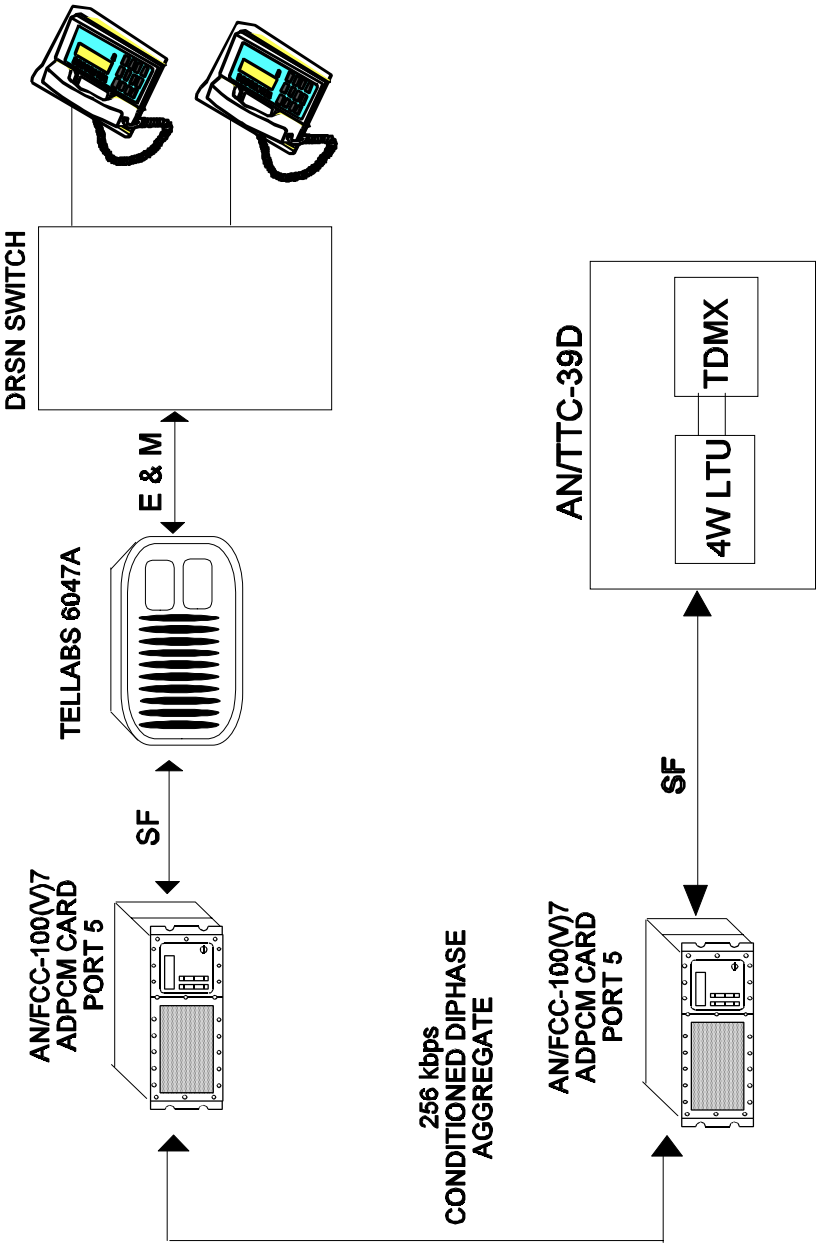

Figure F-14. Overall Test Configuration

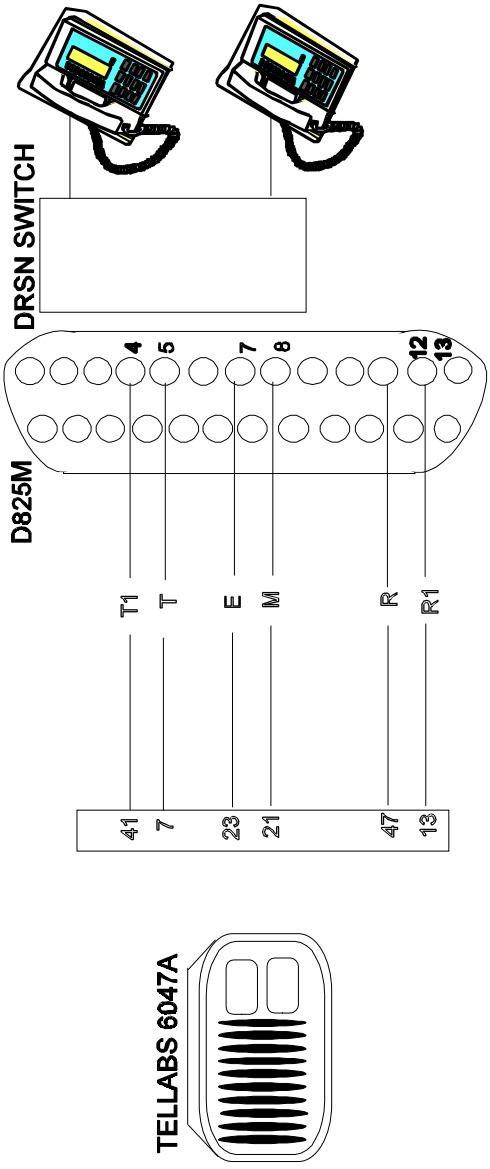

Figure F-15. DRSN Switch to Tellabs Cable Connectivity

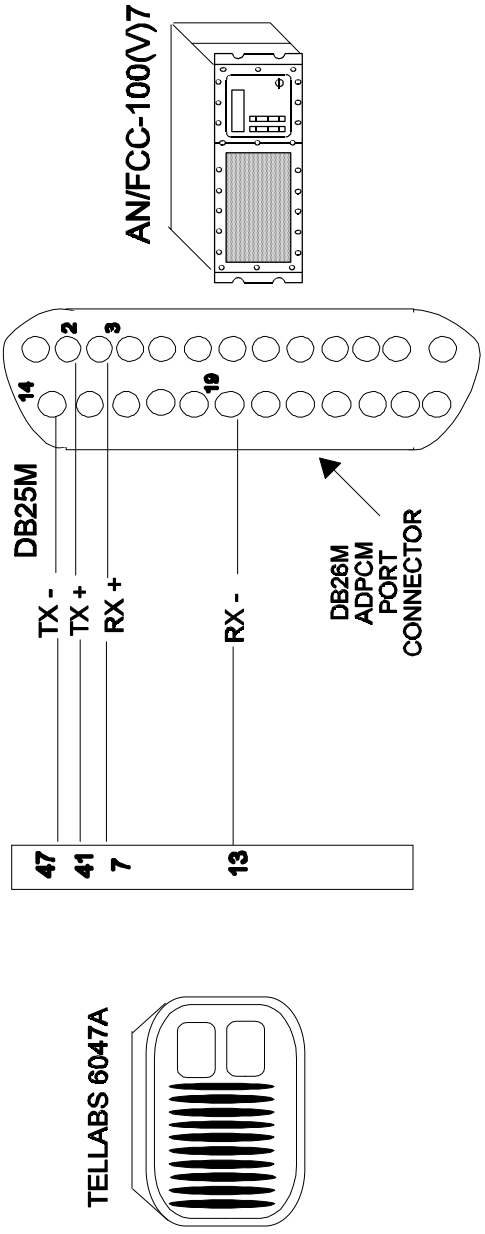

Figure F-16. Tellabs to AN/FCC-100 (V)7 Cable Connectivity

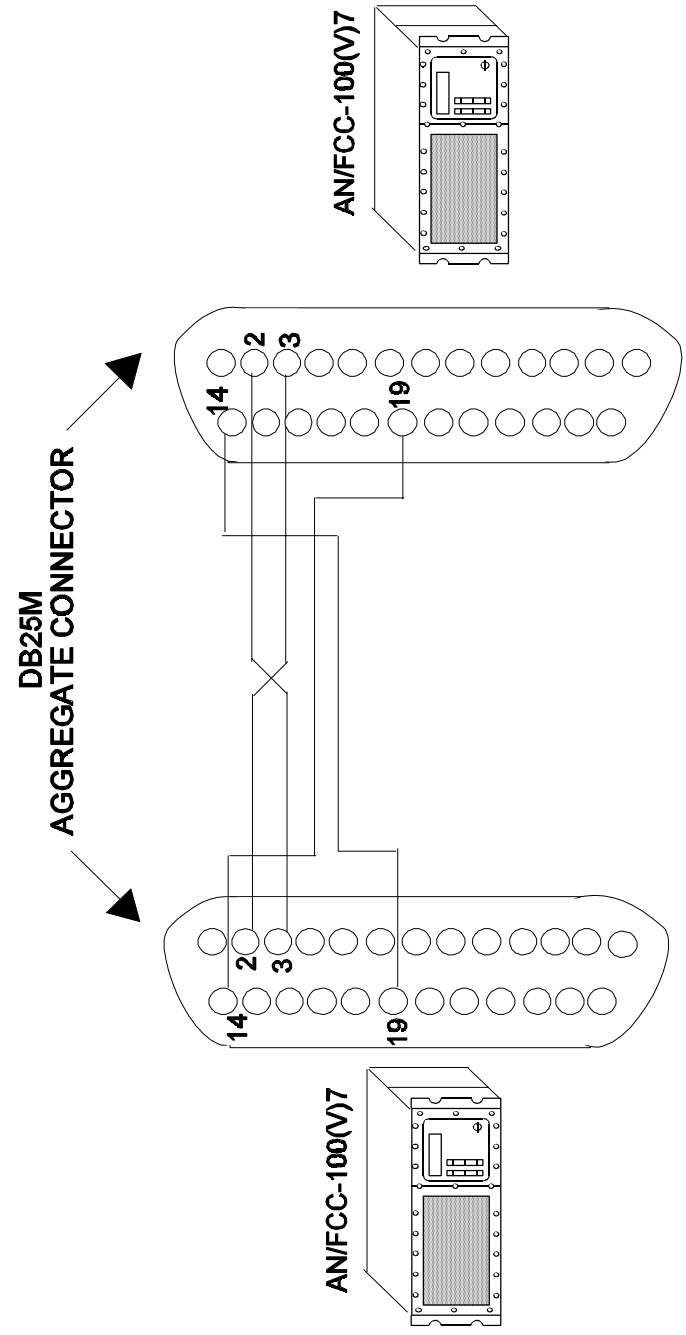

Figure F-17. AN/FCC-100(V) Back-To-Back Connectivity

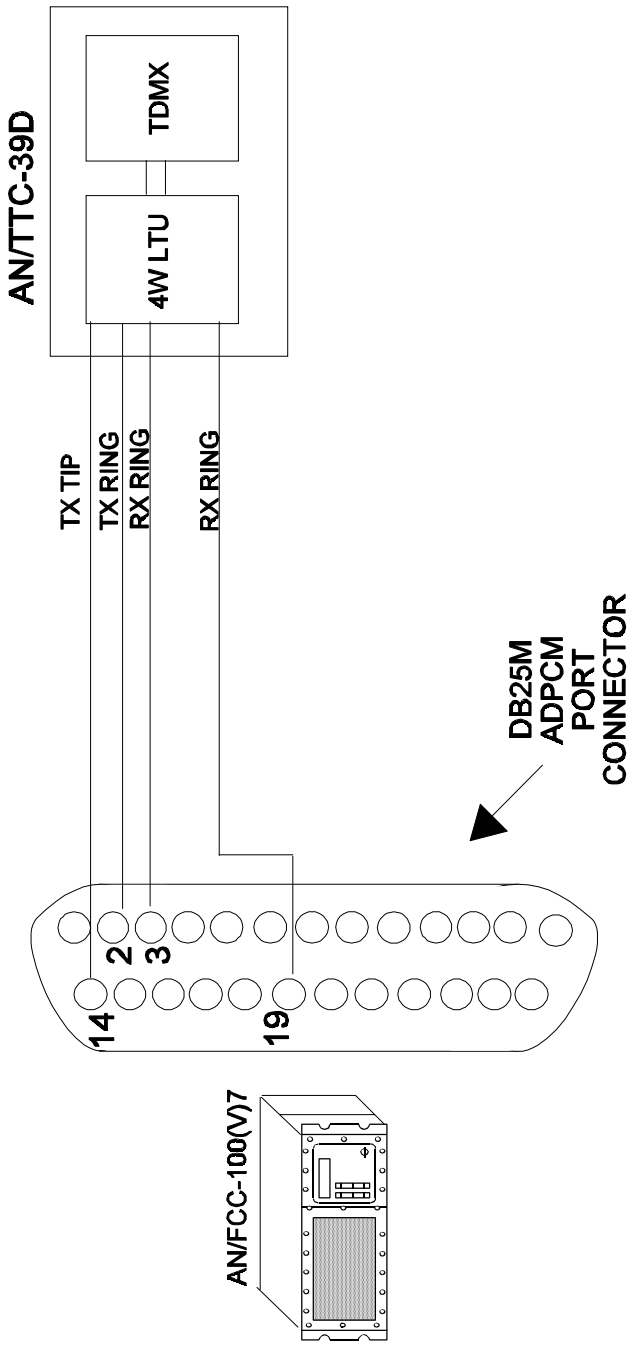

Figure F-18. AN/FCC-100(V) to AN/TTC-39D Cable Connectivity

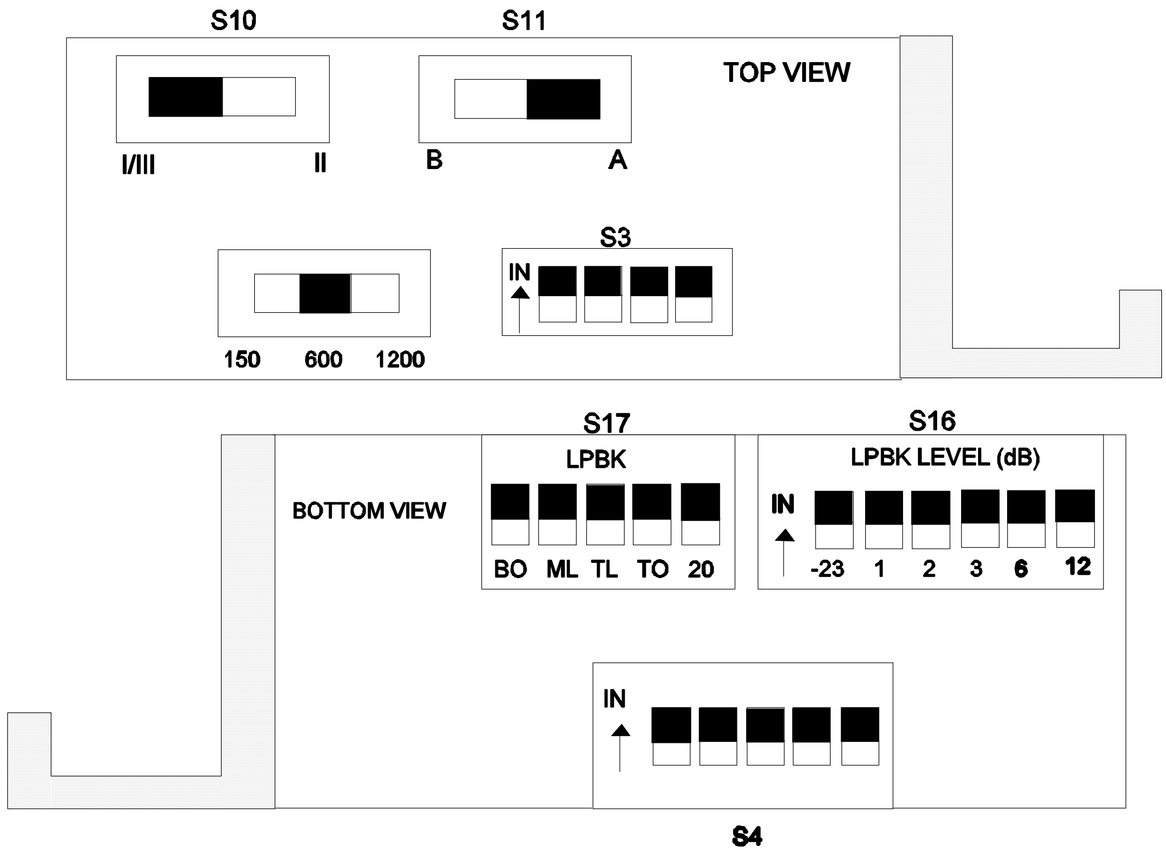

Figure F-19. Tellabs 6047A Switch Locations and Settings for Type I/III E&M Operation

Each call was held long enough to confirm full-duplex voice connectivity. Thirty seconds were allowed between release of a connected call and establishment of the next call.

b. Preemption calls were attempted a total of 16 times in each direction. Each of the four preemption types below was attempted four times in each direction.

(1) Preemption for re-use, answered

(2) Preemption for re-use, unanswered

(3) Preemption not for re-use, answered

(4) Preemption not for re-use, unanswered

c. Tables F-9 through F-12 below provide call attempt, completion, and preemption results. In all areas tested, the ADPCM card provided an interoperable voice interface between the DRSN switch and the tactical circuit switch network.

Table F-8. ADPCM Settings and Descriptions

SETTING	DESCRIPTION
ADPCM	Sets the port ADPCM. Both TX and RX are 4-wire VF analog signals with a 300 to 3000 Hz bandwidth. The port converts the analog signal to a synchronous digital signal for transmission
Equirate	Sets the ADPCM port TX and RX rates to the same rate
64k per card	Card operates only at 64 kbps
0/0 DB	Sets the nominal TX and RX levels to 0dBm in and 0dBm out
DIS-SIG	Disables the ADPCM port E&M signaling

Table F-9. Call Success Rate

	CALLS ATTEMPTED	CALLS COMPLETED	PERCENTAGE COMPLETED
Red Switch to AN/TTC-39D	10	10	100%
AN/TTC-39D to Red Switch	10	10	100%

Table F-10. Voice Quality Rating

	EXCELLENT	GOOD	FAIR	POOR	UNUSABLE
Red Switch to AN/TTC-39D	10				
AN/TTC-39D to Red Switch	10				

Table F-11. Call Release Rate

	CALLS COMPLETED	CALLS COMPLETED	PERCENTAGE RELEASED
Red Switch to An/TCC-39D	10	10	100%
AN/TTC-39D to Red Switch	10	10	100%

Table F-12. Preemption Success Rate

	PREEMPTIONS ATTEMPTED	PREEMPTIONS COMPLETED	PERCENTAGE COMPLETED
Red Switch to AN/TCC-39D	16	16	100%
AN/TTC-39 to Red Switch	16	16	100%

APPENDIX G

SECURE TELEPHONE TERMINALS INTERCONNECTION

1. Introduction. This appendix summarizes information for the interconnection of the STU-III and STSVT (MMT) with the AN/TTC-39 series of tactical circuit switches. The information is based on the tests conducted by Air Force communications units in 1990 and 1991. Additional information on the STU-III and STSVT can be found in Appendix C.

2. STU-III Capabilities and Limitations via Multiple CVSD Conversions. This test was conducted by the 5th Combat Communications Group. The primary purpose of the test was to determine if 16 kbps TRI-TAC channels would sustain STU-III secure voice calls under various conditions. A secondary goal was to determine the limitations imposed on STU-III operation when multiple CVSD conversions at the 32-kbps sampling rate are used. The equipment tested was a Motorola SECTEL 1000, a STU-III capable of 2-wire (full/half duplex) or 4-wire DSN (full/half duplex). The SECTEL is RS-232C/RS-449 compatible and operates synchro-nously at 2,400 baud. Asynchronous rates of 300, 1,200, and 2,400 baud are also available. The speech processor uses the Linear Predictive Coding-10 (LPC-10) algorithm. The modem operates at 2,400 baud with an adjustable output level from 0 to -12 dBm. The test was conducted in two phases.

a. Phase I-In Garrison Bench Top Tests. In this phase, RMCs were used to determine the performance limits of the STU-III when passed through multiple CVSD conver-sions in a laboratory environment.

(1) The Phase I tests were initially conducted in a point-to-point configuration using two RMCs connected by a short length of CX-11230 cable. (See Figure G-1.) A terminating unit STU-5A was installed at each end to provide 20-Hz ringing for the STU-IIIs. The more significant results of the in-garrison tests were:

(a) STU-IIIs failed to go secure when exceeding two 16-kbps CVSD conversions.

(b) 32-kbps point-to-point secure calls were successful at up to five CVSD conversions.

(c) Transfer of data using the STU-III data port failed altogether at the 16-kbps sampling rate, but was successful at up to three CVSD conversions at 32 kbps.

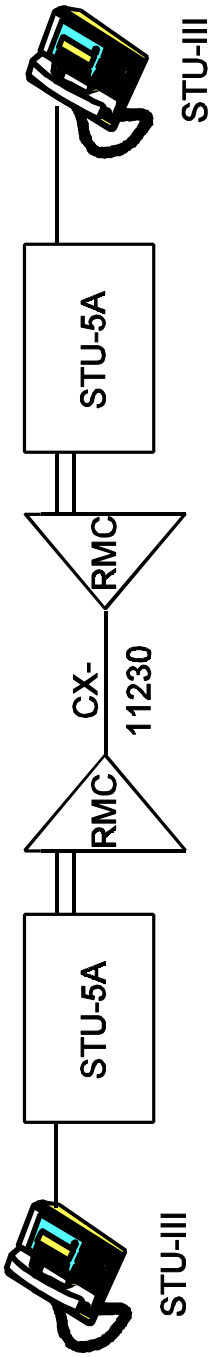

Figure G-1. STU-III In-Garrison Point-To-Point Test Configuration

(2) After completion of the point-to-point tests, the configuration was changed to reflect one STU-III as a subscriber off the Robins AFB DCO, extended (remoted) via RMCs and STU-5As. (See Figure G-2.) The more significant results of this test were:

(a) Secure calls placed to DSN subscribers were successful through one 16-kbps conversion.

(b) At the 32-kbps rate, secure voice calls to DSN subscribers were successful through two CVSD conversions.

(c) Degradation of the STU-5A SF supervision tone (2,600 Hz) to the point of being unusable was observed after attempting two 16-kbps conversions.

b. Phase II-Field Deployment Tests. These tests were used to evaluate STU-III operation using tandem tropo-scatter links and tandem satellite links with up to two complete CVSD conversions. The configuration for this test is depicted in Figure G-3. For these tests only 32 kbps was used as the Phase I tests showed that 16 kbps provided only marginal performance. The significant test results were:

(1) STU-III via Single Tropo Link. Internodal STU-III secure voice calls were repeatedly successful via a single AN/TRC-170 tropo link. The AN/TTC-39A(V)1s IMUs provided the 32-kbps CVSD conversions.

(2) STU-III via Single Satellite Link. Internodal secure voice calls were repeatedly successful using one 32-kbps CVSD conversion.

(3) Tactical STU-III to Strategic STU-III via DCS Entry Satellite. Secure voice calls were repeatedly successful with one 32-kbps CVSD conversion.

(4) Tactical STU-III to Strategic STU-III via Tropo Link and DCS Satellite Link. Secure voice calls were repeatedly successful with two complete 32-kbps CVSD conversions.

(5) Tactical STU-III to Strategic STU-III via Tandem TACSAT and DCS Satellite Links. Secure voice calls were only marginally successful because two tries were necessary before the STU-IIIs achieved synchronization in the secure mode.

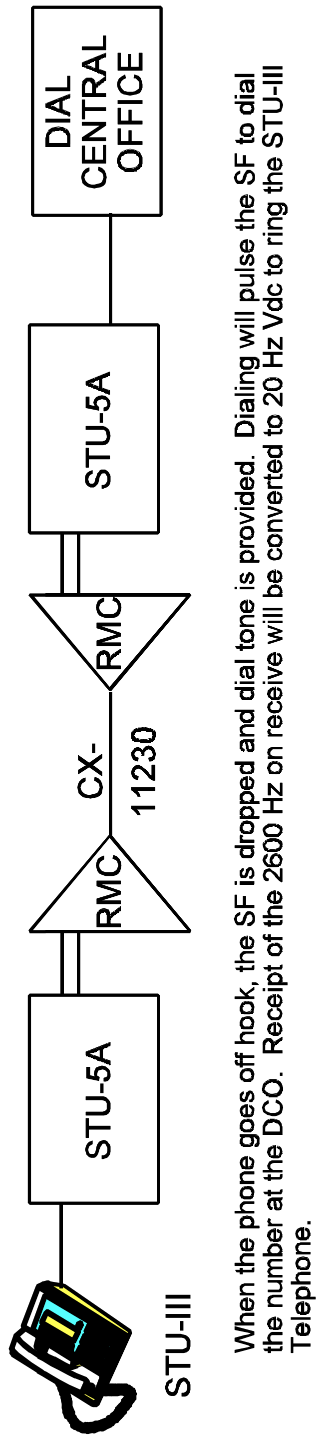

Figure G-2. STU-III In-Garrison Dial Central Office Test Configuration

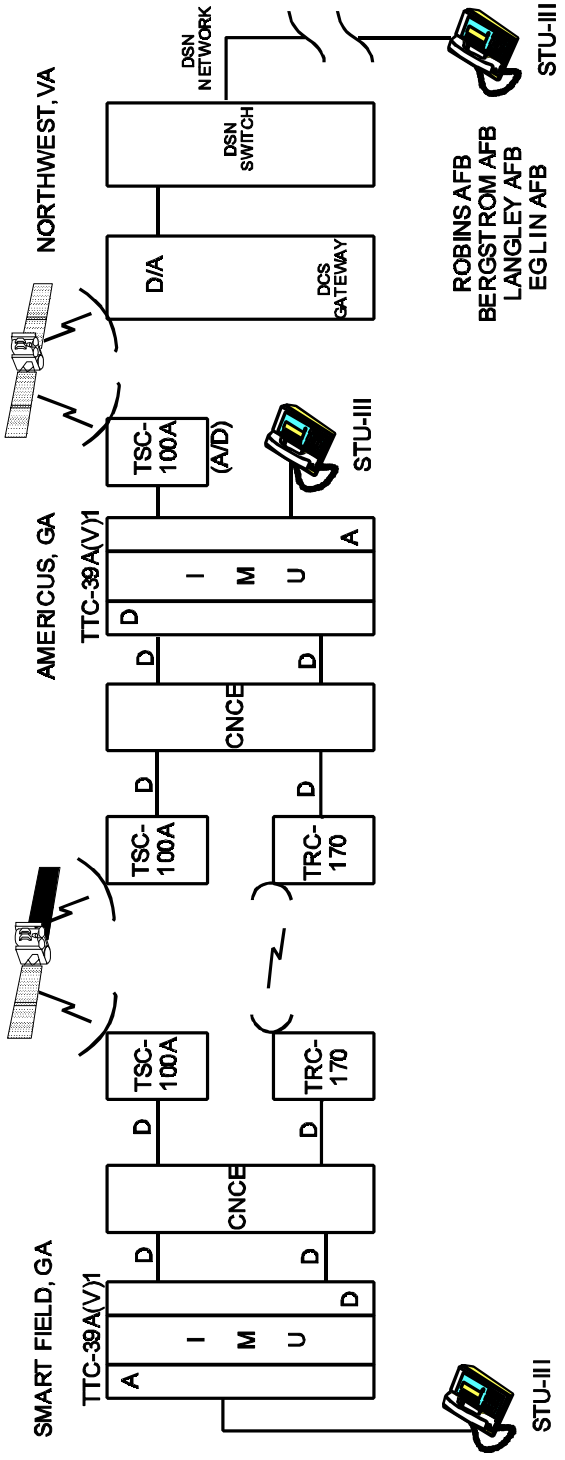

Figure G-3. STU-III Field Deployment Tests Configuration

c. Conclusions

(1) A 16-kbps CVSD channel rate will not sustain STU-III secure voice calls. Although it may be possible to establish calls via a single 16-kbps tactical channel, the DSN access channel must operate at 32 kbps.

(2) DSN access trunks will not function at the 16-kbps CVSD rate. The 2,600-Hz SF tone used for supervision on the DSN trunks is so severely degraded by the 16-kbps processing, the trunk is rendered inoperable. Figure G-4 illustrates a possible solution to this problem using LTUs to digitize DSN lines at the DCS gateway. Using LTMs would also improve the STU-III DCS connectivity into DSN.

3. STU-III Operation Via Digital Multiplexed Groups. In the past, STU-III tactical connectivity was primarily by a 2-wire analog loop terminated on an AN/TTC-39A(V)1 SDSG. The 32th CCSQ conducted a series of tests to support STU-III connectivity via digital multiplexed groups. Although the AN/TTC-39A(V)1 is capable of supporting 4-wire analog telephones using a DTG formed by DGM equipment, the DGM equipment does not support 2-wire terminations. The STU-5M signaling and terminating unit was utilized as a potential temporary solution to this requirement.

a. Test Conduct and Results

(1) The initial test configuration involved the use of two STU-5Ms, which were connected to an AN/TTC-39A(V)4 and to a STU-III on the 2-wire side and connected back-to-back on the 4-wire side. (See Figure G-5.)

(a) The STU-5M connected to the AN/TTC-39A(V)1 was configured for a DCO interface and the second unit configured for a STU-III (2-wire analog) interface. The AN/TTC-39A(V)1 was classmarked as a Type 8 loop (2-wire, DTMF signaling). The SF level was set at -20 dBm, and the transmit and receive tone levels were adjusted to the best listening levels, as shown below.

1. STU-5M Switchside Transmit = 1,004 Hz @ -10 dBm.

2. STU-5M Switchside Receive = 1,004 Hz @ -10 dBm.

3. STU-5M Phoneside Transmit = 1,004 Hz @ -10 dBm.

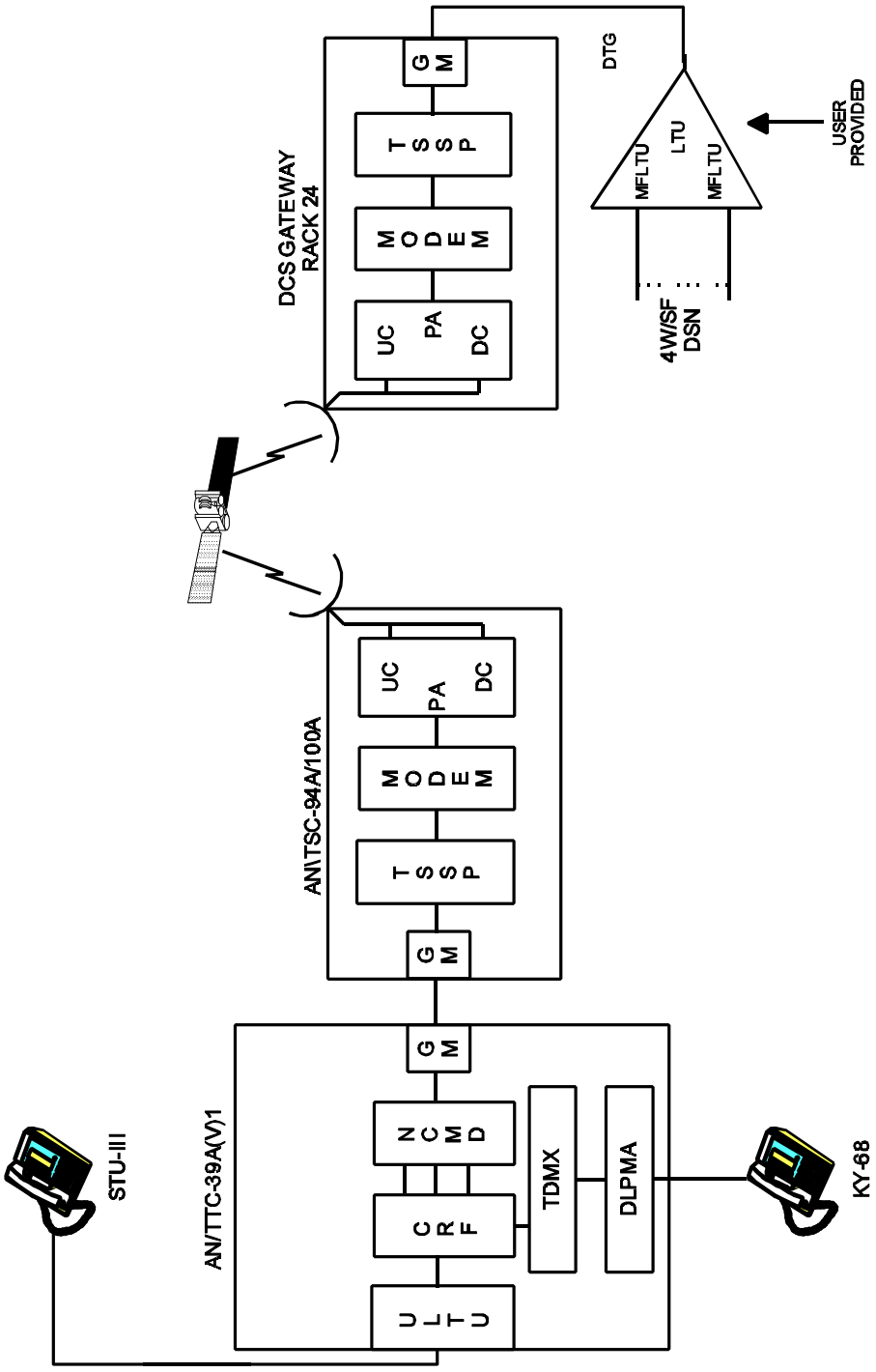

Figure G-4. Use of Remote Digital Multiplexer and LTUs for DSN Access at 16 kbps

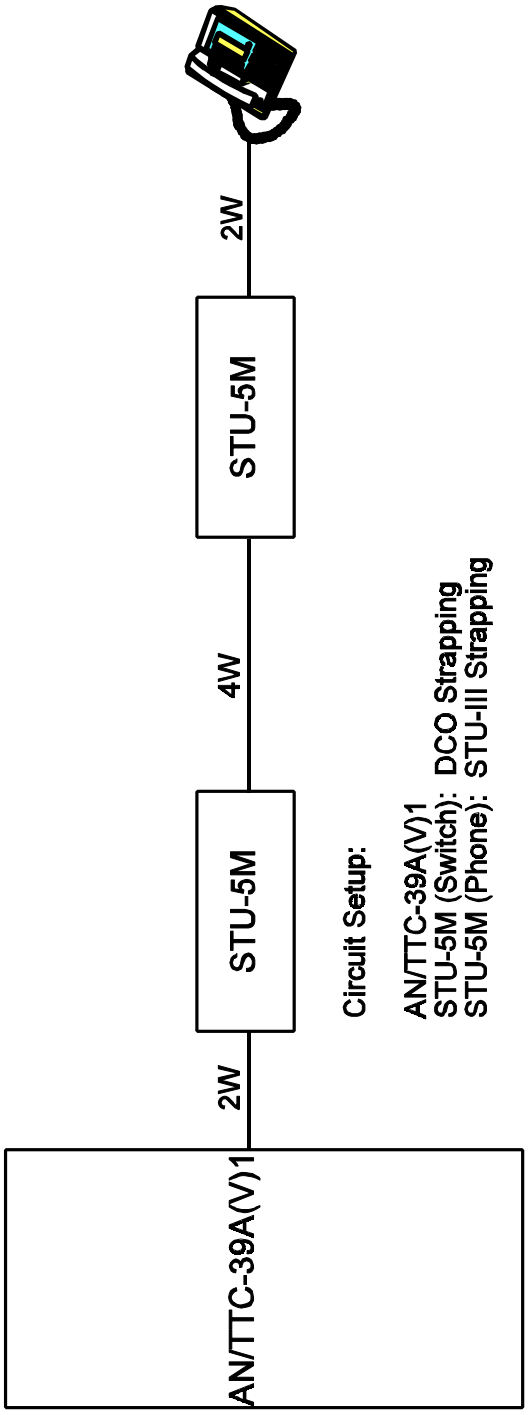

Figure G-5. Initial Test Configuration

4. STU-5M Phoneside Receive = 1,004 Hz @ -13.4 dBm.

(b) In this configuration the STU-III was able to dial through the switch; however, the switch was unable to complete calls to the STU-III. On calls to the STU-III, the instrument making the call dropped to a busy tone after dialing. It was concluded that the AN/TTC-39A(V)1 was sensing an immediate off-hook condition from the STU-III and returning busy tone to the caller.

(2) The test configuration was changed by adding resistance on the STU-5M Switchside using a decade resistance box. Through trial and error, it was determined that the optimum resistance was determined to be 1,200 ohms.

(3) The final test configuration is depicted in Figure G-6 and consisted of a STU-III/STU-5M combination providing a 4-wire analog input to an Air Force "Mini-Mux" assemblage. The Mini-Mux is a portable, DGM assemblage developed by the Air Force. The configuration also included a radio link over a Tropo-Satellite Support Radio (TSSR) to an RMC at the AN/TTC-39A(V)1. This config-uration provided satisfactory performance, with calls being consistently completed in both directions. The loop resistance, however, had to be increased to 1,600 ohms to provide satisfactory operation. This change is suspected to be due to the individual characteristics of each STU-5M.

4. Echo Canceling on STU-III Satellite Circuits. One of the potential problem areas involving use of the STU-III is the generation of echoes when transmission is via GMF satellite. The inherent path delay sometimes causes echoes that are returned to the local user from 0.5 to 1.0 seconds after speaking. The degradation caused by these echoes can range from minor irritation to the inability to synchronize in the secure mode. These echoes can be eliminated from most connections by using an echo canceler. The 123/124 Tactical Control Squadron conducted a series of tests using the STU-III with a 4119S echo canceler over an AN/TSC-94A GMF link. (See Figure G-7.)

a. 4119S Echo Canceler. The 4119S is an adaptive, split-type canceler intended for use near the end points of a 4-wire transmission facilities. The unit is designed to effectively cancel echoes caused by signal reflections from impedance mismatches and 2- to 4-wire connections. The term "split-type" means a 4119S used at one end of the circuit protects the opposite end from undesirable echoes,

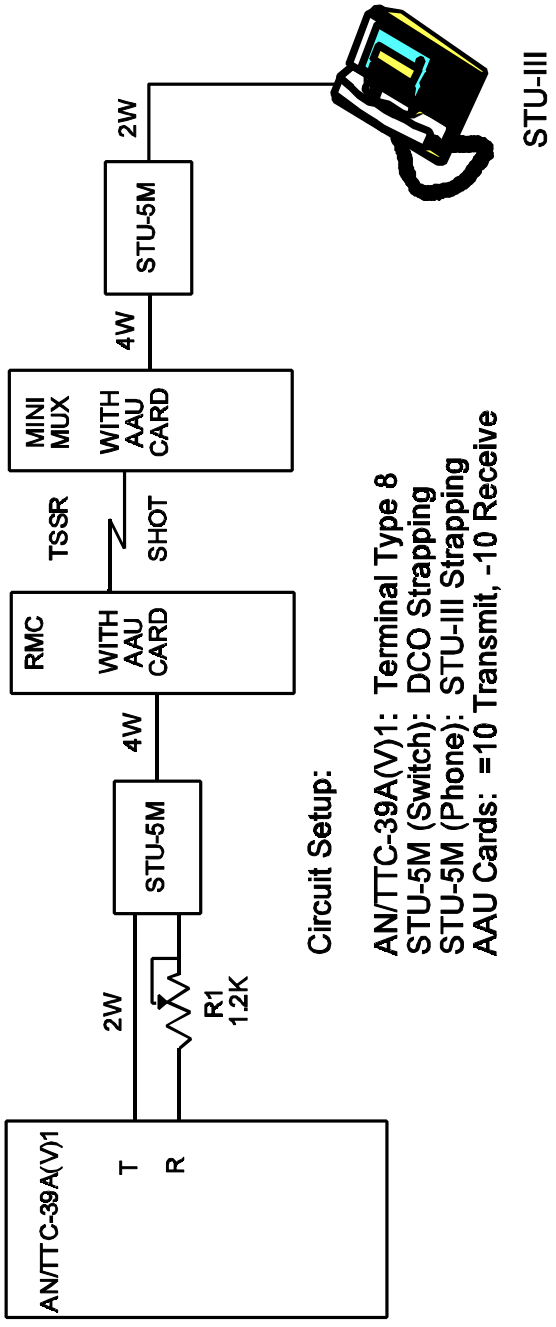

Figure G-6. STU-III Over Digital Multiplexed Group

requiring a canceler be used at both ends of the circuit. The canceler contains an integral tone disabler which, upon detection of a 2,100 Hz tone, disables all echo control circuitry. This renders the module transparent in both directions for the purpose of data transmissions. It also contains a tone disable circuit which disables all echo cancellation functions during the presence of 2,600 Hz SF signaling tones. This allows the 4119S to be used on circuits in which the SF tone is on during idle in one or both directions.

b. Test Conduct and Results. Referring to Figure G-7, tests were initially performed with the 4119S set to the DISABLE mode to provide a baseline for further tests. During this phase, calls were made from the tactical STU-III to a STU-III off a DCO. During baseline testing a pronounced echo was experienced at the tactical STU-III and a mild echo at the DCO STU-III. When the 4119S was first turned on (ENABLED) the echoes were still present. After adjusting the precision attenuators for a minimum 6 dB loss between the transmit signal and the returning echo, the echoes disappeared with no voice quality degradation. The ability to synchronize the STU-IIIs was tested and full-duplex synchronization was achieved on the first attempt. Tests were then made via the local DCO to a STU-III located at Homestead AFB, FL. After adjusting the 4119S, as noted above, normal conversations with no discernible echoes were achieved.

5. USSOCOM/USCENTCOM AN/TTC-39A(V)1 to Red Switch Connectivity

a. During Operations DESERT SHIELD and DESERT STORM USSOCOM did not activate direct Red Switch connectivity to deployed switches, although essential links were available for activation. USSOCOM did have indirect connectivity to the AOR via a T-1 interswitch trunk to USCENTCOM (see Figure G-8).

b. USSOCOM currently achieves interoperability between the strategic and tactical secure voice terminals in two ways.

(1) First, the USSOCOM Red Switch uses a number of interface trunk cards hardwired to DSVTs. When long haul circuits are activated, these DSVTs function as long locals from a deployed AN/TTC-39A(V)1 which can be readily accessed by any Red Switch subscriber. Additionally, the USSOCOM Red Switch is configured to allow Black Switch subscriber connections over interswitch trunks secured with the

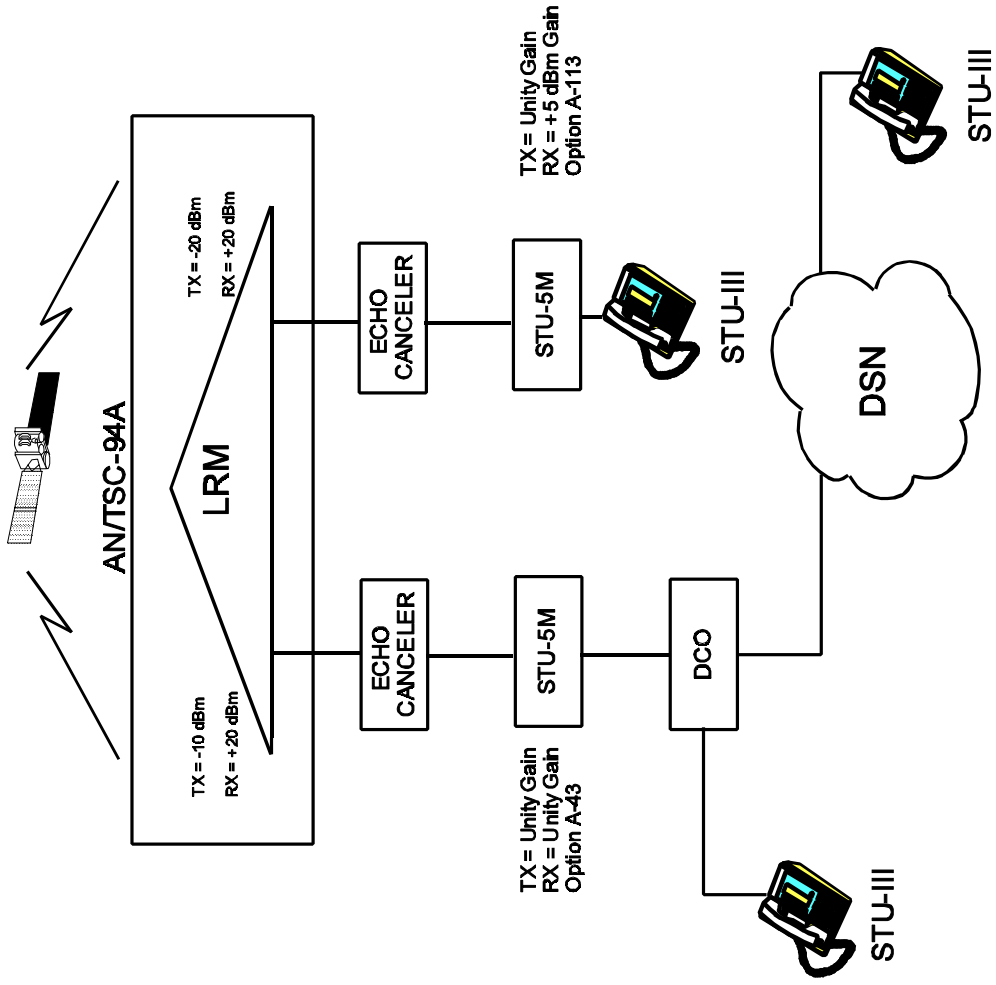

Figure G-7. Echo Canceler Test Configuration

STU-III/R (Remote Control Interface). The STU-III/R provides RED enclave subscribers with STU-III compatible securecommunications in a rack mounted, remote control line encrypting unit. When used in conjunction with a Red switch or conferencing director, the STU-III/R allows users to conference STU-III terminals and have secure PABX functions. STU-III/R interfaces can be applied to field, airborne, and shipboard applications.

(2) Black Switch STU-III subscribers can call Red Switch subscribers or access other Red Switch trunks, including remote DSVT subscribers, also depicted in Figure G-8.

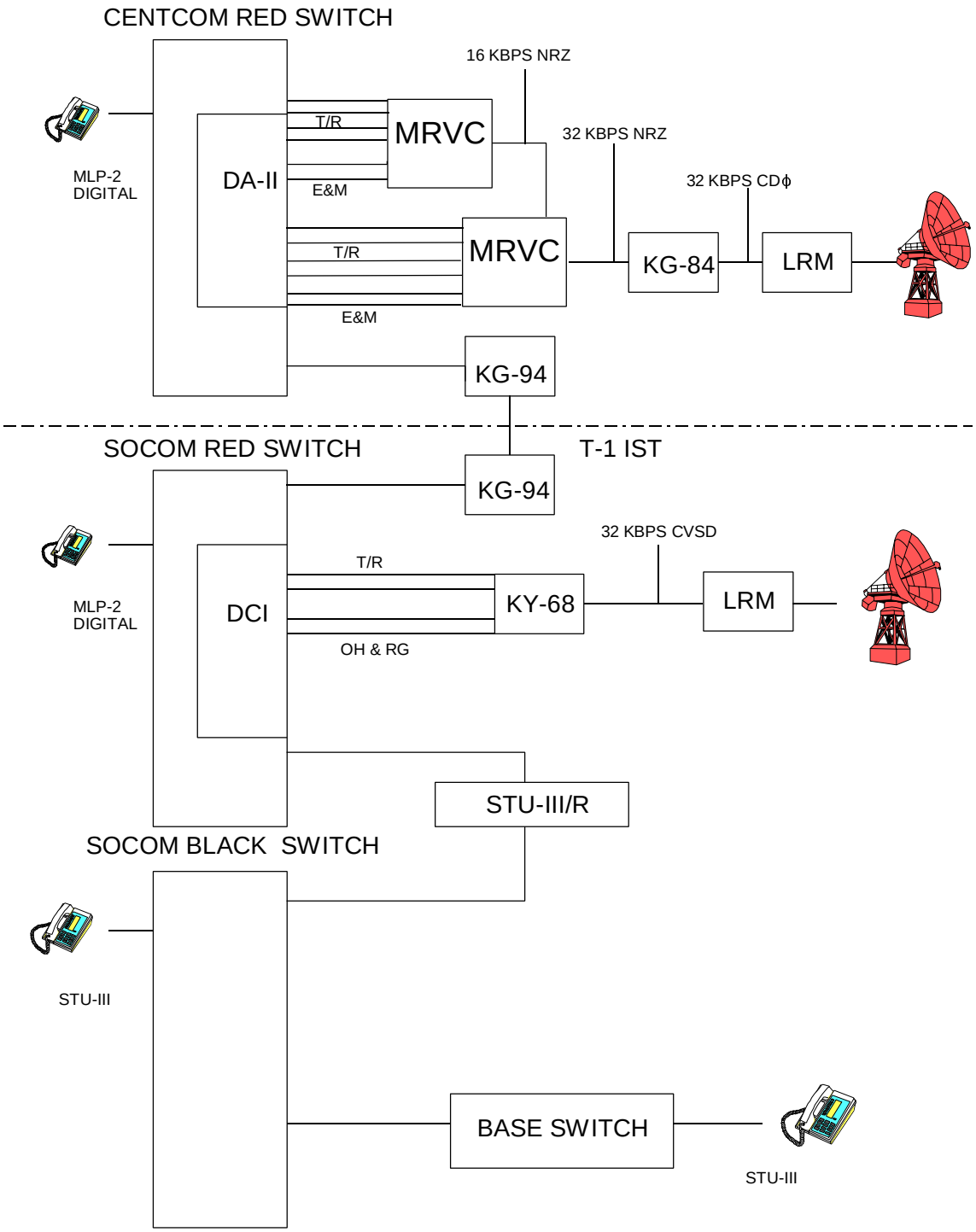

Figure G-8. USSOCOM/USCENTCOM Tactical-Red Switch Connectivity

APPENDIX H

AN/UGC-144 DIAL-UP CONFIGURATION

1. General. This appendix provides information for configuring the AN/UGC-144, AN/TYC-39(V), and circuit switches for dial-up message service. The configuration shown in Figure H-1 is used as an example.

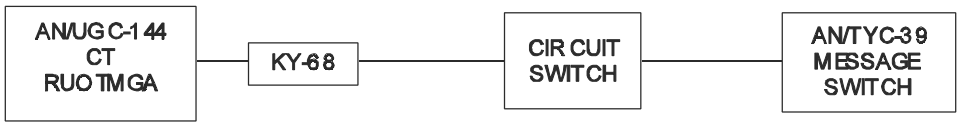

Figure H-1. AN/UGC-144 Connection Via Circuit Switches

2. AN/TTC-39A() Database Assignment. The following subparagraphs describe the configuration of an AN/TTC-39A for dial-up message service. More information about the screens listed can be found in Chapter V.

a. KY-68 Assignment. At a 32 kbps switch, the ATS and AVL screens are used to assign the KY-68 shown in Figure H-1.

(1) ATS. Key entries on this screen are:

(a) TERMINAL TYPE: must be 3.

(b) TERMINAL CHARACTERISTICS: must be M for multimode or D for data only.

(c) MS COMPATIBLE: must be Y.

(d) FAX: must be N.

(2) AVL. TERV (rekey) and TERN (net) are required for this terminal. The TERN must have an entry for NET NO. Other requirements are:

(a) DIR NO./BS-LA: must match the directory number assigned on the ATS screen.

(b) All COMSEC IDs must be loaded in the automatic key distribution center (AKDC).

b. Interswitch Trunk Assignment to Another AN/TTC-39A. For tandem routing through another AN/TTC-39A (not shown in Figure H-1) at 16 or 32 kbps, the screens listed below are used. The screens must be programmed in the order given.

(1) ADT. Key entry assignments are:

(a) GROUP RATE: must coincide with the DTG CHANNEL RATE entry (see Chapter V).

(b) DTG REPEATER MODE: must be N.

(c) ORDER CONTROL UNIT: must be N.

(d) RED GROUP CLOCK: must be N unless trunk encryption devices are bypassed.

(2) ATG. Specific requirements are:

(a) TYPE OF TGC: must be I.

(b) MS TGC: must be N.

(c) TRUNK RATE: must be the same as the previously assigned DTG CHANNEL RATE.

(d) TDMX ADDRESS OF PRIMARY SIGNALING CHANNEL: must be the first address of the START NCMD assigned on the ADT screen.

(3) ATS. This command is used for each trunk assigned. This command should be repeated for each trunk required on the TGC. Specific requirements are:

(a) TERMINAL ADDRESS: must be a location contained in the range of NCMD addresses used for the DTG.

(b) TERMINAL TYPE: must be 29.

(c) TRUNK GROUP CLUSTER NUMBER: must be the same as the TGC assigned on the ATG screen

(d) 16 KB/S TRUNK: must be Y if TRUNK RATE was 16 on the ATG screen.

(4) DTG. This screen is used to ensure that the previous three screens were completed correctly.

(5) DTR. This screen confirms the assignment of traffic trunks to a trunk group cluster.

c. Assignment of a 32 kbps Message Switch Interswitch Link. Screens required for the message switch link shown in Figure H-1 are listed below in order of implementation.

(1) ADT. Required entries are:

(a) DTG CHANNEL RATE: must be 32.

(b) MULTIPLEX SIGNAL FORMAT: must be 1.

(2) ATG. Mandatory entries are:

(a) MS TGC: must be Y.

(b) TSB RATE: must be 32.

(c) TRUNK RATE: must be 32.

(d) TDMX ADDRESS OF PRIMARY SIGNALING CHANNEL: must be the FIRST TDMX address of the first NCMD assigned under ADT.

(3) ATS. Required entries are:

(a) TERMINAL ADDRESS: must be an address in the range of the NCMD addresses assigned by ADT, except for the very first address. The first address was assigned to the signaling channel by ATG.

(b) TERMINAL TYPE: must be 29.

(c) TRUNK GROUP CLUSTER NUMBER: must match the TGC number assigned by ATG.

(d) 16 kbps TRUNK: must be N.

(e) MS TRUNK: must be Y.

(f) MS TRUNK CHARACTERISTIC: must be 0 for digital (1-15 would be used for analog trunks).

(4) AVL. MSRV (rekey) and MSNV (net) variables are required. Required entries are:

(a) COMSEC ID: must be a valid, loaded AKDC location (see CJCSM 6231.05 for more information).

(b) TYPE: must be MSRV or MSNV.

(c) NET NO.: must be blank for MSRV, and have an entry for MSNV.

(5) DTG. DTG is used to ensure that the previous commands were completed correctly. DTG NUMBER on this screen must match the number assigned by ADT.

(6) DTR. DTR confirms the assignment of traffic trunks to the TGC The TRUNK GROUP CLUSTER NUMBER entered must match the TGC number assigned by ATG.

3. AN/TTC-39D Database Assignment. Database entries used to configure the AN/TTC-39D for the circuit shown in Figure H-1 are basically the same as for the AN/TTC-39A(V). The following exceptions apply:

a. Keys assigned to the KY-68 on the AVL screen are U (rekey) and X (net).

b. For assignment of the message switch trunk on the ATG screen, TGC TYPE: must be 4.

4. AN/TTC-42 Database Assignment. To assign a link for an AN/UGC-144 in an AN/TTC-42 database, key [IDX], [2321], and [ADV]. Next, enter the following:

```
TERM NO=0019
TERM TYPE=DLTU
LOOP TYPE=DST-DUAL
DIR NO=225
MAX PRECEDENCE=R
ZONE REST=0
TRUNK BARRING=NO
CONFERENCE PRIV=NO
CALL TRANSFER=NO
NS SERV ALLOWED=NO
DATA TYPE=DATA
MODE=FDX
REKEY ID=101
POWER REQD=YES
EMERGENCY POWER=NO
INHIB ROUTINING=NO
OPNL STATUS=IN-SVCE
MARK FOR INTCP=NO
```

```
IMPLEMENT=1
```

5. AN/TYC-39 Database Assignment. The configuration shown in Figure H-1 requires the following database assignments:

```
LADD 01 CS TP0 T00 MD99 CR538200 G0 TR1 LL01
RADD ROUTMGA LT SD L01 N201 P872345 D1 LMFA0 C80*
RAD* ROUTMGA M1 BS EC0 FR=N IR13 DMC=Y DT=STP SM=ROUTMGA
```

A typical AN/TYC-39 database is used. The switch is using channel 2 of the TDIM going to the circuit switch. CN (continuous) mode is recommended, but BS (block-by-block) may be used if desired and is shown here. The AN/UGC-144 must be similarly configured.

6. AN/UGC-144 Setup. Setup for the AN/UGC-144 shown in Figure J-1 is given in Table H-1. The DATA RATE entry must match the rate in the AN/TYC-39 database. There may be one or more digital circuit switches of various types in this configuration. Typically, the AN/UGC-144 will have a 16 or 32 kbps loop rate, a 2400 bps to 16 kbps data rate, and DATA ADAPTER CONTROL MODE of ON. The KY-68's loop classmark is DUAL at an AN/TTC-42 or SB-3865, or DATA or MULTIMODE at other switches. All transmission paths must be digital with a maximum of 4 km from the KY-68 to the circuit switch.

Table H-1. Example AN/UGC-144 Setup for Dial-Up Operation

SSI Setup Screen	
MASTER/SLAVE:	SLAVE
DACB PROTOCOL:	ON
CHANNEL CONTROL MODE:	MODE I or MODE VI
MESSAGE CODE/PARITY	ASCII ODD PARITY
LOOP RATE:	16000 or 32000
DATA RATE:	As Required
ERROR CONTROL:	MULTISAMPLING
SSI INTERFACE:	DSVT
AUTO RESYNC:	OFF
CLOCK SOURCE:	INTERNAL
EXTERNAL CLOCK PARITY:	POSITIVE

Table H-1. (Cont'd)

SSI Setup Screen	
TX SIGNAL SENSE:	MARK POSITIVE
RX SIGNAL SENSE:	MARK POSITIVE
SERIAL DATA CODE:	NRZ
# STOP BITS:	1
DATA MODE CONTROL:	ON
MODE 6 STORAGE BLOCKS:	NONE
MODE 1 ANSWER TIMER:	DEFAULT
System Setup Screen	
TERMINAL COMM:	R
CONTENT/COMM IND:	ZYUW
ORIG/DEST:	LMF AA
TERMINAL ROUT IND:	RUOTGMA
TERMINAL PLA:	(As Required)
TERMINAL CLASS:	(As Prescribed)
TERM PHONE:	(As Assigned)
CHANNEL ID:	CTA
END OF LINE SEQ:	<CR> <CR> <LF>
CLOCK SOURCE:	INTERNAL
TX START ENV:	BLANK
TX STOP ENV:	NNNN
RX START ENV:	BLANK
RX STOP ENV:	NNNN

7. AN/UGC-144 to SB-3865 Database Assignment. The following parameters are based on the test configuration shown in Figure H-2 as documented in the "AN/UGC-144 CT to SB-3865 Interoperability User's Guide."

a. AN/UGC-144 Database Parameters. The following parameters, from the Current Setup Parameter, are based on Software Version 2.20 used in the aforementioned test configuration.

(1) Current System Setup

(a) TERMINAL COMMUNITY. R.

(b) CONTENT/COMM INDICATOR. ZYUW.

(c) ORIGINATOR/DESTINATION. RUTCCTA.

(d) TERMINAL PLA. CT.

(e) TERMINAL CLASSIFICATION. E - Unclassified EFTO.

(f) TERMINAL PHONE NUMBER. 2017940117.

(g) CHANNEL ID. CTA.

(h) EOL SEQUENCE. <CR><CR><LF>

(i) XMIT START ENVELOPE. <LF><LF><LF><LF><LF><LF><LF>N.

(j) XMIT STOP ENVELOPE. NNN.

(k) REV START ENVELOPE. <LF><LF><LF><LF><LF><LF><LF>N.

(l) REV STOP ENVELOPE. NNN.

(m) PRETEXT CAPABILITY. Disabled.

(2) Current SSI Setup

(a) MASTER/SLAVE. Slave.

(b) DACB PROTOCOL. On.

(c) CHANNEL CONTROL. Mode Continuous.

(d) MESSAGE CODE/PARITY. ASCII Odd Parity.

(e) LOOP RATE. 32000.

(f) DATA RATE. 16000.

(g) ERROR CONTROL. Multi-sampling.

(h) SSI INTERFACE. KY-68 or TA-1042.

(i) AUTO RESYNCH. Off.

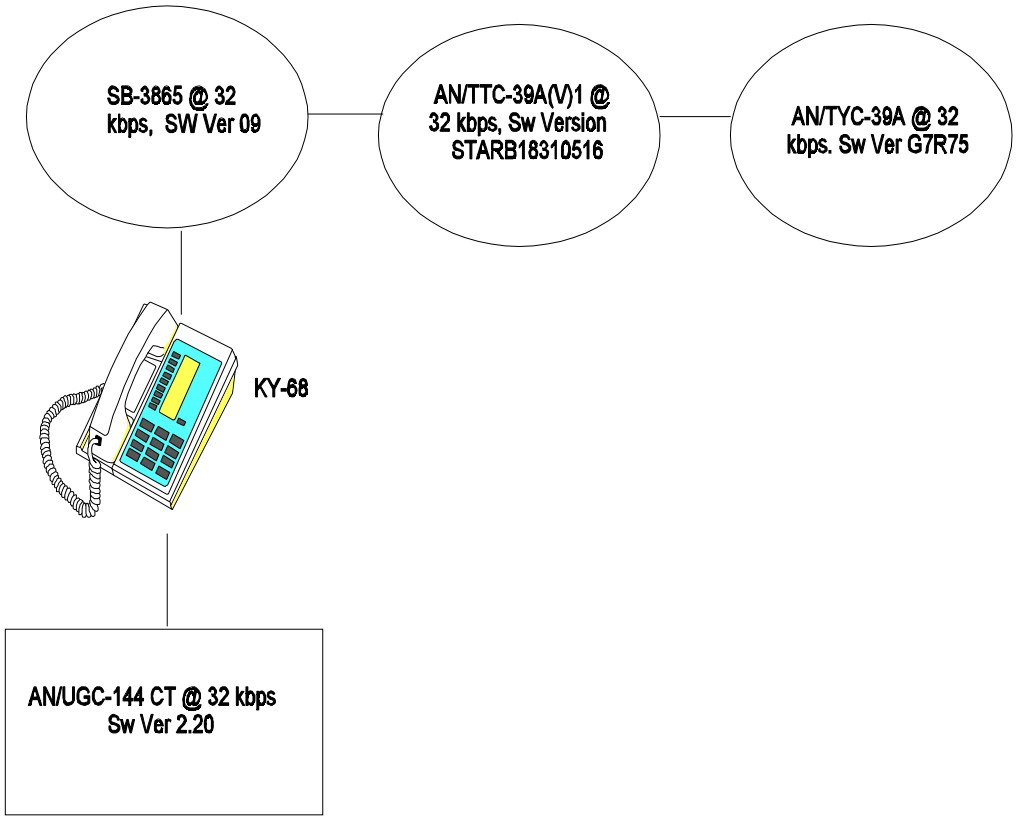

Figure H-2. SB-3865 to AN/UGC-144 CT Test Configuration

(j) CLOCK SOURCE. Internal.

(k) EXT CLOCK POLARITY. Positive.

(l) TRANSMIT SIGNAL SENSE. Mark Positive.

(m) RECEIVE SIGNAL SENSE. Mark Positive.

(n) SERIAL DATA CODE. NRZ.

(o) NUMBER OF STOP BITS. 1.

(p) DATA MODE CONTROL. On.

(q) MODE VI STORAGE BLOCKS. None.

(r) MODE I ANSWER TIMER. Default.

(3) Current Editor Setup

(a) CAPS LOCK. Off.

(b) LINE LENGTH. 69.

(c) WORD WRAP OPTION. Off.

(d) TABS.

(4) Current Printer Setup

(a) BAUD RATE. 9600.

(b) DATA BITE. 7.

(c) STOP BITE. 1.

(d) PARITY. Odd.

(e) AUTOPRINT OPTION. Off.

(f) DELETE AFTER AUTOPRINT. Off.

(5) Current Autosave Setup

(a) AUTOSAVE OPTION. Receive.

(b) AUTOSAVE DEVICE. Hard Disk.

(c) DELETE SAFESTORED MSG OPTION. On.

(6) Current Comm Setup

(a) COMM PROTOCOL. Kermit.

(b) COMM BAUD RATE. 2400.

(c) COMM ERROR DETECTION. Checksum (1 character).

(d) COMM RECEIVE ALARM. Off.

b. SB-3865 Parameters. The SB-3865's software version 09 was used in the test. The following depicts the SB-3865 screens' entries used in the test.

(1) Mux Group Assignment (IDX 2.2.1.1)

(a) GROUP. 1.

(b) MODEM TYPE. Diphase.

(c) INB. NA.

(d) NO. OF CHANNELS. 8.

(e) STED. No.

(f) FLYWHEEL. No.

(2) Trunk Group Assignment (IDX 2.3.1.1)

(a) TRUNK GROUP NO. 01.

(b) TRUNK GROUP TYPE. DIBTS.

(c) DIR COM SWITCH CD. 8723.

(d) SOC CALLS ONLY. 2 (no).

(e) ACCEPT GLARE. 2 (no).

(f) SPILL FORWARD IN. 1 (yes).

(g) SPILL FORWARD OUT. 1 (yes).

(h) SATELLITE LINK. 2 (no).

(i) INHIBIT ROUTING. 2 (no).

(j) THRESHOLD. 07.

(k) SEARCH ORDER. 2 (bottom up).

(l) MARK FOR INTERCEPT. 2 (no).

(3) Routing

(a) 2 = IntroFCE.

(b) SWITCH CODE. 8723.

(c) DIR DSVT ZONE. 1 (yes).

(d) PRIMARY TRUNK GROUP. 01.

(e) ALTERNATE TRUNK GROUP. 00.

(f) 2 = IntroFCE.

(g) SWITCH CODE. 8739.

(h) DIR DSVT ZONE. 1 (yes).

(i) PRIMARY TRUNK GROUP. 01.

(j) ALTERNATE TRUNK GROUP. 00.

(4) Assigning Phone Loop (IDX 2.3.2.1)

(a) TERMINAL NO. 0017.

(b) TERMINAL TYPE. DLTU.

(c) LOOP TYPE. DST-Dual.

(d) DIR NO. 117.

(e) MAX PRECEDENCE. FO.

(f) ZONE REST. 0.

(g) TRUNK BARRING. No.

(h) CONFERENCE PRIVILEGE. No.

(i) NON-SECURED SERV ALLOWED. No.

(j) DATA TYPE. 1 (data).

(k) MODE. 1 (FDX).

(l) REY KEY ID. 1.

(m) POWER REQUIRED. 1 (yes).

(n) INHIBIT ROUTING. 2 (no).

(o) OPERATIONAL STATUS. 1 (in service).

(p) MARK FOR INTER. 2 (no).

c. AN/TTC-39 Series-AN/TYC-39(V) Parameters. The interface between the CS and MS is the usual generic setup, as defined in paragraphs 2 and 5 above.

8. Communications Security Considerations. End-to-end encryption and decryption of data calls between the AN/TYC-39 and circuited switched data subscribers is performed by the LKGs in the MS and KY-68s at the CS subscriber terminal location. In cases where digital nonsecure voice terminals (DNVTs) with digital data ports have been authorized for use (i.e., MSE), LKGs provide encryption and decryption between the tactical switches only. For compatibility with the KY-68s and/or the CS LKGs, the FUNCTION switch on all MS LKGs used on CS trunks should be set to position 1. AN/TTC-39() and MSE switches use the message switch rekey variable (MSRV) and message switch net variable (MSNV) to encrypt the link to the message switch. Bulk encryption of the multiplexed group is performed by the KG-81 or KG-94() TED. See CJCSM 6231.03, Tables IV-10 and IV-11 for KG-81s and KG-94s when used to secure DTGs between an MS and a CS. Calls from a DNVT (permitted only from MSE and AN/TTC-39D switches) are limited to SECRET traffic. Waivers exist which may permit TOP SECRET calls from a DSVT using a SECRET key. Planners and operators should verify the applicability of these waivers before setting up this service.

APPENDIX J

ENHANCED SWITCH OPERATIONS PROGRAM AND GLOBAL DATABASE

1. Introduction. This appendix describes the Enhanced Switch Operations Program (ESOP) and Global Database effort that are being fielded in support of the CSR TEP and will be applied to the CBCS. ESOP is a program which will automate switch operation and upgrade the workstation in the MSE switches and the AN/TTC-39D.

2. ESOP. The primary purpose of ESOP is to provide more efficient and responsive switch operation by the use of menu-driven rather than command-driven operations. Also, multiple screen operations are reduced to a single screen. ESOP is a common hardware/software (CHS) two workstation with a color graphics monitor that provides the switch operator numerous switching operations, diagnostics, and maintenance capabilities. The color graphical displays the following information:

a. Local Network Diagram - shows connectivity and status of all locally connected links.

b. Signal Flow Diagram - shows connectivity and status of hardware components that make up a link or trunk.

c. Packet Network Diagram - shows up/down status of all packet switches in the network.

d. Call Service Position - enables the user to function as a true telephone operator while monitoring and maintaining access to switch resources. This function is not available for the AN/TTC-39D.

e. Additional software embedded in ESOP include:

(1) Online troubleshooter - automatically monitors the system status, identifies fault indicators, and guides the operator to fault isolation in a step-by-step manner.

(2) Link management - menu driven screens for adding, deleting, and modifying links in a single screen command with a minimum amount of inputs.

(3) Fault recognition and isolation color-coded depictions of faulted links allow operators to quickly and easily identify outages.

(4) Network Management Terminal operational orders - ESOP automatically recognizes events that require reporting and sends the report to the controlling NMT.

(5) Electronic journals for the logging of node-specific information.

(6) Ability to direct the node management facility (NMF) display to one of several display devices.

(7) Switch initialization command macros.

(8) Access to UNIX, file transfer protocol (FTP), mail, and text-editing functions.

3. Global Database. The global database provides improved tools for network managers to manage mixed/joint networks more easily and efficiently.

a. Four-digit unique team label/switch codes provides for unique identification of all tactical communications switches.

b. Five digit global sublist numbers provide unique identification directory listings for every Service unit. An example of global sublist number construction is shown in Figure J-1. Sublist numbers are controlled by the command or Service.

c. Provides improvement to system to allow system control to manage network more easily and efficiently.

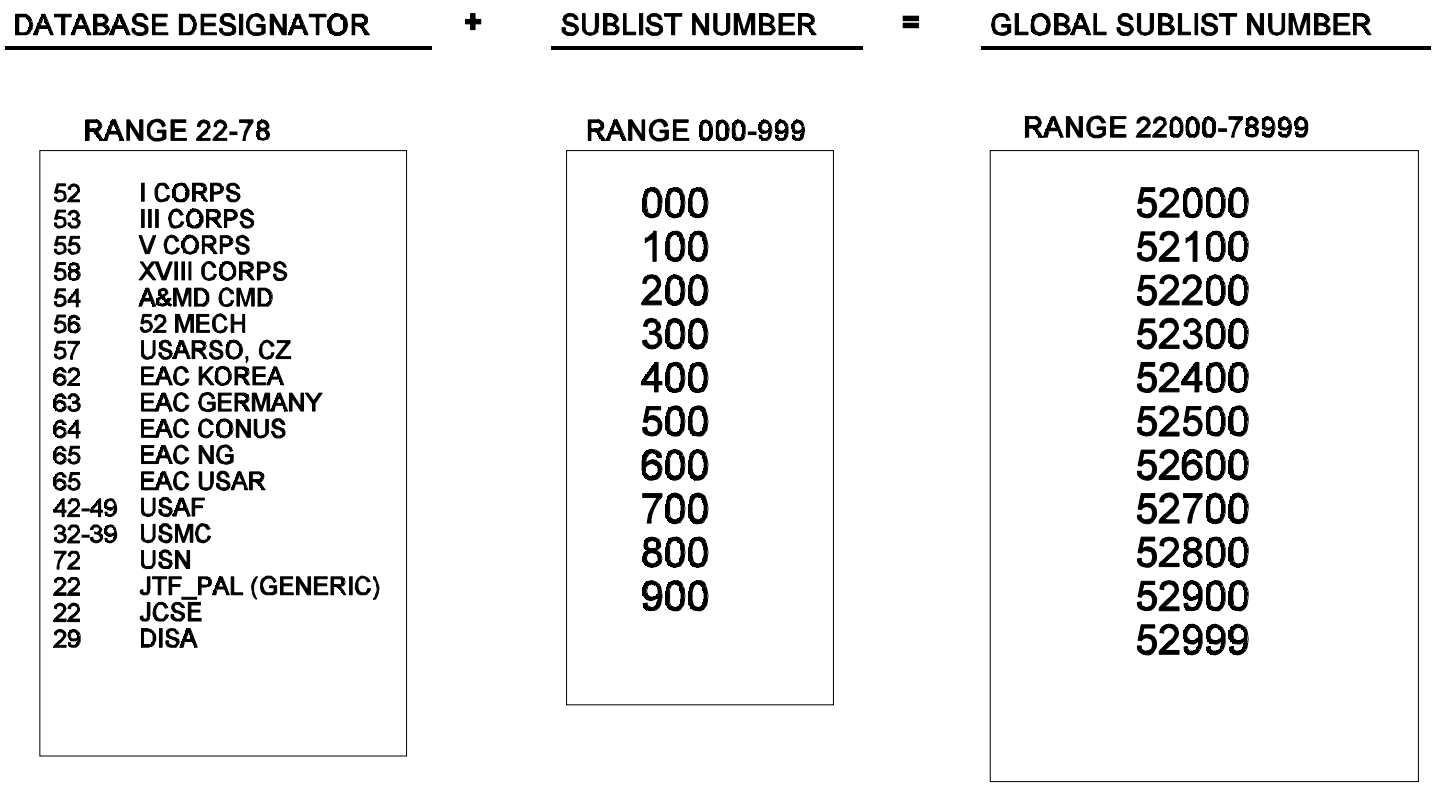

Figure J-1. Example Global Sublist Number Construction

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APPENDIX K

DUPLICATION AND BYPASS

1. Introduction. Duplication and bypass are two separate but related functions that reside in all CBCSs, with the exception of the activate EUB function which cannot be performed for the SMU. Network Managers must develop and specify the duplication plan for the network.

a. Duplication is the process of safeguarding all local subscriber information from one circuit switch to another circuit switch or to multiple circuit switches. It is common practice to distribute all the subscribers from one circuit switch to two separate circuit switches.

b. Essential User Bypass (EUB) is the process of providing service to critical subscribers and SEN/RAU/SCC subscribers in the event of some types of circuit switch failures. The NCS, LEN, FES, CDS, and DS can have up to 120 terminations processed for bypass while the AN/TTC-39D and AN/TTC-39A(V)4 can have only 60. All switches may receive a maximum of 120 terminations.

c. Subscribers are loaded in the circuit switches and stored into Virtual Trunk Group Clusters (VTGCs). These VTGCs are numbered 32 through 35 for affiliated subscribers, 36 for disaffiliated subscribers, and 37 through 40 for preaffiliated subscribers. Subscribers affiliated on an SEN, RAU, or SCC are stored in the their respective Trunk Group Clusters (TGCs).

2. Planning. It is the Network Manager’s responsibility to develop the duplication and bypass plan of the network. Many factors must be considered when selecting the interswitch links used for the duplication process. It is important that the Network Managers have their switch operators follow the procedures of duplication and bypass in accordance with the network plan.

a. Profile and Bit Error Rate (BER). Duplication can only be assigned to a flood-search link. It is best to use a stable interswitch link to minimize errors in transmission. The minimal requirement is a 10^{-5} rating, although it is strongly recommended to pursue a 10^{-6} rating. In the event of a switch failure, the assigned link could be used to support the critical subscribers if EUB is implemented. With high BER, these subscribers will be provided with low-quality and interrupted service.

b. TGC Size. The size of the TGC is a critical consideration when determining the number of subscribers that can be bypassed. Echelons corps and below (ECB) switches can support up to 120 EUB terminations, while echelons above corps (EAC) switches can support up to 60. For example, consider a network where Switch A duplicates to Switches B and C, with 14 trunks in their respective interswitching TGCs. In the event of Switch A failing, only 14 EUB terminations will have service from each switch, therefore not maximizing the capability of EUB.

c. Data Rates. Data rates must be considered in case bypass has to be performed. For example, a switch operating at 32 kbps using a 16 kbps trunk group as the interswitching TGC will not be able to service EUB subscribers. The data rate rule for bypass is that both switches and the interswitch trunk group must operate at the same speed, either 32 or 16 kbps.

(1) Distribution of Duplication. It is common practice to duplicate to two different switches. This will give a switch a greater number of trunks for bypass and therefore, better distribution. Conventionally, the even numbered TGCs are duplicated to the higher numbered switch and the odd TGCs are duplicated to the lower numbered switch.

(2) Amount of Numbers Duplicated to a Single Switch. A switch is limited to the amount of subscriber numbers it has affiliated, preaffiliated, and duplicated. This number is a critical factor when developing a network switch duplication plan. It should be common duplication planning practice to evenly distribute numbers throughout the switches. The following formula can be used to determine the amount of numbers that can be stored in a switchboard.

(a) S1 = affiliated + disaffiliated + preaffiliated + received duplicated subscribers

(b) S2 = preaffiliated + received duplicated subscribers

(c) The lesser of (2048 - S1) or (1536 - S2).

d. Loopbacks. Some switch operators have a tendency to place DTGs into loopbacks when the distant end switch has a failure, engineering other links, or the transmission medium is down. In addition, some SOPs and training doctrines

specify this practice. This practice should be reviewed and updated. These particular loopbacks might cause some of the following problems:

(1) Switches will loose the orderwire over loopbacked DTG. The failed switches' only means of communication is via this orderwire.

(2) Radio equipment slaves timing off the DTG. Timing is slaved off the closest rubidium clock through the group modems. A switch loopback will kill the group timing and hinder the system engineering efforts.

(3) If bypass is activated for a failed switch, EUB subscribers will not be able to be serviced.

(4) Loopbacks give the switch’s processor a false state of the network. This will hinder the duplication and bypass function. Note: Loopback should only be performed while engineering or troubleshooting a specific DTG and should not be left in place unattended.

e. Critical Subscribers Assignments. It is good practice to have critical subscribers off a SEN, RAU, or SCC. For example, a SEN could support 41 subscribers using only 14 trunks to its parent switch. If duplicated for bypass Yes and if EUB is performed, all 41 SEN subscribers will be provided service over the 14 bypass channels. This example demonstrates the advantage duplicating the SEN, RAU, and SCC as bypass Yes first, to ensure the trunk addresses are assigned into the EUB table. If no critical subscribers are placed in the subordinate switch (SEN), this TGC should be duplicated for bypass No so they will not use bypass positions in the EUB table.

f. PAL Assignments. Loading all the PALs of the network into a single switch is not recommended. Correct distribution of the subscribers is critical. The same numbers should be loaded in two different switches. The localization process searches for duplicate numbers in the network; this process can take several hours to correct the problem.

3. Commands Used in the Circuit Switch

a. ABD (Assign Bypass and Duplication). The duplication and bypass process is established when the circuit switch operator performs this command. The command

can only be performed over a flood-search link. (See Figure K-1.)

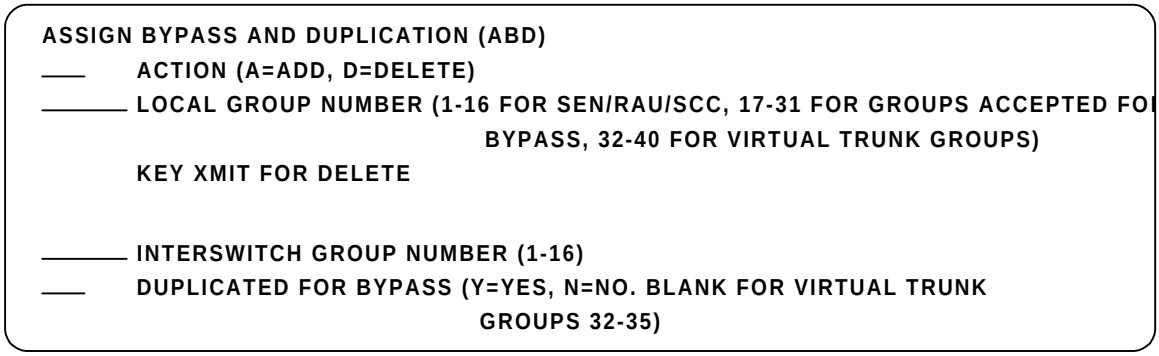

Figure K-1. Assign Bypass and Duplication

(1) Action: Single character (A=Add, D=Delete). Add to send the duplication to the recipient switch and Delete to remove the duplication from the recipient switch.

(2) Local Group Number: Enter the SEN, RAU, SCC, or VTGC number that the action will be performed on. Conventionally, the SEN, RAU, and SCC should be assigned TGCs 7 through 16. TGCs 17 through 31 are for groups accepted for bypass and TGCs 32 through 40 are the VTGCs.

(3) Key XMIT for Delete: Key "XMIT" for a Delete action; continue on for Add action.

(4) Interswitch Group Number: Enter the TGC number of the flood-search link where the duplication is to be sent. Conventionally, TGC numbers 1 through 6 are used for flood-search TGCs.

(5) Duplicated for Bypass: Enter a single character (Y=Yes, N=No) to specify if the TGC should be classmarked for bypass. A Yes entry will store the critical addresses used for bypass in the EUB table. The EUB table, which has 60 entries for EAC switches and 120 entries for ECB switches, is filled on a first-come first-serve (FCFS) basis. For example, in an EAC switch, the first 60 critical addresses entered will be entered into the EUB table; all others will be treated as noncritical and will not be marked for bypass.

(a) SEN, RAU, and SCC TGCs classmarked as bypass Yes will insert the trunk addresses associated with the TGC in the EUB table. For example, if a SEN TGC is selected for bypass, the TGC (13 voice trunks and one packet switch trunk) will be treated as critical, if the number of addresses fall within the critical address limit. In this example, only the trunk addresses are assigned to the EUB table, independent of how many subscribers the SEN is supporting. If EUB is initiated at the SEN's parent switch, then the SEN TGC will be assigned a new number (17 through 31) on the new parent switch. Once EUB is in effect, all the subscribers off the SEN will have network service from the new parent switch. It is recommended to first process the SEN, RAU, and SCC TGCs as duplicate for bypass Yes to ensure these addresses are assigned into the EUB table. This will provide service to more subscribers.

(b) VTGCs 32 through 35 are automatically classmarked as bypass Yes, but only those subscribers classmarked as Essential Users in their profile will be considered for storage in the EUB table based on the FCFS basis.

(c) VTGCs 36 through 40 cannot be classmarked for bypass. Because these subscribers are not affiliated, they are only treated as potential subscribers to the network.

b. Display Bypass and Duplication (DBD). This screen displays all TGCs that have been assigned for duplication, the interswitch TGC to which they are assigned, and their classification for bypass. (See Figure K-2.)

(1) Interswitch Trunk Group: Flood-search TGC number used to duplicate.

(2) Duplicated Trunk Group: VTGC, SEN, RAU, or SCC trunk group number.

(3) Bypass (Yes/No): Entered in the bypass table. VTGCs 32 through 35 always yes, 36 through 40 always no, SEN/RAU/SCC selectable in the ABD command.

c. ABR (Assign Bypass Reception). This command is performed only when DIRECTED by the Network Manager. This command is initiated by the recipient switches of the duplication process. It is used to either Activate or Delete the bypass table. A Delete clears all the entries in

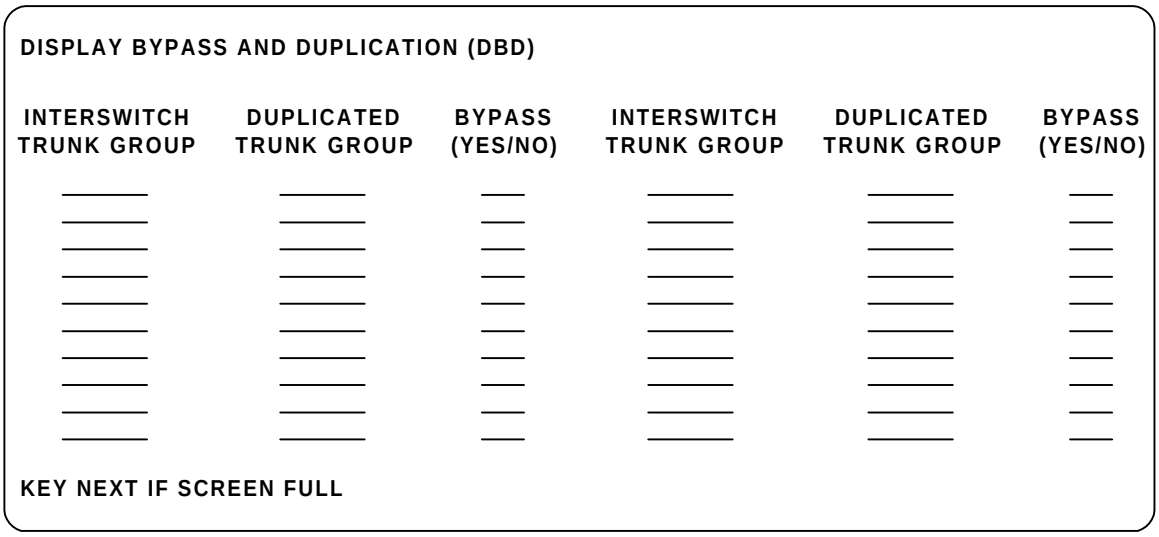

Figure K-2. Display Bypass and Duplication

the bypass table. In the event of some types of switch failures, the recipient switches will initiate the bypass reception (Activate) and provide service to the critical subscribers of the failed switch. It is only implemented if EUB is being performed. This command is not a flood-search command. A flood-search command is a command that can be performed in a single switch in the network and will initiate a message transfer to all other switchboards to perform the appropriate action. In the event of a switch failure, this command must be initiated in every switch that holds the failed switch's duplication. (See Figure K-3.)

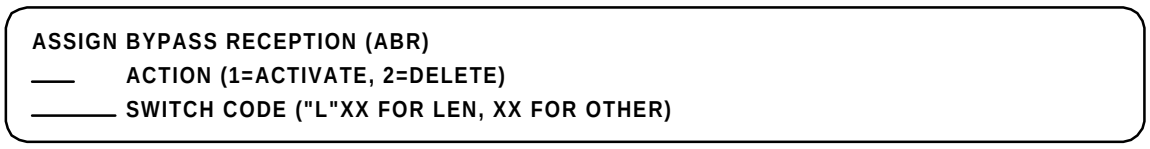

Figure K-3. Assign Bypass Reception

(1) Action: Single character (1=Activate, 2=Delete). Activate to service critical subscribers from a failed switch. Delete to clear all entries in the bypass table.

(2) Switch Code: Enter the switch code of the switch.

d. Display Bypass Reception (DBR). This screen displays the number of duplicated subscribers on the recipient switch from a particular switch and the TGCs that were accepted for bypass if an ABR Activate was previously performed. (See Figure K-4.)

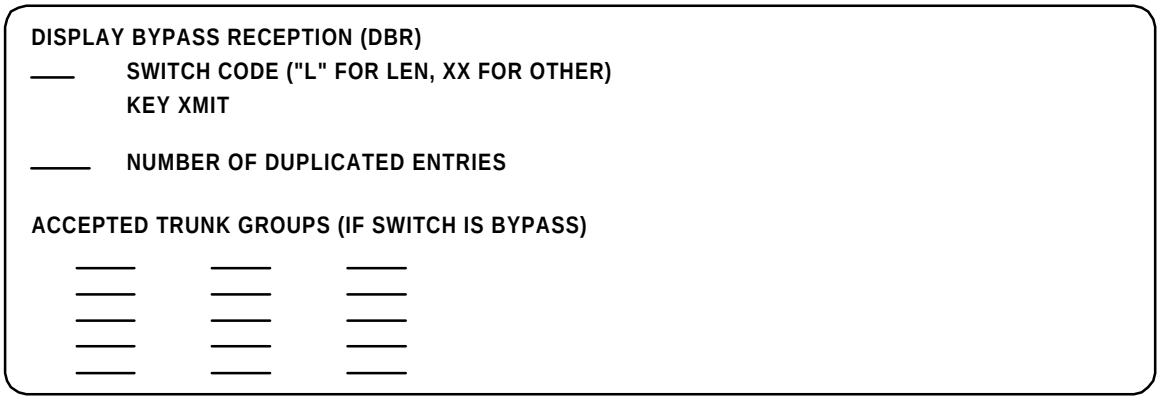

Figure K-4. Display Bypass Reception

(1) Switch Code: Enter switch code to query.

(2) Number of Duplicated Entries: Displays the amount of duplicated subscribers received.

(3) Accepted Trunk Groups: Displays the TGC numbers of SEN, RAU, and SCC when they are accepted for bypass in the event of EUB being performed for an adjoining switch.

e. Assign Local Duplication (ALD). This command (Figure K-5) activates or deletes duplicated subscribers at the recipient switch.

Figure K-5. Assign Local Duplication

(1) Action: Single character (1 = Activate or 2 = Delete).

(a) Activate: Performed only when DIRECTED by the Network Manager. This command is performed if either a switch failure occurs or if a switch disconnects from the network. This command is a flood-search command. Remember, a flood-search command is a command that can be performed in a single switch in the network and will initiate an message transfer to all other switchboards to perform the appropriate action. Therefore, only one switch in the network has to perform the activation. All other circuit switches will automatically activate the failed switch's duplication. Once the activation is performed, all the numbers residing in the recipient switches as duplicated entries will then become activated local subscribers.

Note: SOPs should be reviewed to reflect the procedures of which switch in the network will activate duplication.

(b) Delete: Performed if the recipient switch wants to delete all numbers received from the designated switch. This is not a flood-search command therefore, other recipient switches will not be affected and will still maintain their duplicated numbers for that originating switch.

(2) Switch Code: Enter the switch code for which the action is to be performed.

f. Display Directory Status (DDS). This screen (Figure K-6) displays the number of local subscribers in the circuit switch, the number of duplicated subscribers received from other circuit switches, and the number of available locations in the table. Subscribers of a SEN, RAU, and SCC, are considered local subscribers of the parent switch.

DISPLAY DIRECTORY STATUS (DDS)

NUMBER OF ENTRIES		MAXIMUM
_____	NON-DUPLICATED	2048
_____	DUPLICATED	1536
_____	AVAILABLE IN PREAFFILIATION/DUPLICATION TABLE	1536

Figure K-6. Display Directory Status

(1) Non-Duplicated: Total number of local subscribers in the circuit switch. Subscribers off the SEN, RAU, and SCC are considered local.

(2) Duplicated: Total numbers received as duplicated from other switches.

(3) Available in Preaffiliated/Duplicated Table: Available software storage locations. To calculate this amount, use the formula described in subparagraph 2c(2).

g. Display Group Status (DGS). This screen (Figure K-7) displays the total subscriber numbers in a VTGC or in a TGC.

(1) Trunk Group Number: The TGC number to query.

(2) Number of Entries: The total amount of numbers in the TGC.

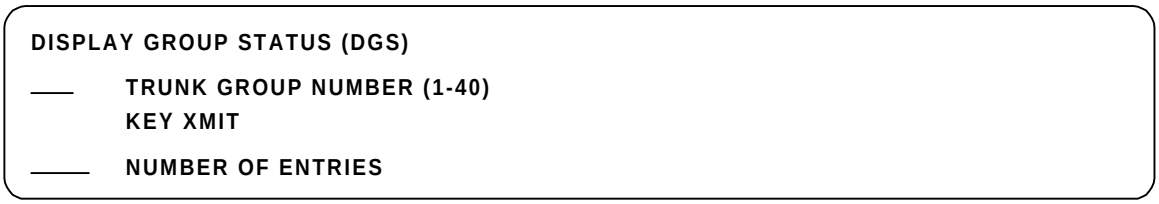

Figure K-7. Display Group Status

4. Associated Fault Messages. The following messages are associated with the duplication and bypass process. The *italicized* section is the technical description followed by an explanation. The ACTION section explains what the switch operator must do if this message is received.

a. DIRECTORY NUMBER LNXXXXX AFFILIATED AT SWITCH xxx. *Directory number listed is a nonduplicated entry at home switch and affiliated entry at switch xxx.*

(1) This message appears at the recipient switch. There are two separate reasons this message can appear. First, if a switch duplicates an affiliated subscriber number and the recipient switch has the same number as affiliated, preaffiliated, disaffiliated, or duplicated from another switch. Second, when two switches have the same affiliated number in the network during the localization process.

(2) Action:

(a) If the switch code in the error message is the own duplicating switch code the DTG is in a loopback condition. Delete duplication and correct before continuing.

(b) The switch operator must immediately contact operations and the distant end switch.

(c) The Network Manager must determine which switch should have the subscriber number.

(d) To correct the error, the subscriber should be reaffiliated by the subscriber or by the switch operator. The switch operator cannot affiliate a subscriber off a SEN, RAU, or SCC. This subscriber must disaffiliate and reaffilliate. A flood-search affiliation message will automatically delete the number on the other switch.

b. Directory Number LNXXXXX Pre/Disaffiliated at SW xxx. *Directory listed is a nonduplicated entry at home switch and preaffiliated or disaffiliated in switch xxx.*

(1) This message appears at the recipient switch. This message appears when a switch duplicates a preaffiliated or disaffiliated subscriber number and the recipient switch has the same number as affiliated, preaffiliated, disaffiliated, or duplicated from another switch.

(2) Action

(a) If the switch code in the error message is the own duplicating switch code the DTG is in a loopback condition. Delete duplication and correct before continuing.

(2) The switch operator must immediately contact operations and the distant end switch.

(3) The Network Manager must determine which switch should have the subscriber number.

(4) If the number is affiliated in the recipient switch, correct by reaffiliating the number. A flood-search affiliation message will automatically delete the number on the other switch.

(5) If the number is preaffiliated or disaffiliated in both switches, first obtain the profile for the

subscriber and then perform an AMA Delete for the directory number in either switch. (AMA Delete is a flood-search command and will delete the number in both switches). Perform an APL single subscriber if the number was a valid number that should have been in the network.

c. Duplicated List of Switch xxx Activated. *All duplicated directory numbers associated with switch xxx are activated in the home switch.*

(1) This message will only appear in the switches that hold duplications for switch xxx, after an ALD Activate has been performed for switch xxx. At this time, all the numbers that were received for duplication become activated as local subscribers in this recipient switch.

(2) Action

(a) If any duplication was directed to switch xxx, inform operations and wait for a re-direct duplication plan.

(b) Switch operators must verify their duplication using the duplication verification formula in Section V.

d. Duplication Deleted in Switch xxx. *All duplicated entries corresponding to the home switch directory list have just been deleted.*

(1) This message appears at the duplicating switch when a recipient switch performs an ALD Delete for that switch. This informs the operator that the recipient switch has deleted the duplications and those numbers are no longer held at the recipient switch.

(2) Action. Inform operations that the duplications were deleted by the recipient switch xxx. The switch operator must wait for instruction to either reduplicate or redirect duplication to another switch.

e. Incoming Essential User Message Failed e Switch xxx

(1) e = 1: *Interswitch TGC number is not assigned in AIL*.

(a) This message can appear at the recipient switch if an EUB subscriber is being duplicated and an error

condition has occurred, such as a half-connect in the RSS channel.

(b) Action. Troubleshoot the RSS channel according to TM.

(2) e = 2: *Too many entries in table*.

(a) This message appears at the recipient switch when the duplicating switch has more EUB subscribers than available storage in his table. The subscribers are being duplicated, but not stored for bypass, in the event of a switch failure.

(b) Action. Inform operations.

f. Local Directory Status s

(1) s = 1. *Only 99 entries remain available within the local directory list for assignment.*

(a) This message appears when there are only 99 entries available in the switch's entry table. These subscribers consist of the local subscribers (affiliated, preaffiliated, and disaffiliated) and duplicated subscribers from other switches (2,048 - 99 = 1,949).

(b) Action

1. Inform operations.

2. If receiving too many duplications from other switches, request that some of those duplications be redirected to other switches.

(2) s = 2. *The routing processor attempted to create a new entry in the local directory, but no space was left and the entry was lost*.

(a) This message appears when there are NO entries available in the switch's entry table. These subscribers consist of the local subscribers (affiliated, preaffiliated, and disaffiliated) and duplicated subscribers from other switches (2,048).

(b) Action

1. Inform operations.

2. If receiving too many duplications from other switches, request that some of those duplications be redirected to other switches.

g. Preaffiliation List Status s

(1) **s** = 1. *The home preaffiliation table is only able to house 49 new preaffiliation or duplicate entries.*

(a) This message appears when there are only 49 entries available in the switch's preaffiliation/ duplication table. These subscribers consist of the local preaffiliated subscribers and duplicated subscribers from other switches (1,536 - 49 = 1,487).

(b) Action

1. Inform operations.

2. If receiving too many duplications from other switches, request that some of those duplications be redirected to other switches.

(2) **s** = 2. *The routing processor attempted to create a new preaffiliation or duplicated entry, but the preaffiliation table is in overflow condition.*

(a) This message appears when there are NO entries available in the switch's preaffiliated table. These subscribers consist of the local preaffiliated subscribers and duplicated subscribers from other switches (1,536).

(b) Action

1. Inform operations.

2. If receiving too many duplications from other switches, request that some of those duplications be redirected to other switches.

h. RAU Trunk Group Number nn Status s

(1) s = 1. *Only 5 entries from 45 entries available in the RAU Trunk Group Table.*

(2) This message appears when there are only five subscribers' entries left in the RAU table. The RAU table is capable of storing 45 entries.

(3) Action: Inform operations.

i. RSS Request Rejected nn, MSG TYPE xx E

(1) **nn** = 8, *Switch still active in network.*

(a) An ALD Activate was attempted while the originating switch is still connected and active in the network.

(b) Action: Verify with operations if an ALD Activate was to be performed.

(2) **nn** = 12, *Duplication not possible, directory overflow in recipient switch.*

(a) This occurs with an ABD Add. See **TGN xx DUPLICATION STATUS 1.**

(b) Action: Perform action of TGN xx DUPLICATION STATUS 1.

(3) nn = 13, *Trunk group not duplicated.*

(a) An ABD Delete was performed on a TGC that was previously duplicated when the link was down. An **RSS REQUEST REJECTED 18** was previously received.

(b) Action

1. Verify that the correct TGC is being used for duplication and is operational.

2. If TGC is not operational, inform operations and request redirection for duplication.

(4) nn = 16, *No duplicated list associated with the indicated switch code.*

(a) An ALD Delete was attempted without receiving duplications from the specified switch.

(b) Action

1. Verify that the action was to be performed on the specified switch.

2. If it was the correct switch code, inform operations and the other switch operator that there were no numbers previously received for duplication.

(5) nn = 17 *SS in originating switch not notified of deletion (duplication list deleted).*

(a) This message appears at the recipient switch if the operator performs an ALD Delete and the message **DUPLICATION DELETED IN SWITCH xxx** was not received at the duplicating switch.

(b) Action: Inform operations and the other switch operator that an ALD Delete was performed for those duplications.

(6) nn = 18 *CMD processing temporarily impossible.*

(a) This message indicates to the operator that the previous command did not occur. It appears after an ABD Add was performed when the link was down or in loopback.

(b) Action

1. Perform an ABD Delete for the same TGC.

2. Check the status of the link.

3. If link is down, correct the link prior to reduplicating.

j. Subscriber LNXXXXX Not Bypassed e

(1) e = 5 *No channels available on TGC*.

(a) This message appears when there are more EUB subscribers entries than trunks available to house the subscribers. For example, when duplicating 15 EUB subscribers to a TGC that has only 14 trunks assigned.

(b) Action

1. Inform operations.

2. If it is determined that the EUB function is critical for these subscribers, either increase

the group rate and trunks or redirect duplication to another TGC that has more available trunks.

(2) e = 6 Essential user table is full.

(a) This message appears when there are more EUB subscribers entries than available EUB storage locations in the switch. There are 60 EUB storage locations for the AN/TTC-39D and AN/TTC-39A(V)4 switches, and 120 for MSE, CDS, and DS switches.

(b) Action

1. Inform operations.

2. Determine if there are any subordinate switches (SEN, RAU) that are duplicated as bypass Yes without critical subscribers that can be duplicated as bypass No taking less EUB storage locations.

k. TGN xx Duplication Status s. xx = TGC number.

(1) s = 1 *The destination switch preaffiliated/duplicated table is in an overflow condition.*

(a) The message appears at the duplicating switch when the recipient switch's table is full and cannot accept any more numbers.

(b) Action

1. Inform operations and request for duplication to be redirected to a different switch.

2. Delete all duplication directed to the TGC and reduplicate to the new switch.

3. Inform the original recipient switch that all duplications from the switch were deleted and verify that their DBR shows 0 entries. If the recipient switch still shows duplicated entries after deletion, have the operator perform an ALD delete for that switch.

(2) s = 2 *All the directory numbers are properly duplicated in the destination switch*.

(a) The message appears at the duplicating switch when the last number from the TGC has been successfully duplicated at the recipient switch.

(b) Action

1. After the last TGC has been duplicated and status 2 received for all TGCs, verify that all numbers were properly duplicated using the duplication verification formula in Section V.

2. Inform operations.

(3) s = 3 *All duplicated entries associated with the home list number are properly transmitted for deletion throughout all flood-search links.*

(a) The message appears at the duplicating switch when the last number from the TGC marked for deletion has been transmitted to the recipient switch. It does not mean that the recipient switch has deleted the entries from the table. This is because the recipient switch might be down at the time or there was no connectivity at the time the command was performed.

(b) Action

1. After last TGC has been deleted and a status 3 has been received for all TGCs, inform the original recipient switch that all duplications from your switch were deleted and verify that their DBR shows 0 entries. If the recipient switch still shows duplicated entries after deletion, have the operator perform an ALD delete for the switch.

2. Inform operations.

(4) s = 4 *Duplication protocol failure.*

(1) This message appears at the duplicating switch when an acknowledgment from the recipient switch for a transmitted number for duplication was not received. This occurs when there is no connectivity at the time duplication was performed.

(2) Action: Check for status on the interswitch link. An interrupt on the link while duplicating could cause the error. Perform an ABD Delete on the TGC and reduplicate it. If the problem persists, the TGC used has a high BER and should not be used for duplication. Inform operations and request that duplication be redirected to a different switch.

5. Verifying Duplication

a. Duplication Status. It is important that the Network Managers ensure the switch operators perform the duplications immediately upon initializing and stabilizing the links that will be used in the duplication plan. It is also important that the switch operators verify the duplications and report the status back to their operations. To verify the duplication, the operator must request the number of duplicated entries received by the recipient switches. This number is displayed in the DBR screen of the recipient switch. Either one of the following formulas can be utilized to ensure that the duplication process was successful.

(1) DBR switch #1 + DBR switch # 2 = DDS Non-Duplicated - (special subscribers)*

(2) DBR switch #1 = Total DGS of odd virtuals 33, 35, 37, 39 and odd SEN, RAU, and SCC TGCs -(special subscribers)*

(c) DBR switch #2 = Total DGS of even virtuals 32, 34, 36, 38, 40 and even SEN, RAU, and SCC TGCs - (special subscribers)

* Special subscribers are the Call Service Position (CSP), Bulk Transfer number, and Remote CSP (RCSP).

b. Continue Checkup of Duplication. Duplication becomes an ongoing process once it is initialized by the switch operator. The duplication process takes place when an operator preaffiliates subscriber number(s), every time a subscriber affiliates or disaffiliates, or when an ALD/ABR is performed at a switch. The information from these subscribers is automatically sent to the recipient switch to update its tables. If the link has an outage, this automatic process will not be able to transfer the updated information to the recipient switch. The switch operators must check their duplication according to the unit’s SOP. At the initial state of a network, verification should be performed more often than when the network has stabilized. Unit SOPs should be reviewed and updated to reflect frequency of verification. If the numbers do not match, the switch operators can initiate a refresh. Refresh can be performed by disabling and reenabling the AIL link. Automatically, every TGC gets reduplicated to the recipient switch.

c. Loading PALs. PALs should be loaded only once in a switch and in the network. In the event of a switch relocation or failure, ALD or ABR activate saves all the numbers for the particular switch. Multiple loads of a PAL in the network will cause calls not being able to complete to the proper subscriber and verification for duplication not possible.

d. Using the AAL command. The AAL command allows the switch operator to save preaffiliated or affiliated numbers in their database. In the case of a switch relocation or failure when this switch is reintroduced to the network these numbers will appear in two different switches because they where activated in the recipient switches. This can be corrected by:

(1) If using AAL for preaffiliated numbers, delete the list prior to initializing the switch.

(2) If using AAL for affiliated numbers, after the first flood-search link has been initialized, call the command by modifying the list and restore the list. A flood-search affiliation message will automatically delete the numbers in the other switches.

6. Duplication and Bypass Flow Charts. The following flow charts (Figures K-8 to K-15) provide a procedure that should be used by the switch operator and the Network Manager to ensure that the duplication and bypass process is done correctly. These flow charts depict which functions are the Network Managers and which are the switch operators.

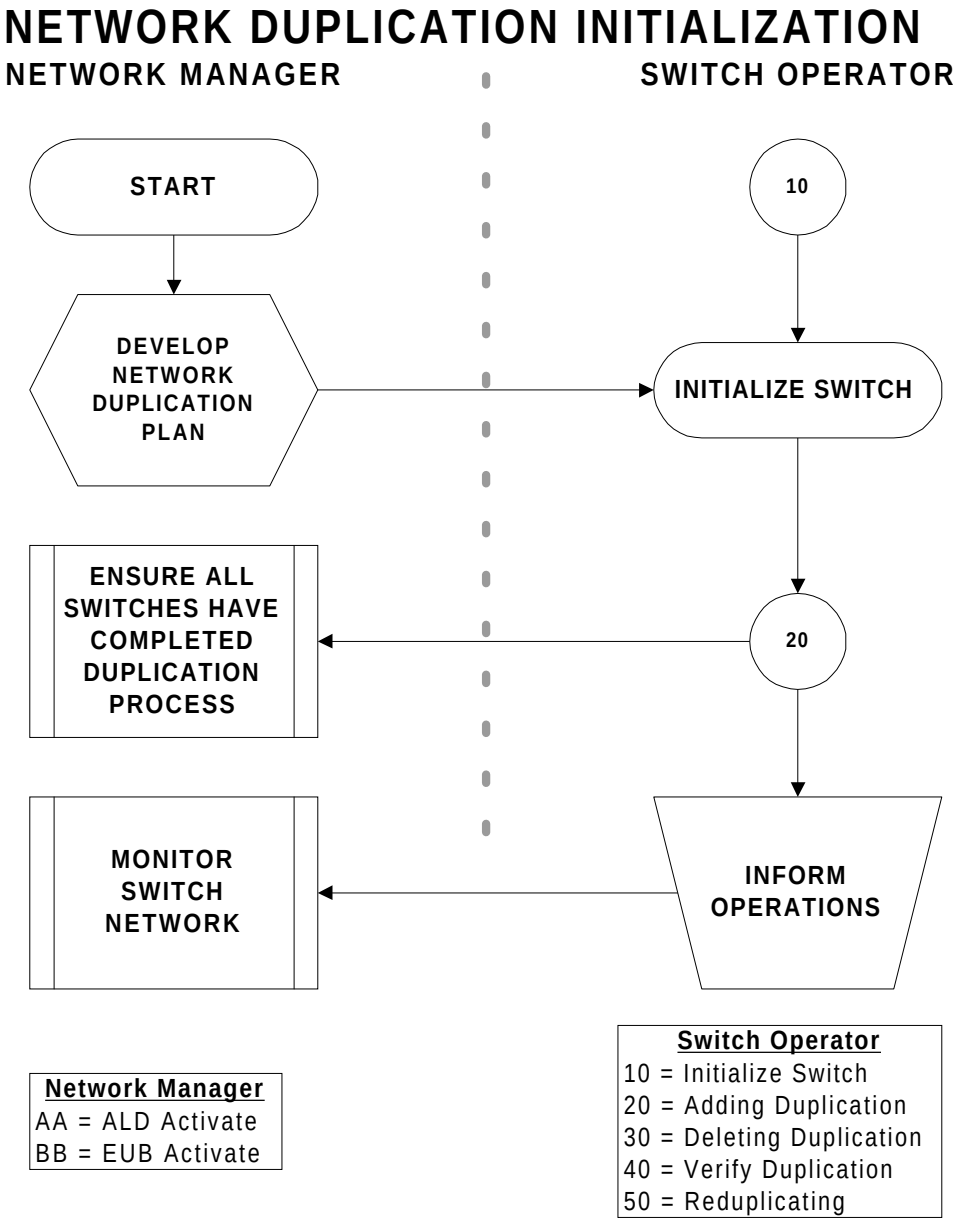

Figure K-8. Network Duplication Initialization

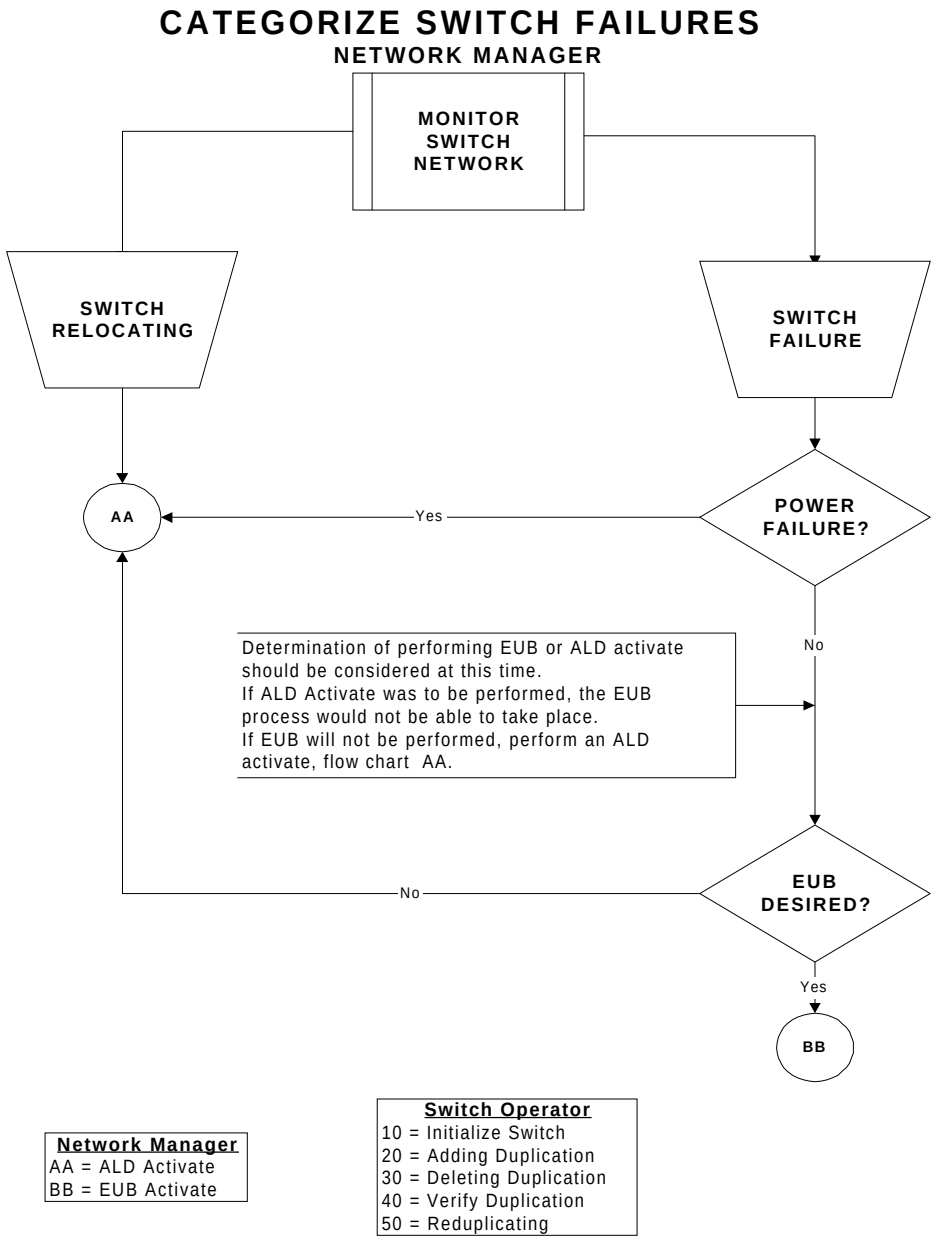

Figure K-9. Categorize Switch Failures

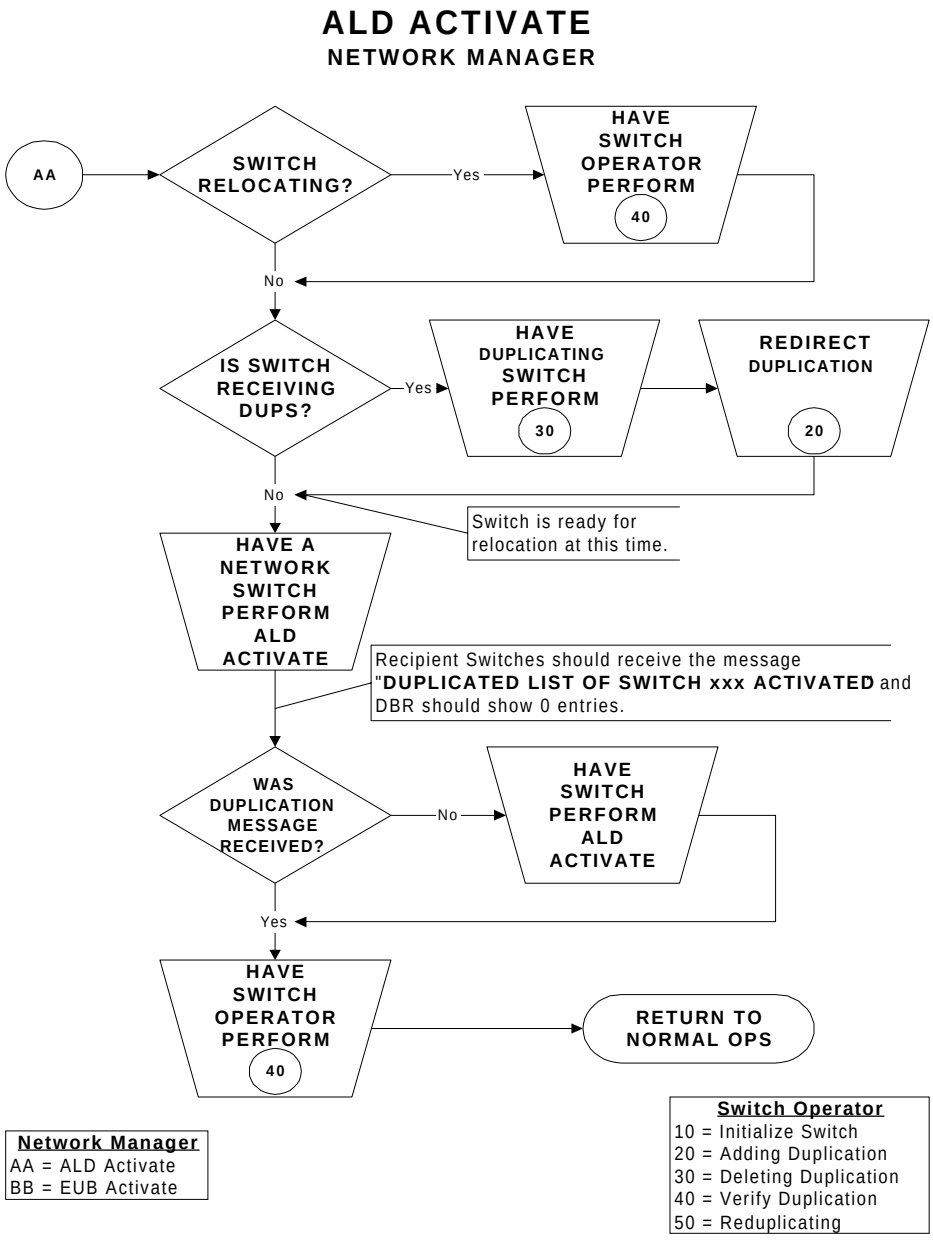

Figure K-10. ALD Activate

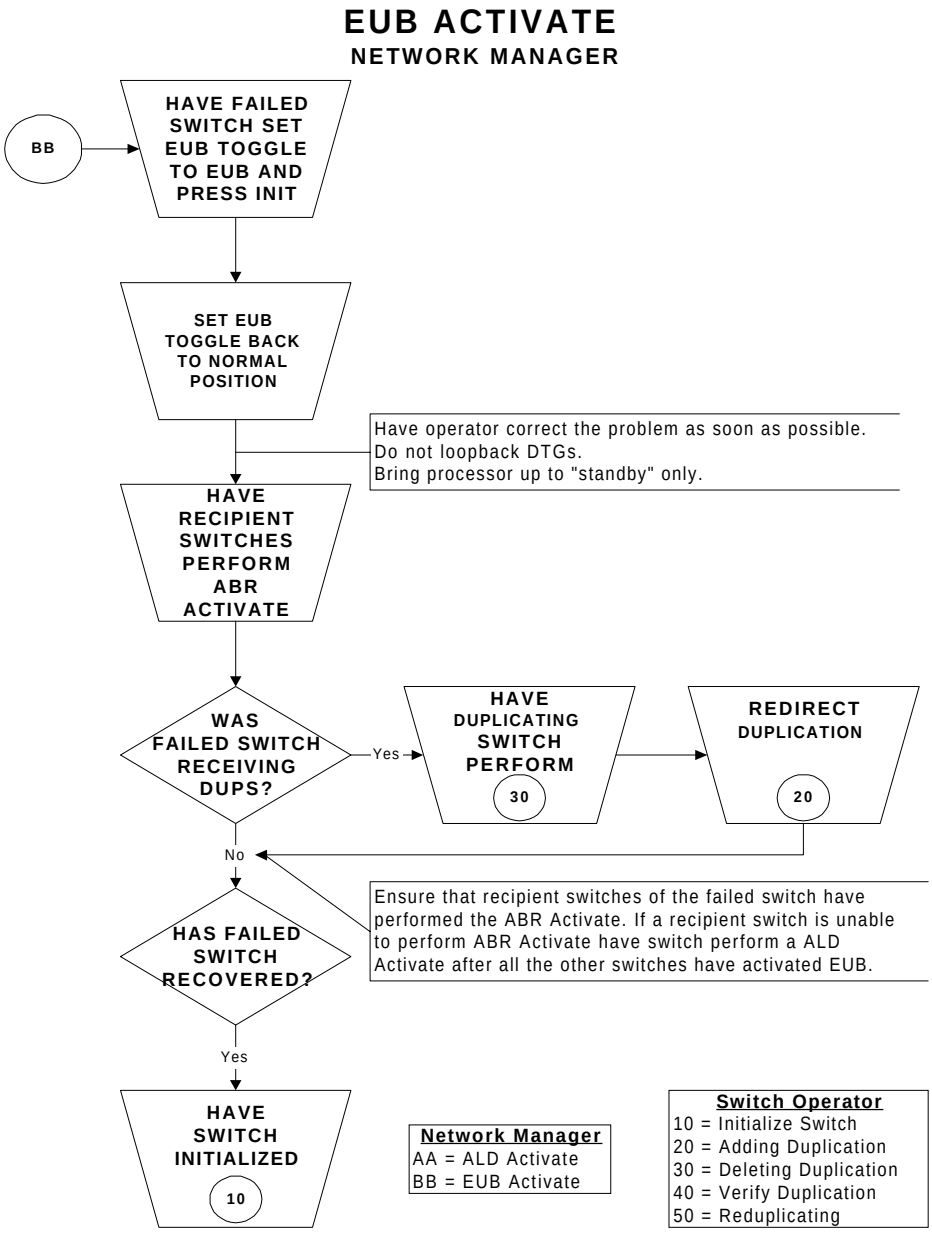

Figure K-11. EUB Activate

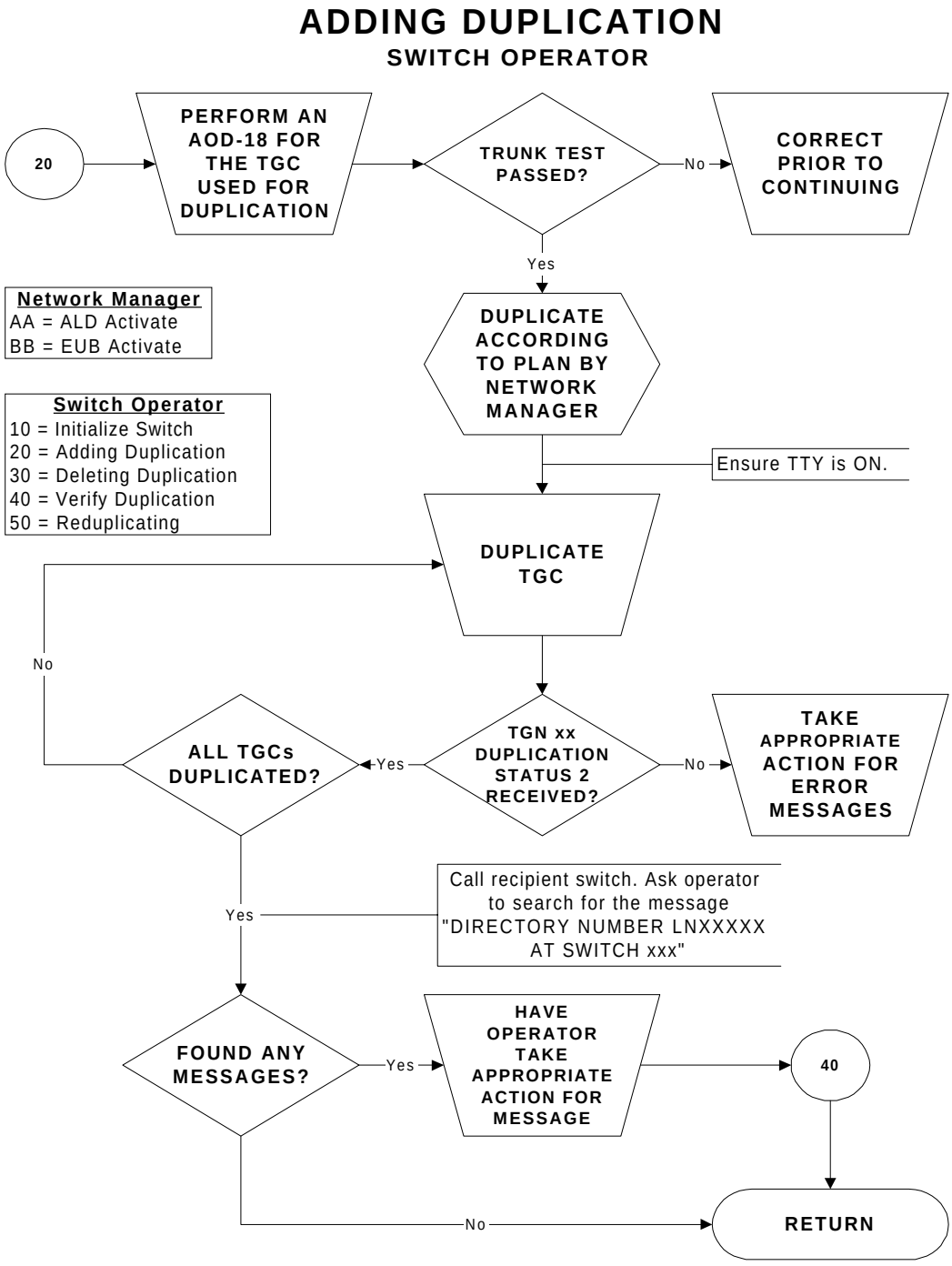

Figure K-12. Adding Duplication

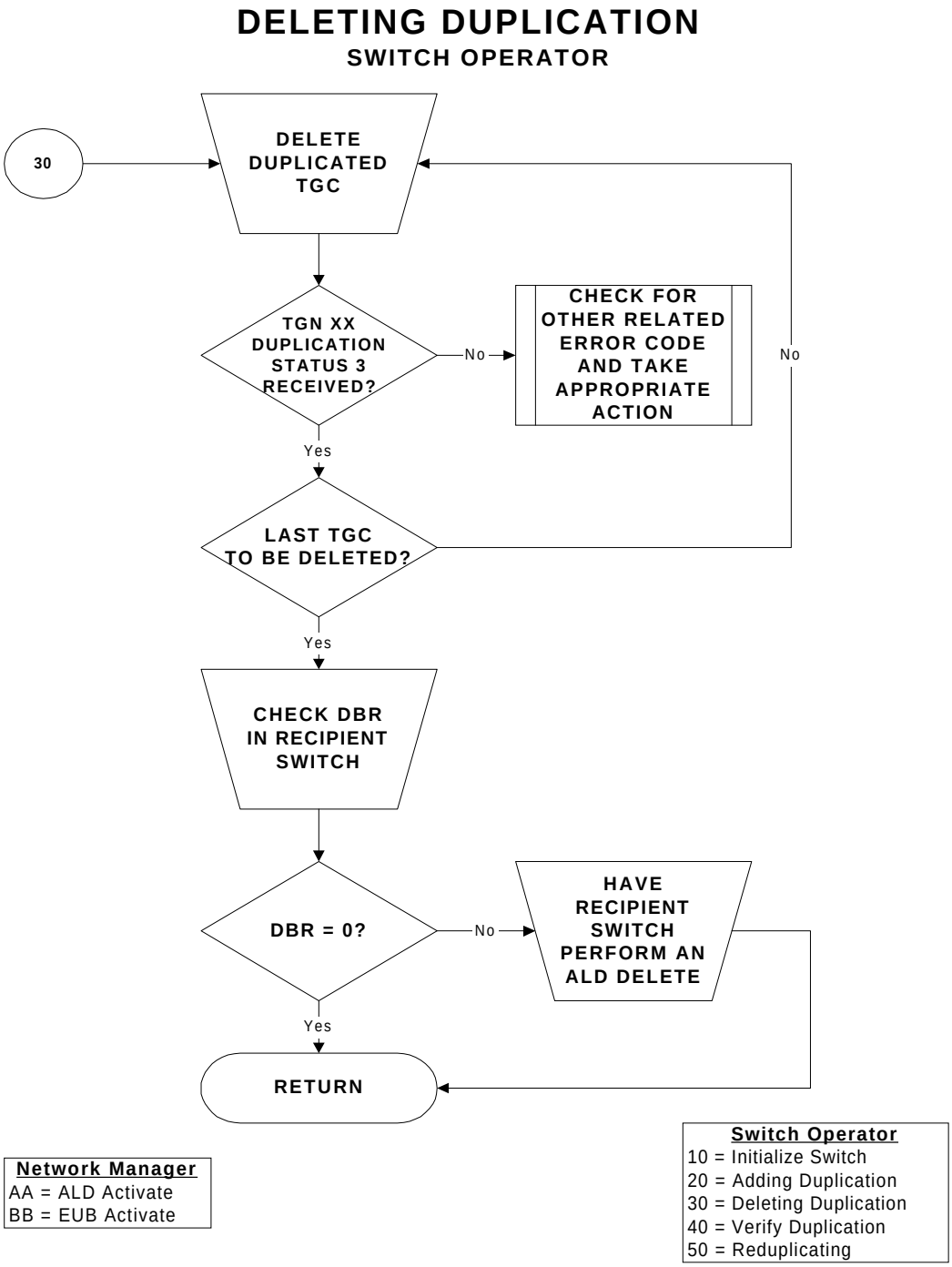

Figure K-13. Deleting Duplication

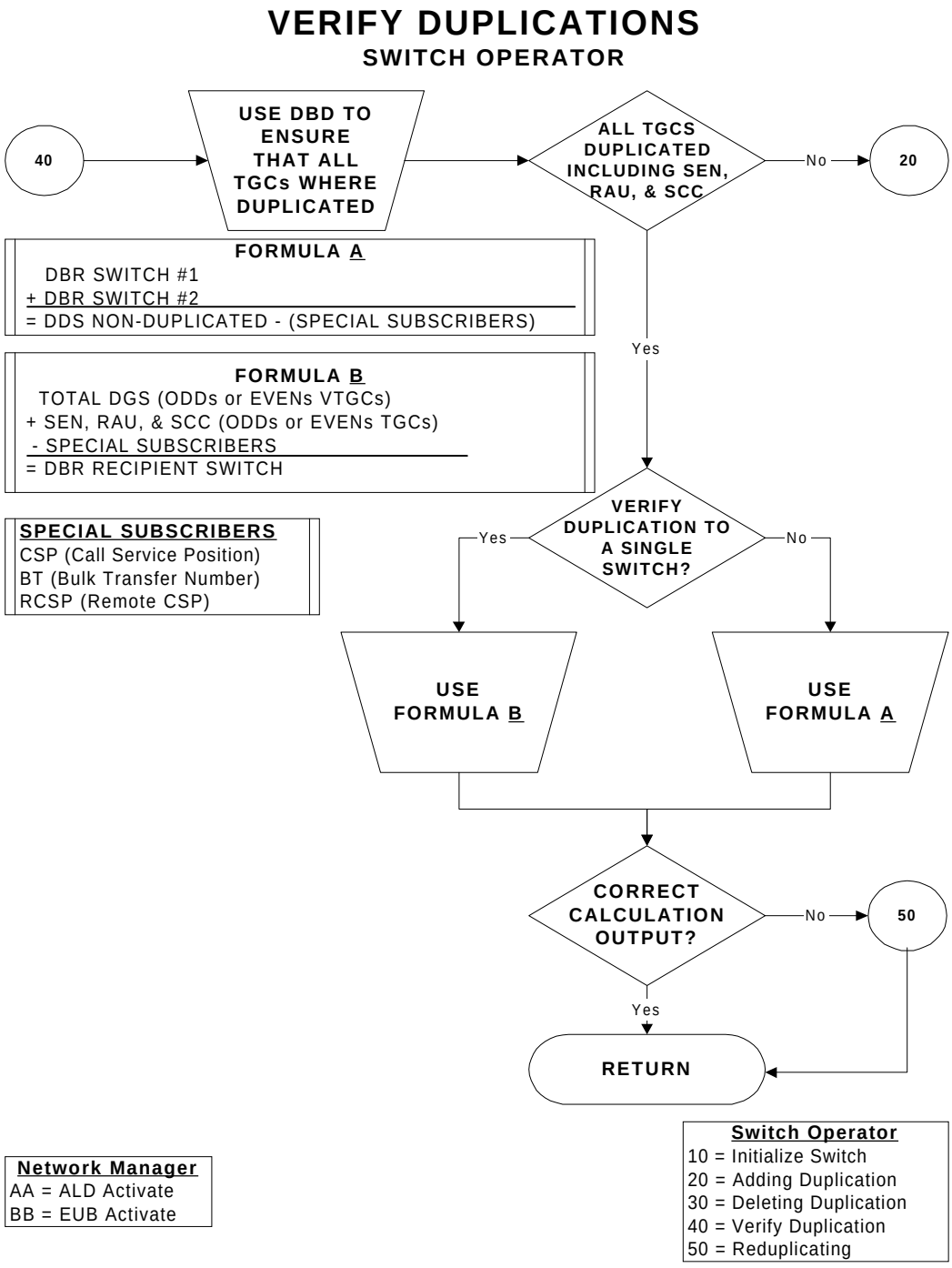

Figure K-14. Verify Duplications

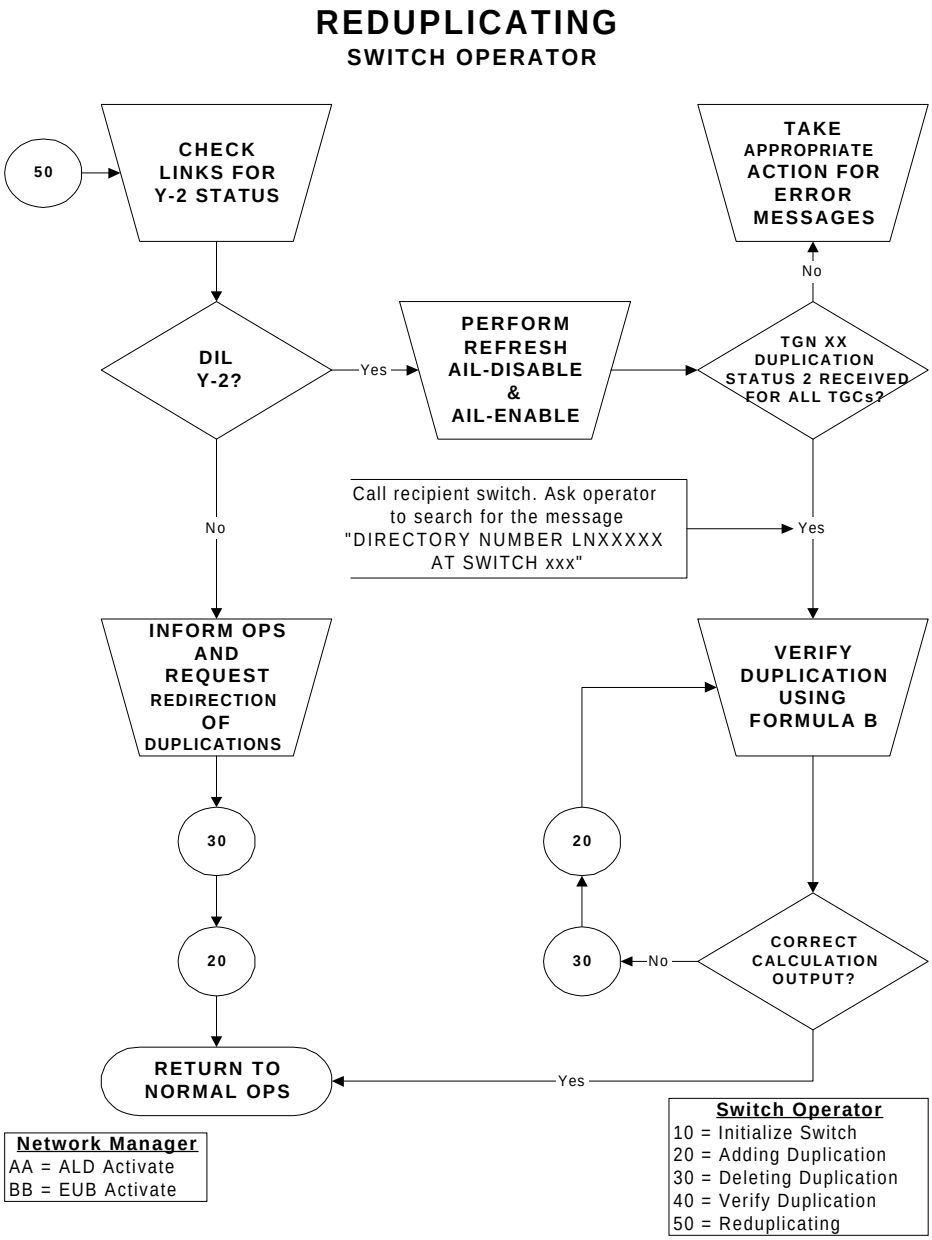

Figure K-15. Reduplicating

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APPENDIX L

GLOBAL CBCS PROFILE MATRIX

Table L-1 depicts the organizational structure of the CBCS profile matrix. Table L-2 lists the classmarks used in the 255 profiles which are listed in Table L-3.

Table L-1. CBCS Organizational Description

Organization	
Basic Groups	0 = Wireline Subscribers (DSVT) 1 = Mobile Subscribers (MSRT) 2 = Wireline Subscribers (DNVT) 3 = DTA (MSE) 4 = LG-1 (MSE) 5 = Generic Analog/STU
50 Subgroups	
COMSEC	
COMSEC Rekey Rule:	Applies to MSRT Subscriber Profiles Only All wireline subscribers will be assigned to one rekey ID-01 14 Mobile Groups with unique rekey IDs preserve COMSEC Limit- 250

Table L-2. CBCS Profile Classmarks

Profile Entry	Classmark
PRO	Profile Numerical Designation = 001-255
OLD PRO	Old Profile Number
TER TYPE	Type of Terminal: (3 = DSVT, 13 = DNVT, 15 = DTA, 16 = LG1, 248 = DLTU)
TLC	Traffic Load Level: 1-5
SEC	Security Level: P = Preferred E = End-to-End encryption, R = Required or N = Not Required
PRE	Precedence: FO = Flash Override F = Flash, I = Immediate P = Priority, R = Routine

Table L-2. (Cont'd)

Profile Entry	Classmark
TERM CHAR MODE	Mode of Operation: V = Voice M = Multimode, or D = Data
MSG SW COM	Message Switch Operation: Y or N
NRI	Net Radio Interface: Y or N
PROG CONF	Progressive Conference: Y or N
CALL FWD	Call Forwarding: Y or N
COMM	Commercial Access Authorized: Y or N
ESSENTIAL USER	Essential User Bypass: Y or N
CDL	Compressed Dial List Group: 1-5
ZONE	Zone Restriction: 0-6
DAS	Direct Access Service: Y or N
REKEY ID	Net Number of U Key: 0-25
OLD REKEY ID	Old net Number of U Key
NET ID-A	Net Number of X Key: 2-26
NET ID-B	Net Number or Future or Next X Key: 27-51
BAR TRNK ACC	Barred Trunk Access: Y or N
BAR CALL	Barred Origination or Termination of Calls: 1 or 2

Table L-3. CBCS Profile Matrix

PRO	OLD PRO	TERTYPE	TLC	SEC	PRE	TERM CHAR MODE	MSG SW COM	NRI	PCRONGF	CALL FWD	COMM	EUB	CDL	ZONE	DAS	REKEYID	OLD REKEY ID	NET ID-A	NET ID-B	BAR TRNK ACC	BARCALL
**GROUP: 001 WIRELINE CD0																					
001		3	1	P	F	V	N	N	Y	Y	Y	Y	0	0	0	01		02	27	N	
002		3	1	P	I	V	N	N	Y	N	N	N	0	0	0	01		02	27	N	
003		3	1	P	I	V	N	N	Y	Y	Y	Y	0	1	0	01		02	27	N	
004		3	2	P	P	V	N	N	Y	Y	Y	Y	0	2	0	01		02	27	N	
005		3	3	P	R	V	N	N	Y	N	N	N	0	4	0	01		02	27	N	
006		3	3	P	R	V	N	N	Y	Y	Y	N	0	4	0	01		02	27	N	
** GROUP: 002 WIRELINE CD1																					
007	01	3	1	P	FO	V	N	N	Y	Y	Y	Y	1	0	0	01	01	02	27	N	
008	02	3	1	P	F	V	N	N	Y	Y	Y	Y	1	0	0	01	01	02	27	N	
009	03	3	1	P	I	V	N	N	Y	Y	Y	Y	1	1	0	01	02	02	27	N	
010	04	3	1	P	P	V	N	N	Y	Y	Y	Y	1	2	0	01	03	02	27	N	
011		3	2	P	P	V	N	N	Y	Y	Y	Y	1	2	0	01		02	27	N	
012	05	3	2	P	R	V	N	N	Y	Y	Y	Y	1	4	0	01	04	02	27	N	
013		3	3	P	R	V	N	N	Y	N	N	N	1	4	0	01		02	27	N	
014		3	3	P	R	V	N	N	Y	Y	Y	N	1	4	0	01		02	27	N	
015	06	3	5	P	R	V	N	N	Y	Y	N	N	1	5	0	01	05	02	27	N	
** GROUP: 003 WIRELINE CD2																					
016		3	1	P	FO	V	N	N	Y	Y	Y	Y	2	0	0	01		02	27	N	
017	07	3	1	P	F	V	N	N	Y	Y	Y	Y	2	0	0	01	06	02	27	N	
018	08	3	1	P	I	V	N	N	Y	Y	Y	Y	2	1	0	01	07	02	27	N	
019	09	3	1	P	P	V	N	N	Y	Y	Y	Y	2	2	0	01	08	02	27	N	

Table L-3. (Cont'd)

PRO	OLD PRO	TERTYPE	TLC	SEC	PRE	TERM CHAR MODE	MSG SW COM	NRI	PCONGF	CALL FWD	COMM	EUB	CDL	ZONE	DAS	REKEY ID	OLD REKEY ID	NET ID-A	NET ID-B	BAR TRNK ACC	BARCALL
**GROUP: 003 WIRELINE CD2																					
020		3	2	P	P	V	N	N	Y	Y	Y	Y	2	2	0	01		02	27	N	
021	10	3	2	P	R	V	N	N	Y	Y	Y	Y	2	4	0	01	09	02	27	N	
022		3	3	P	R	V	N	N	Y	N	N	N	2	4	0	01		02	27	N	
023		3	3	P	R	V	N	N	Y	Y	Y	N	2	4	0	01		02	27	N	
024	11	3	5	P	R	V	N	N	Y	Y	N	N	2	5	0	01	10	02	27	N	
** GROUP: 004 WIRELINE CD3																					
025		3	1	P	F	V	N	N	Y	Y	Y	Y	3	0	0	01		02	27	N	
026		3	1	P	I	V	N	N	Y	Y	Y	Y	3	1	0	01		02	27	N	
027		3	2	P	P	V	N	N	Y	Y	Y	Y	3	2	0	01		02	27	N	
028		3	3	P	R	V	N	N	Y	N	N	N	3	4	0	01		02	27	N	
029		3	3	P	R	V	N	N	Y	Y	Y	N	3	4	0	01		02	27	N	
** GROUP: 005 WIRELINE CD4																					
030		3	1	P	F	V	N	N	Y	Y	Y	Y	4	0	0	01		02	27	N	
031		3	1	P	I	V	N	N	Y	Y	Y	Y	4	1	0	01		02	27	N	
032		3	2	P	P	V	N	N	Y	Y	Y	Y	4	2	0	01		02	27	N	
033		3	3	P	R	V	N	N	Y	N	N	N	4	4	0	01		02	27	N	
034		3	3	P	R	V	N	N	Y	Y	Y	N	4	4	0	01		02	27	N	
** GROUP: 006 WIRELINE CD5																					
035		3	1	P	F	V	N	N	Y	Y	Y	Y	5	0	0	01		02	27	N	
036		3	1	P	I	V	N	N	Y	Y	Y	Y	5	1	0	01		02	27	N	
037		3	2	P	P	V	N	N	Y	Y	Y	Y	5	2	0	01		02	27	N	
038		3	3	P	R	V	N	N	Y	N	N	N	5	4	0	01		02	27	N	

Table L-3. (Cont'd)

PRO	OLD PRO	TERTYPE	TLC	SEC	PRE	TERM CHAR MODE	MSG SW COM	NRI	PCRONGF	CALL FWD	COMM	EUB	CDL	ZONE	DAS	RE KEY ID	OLD RE KEY ID	NET ID-A	NET ID-B	BAR TRNK ACC	BARCALL
**GROUP: 006 WIRELINE CD5																					
039		3	3	P	R	V	N	N	Y	Y	Y	N	5	4	0	01		02	27	N	
** GROUP: 007 WIRELINE NRI																					
040	38	3	2	P	I	V	N	Y	N	N	N	N	0	0	0	01	23	02	27	N	
** GROUP: 008 WIRELINE AF PACKET->AR																					
041		3	1	P	F	M	N	N	N	N	N	Y	0	0	0	01		02	27	N	
** GROUP: 009 WIRELINE DATA/VOICE																					
042		3	1	P	FO	M	Y	N	N	N	N	Y	0	0	0	01		02	27	N	
043		3	1	P	F	M	Y	N	N	N	N	Y	0	0	0	01		02	27	N	
044		3	1	P	F	M	Y	N	N	N	N	N	0	1	0	01		02	27	N	
045	33	3	2	P	F	M	Y	N	N	N	N	Y	0	6	0	01	18	02	27	N	
046		3	1	P	I	M	Y	N	N	N	N	Y	0	1	0	01		02	27	N	
047		3	1	P	I	M	Y	N	N	N	N	Y	0	6	0	01		02	27	N	
048	34	3	2	P	I	M	Y	N	N	N	N	Y	0	6	0	01	19	02	27	N	
049		3	1	P	P	M	Y	N	N	N	N	Y	0	2	0	01		02	27	N	
050		3	1	P	P	M	Y	N	N	N	N	Y	0	6	0	01		02	27	N	
051	35	3	3	P	P	M	Y	N	N	N	N	Y	0	6	0	01	20	02	27	N	
052		3	2	P	R	M	Y	N	N	N	N	N	0	4	0	01		02	27	N	
053	36	3	3	P	R	M	Y	N	N	N	N	N	0	6	0	01	21	02	27	N	
054		3	5	P	R	M	Y	N	N	N	N	N	0	6	0	01		02	27	N	
** GROUP: 010 WIRELINE DATA/ONLY																					
055		3	1	P	FO	D	N	N	N	N	N	Y	0	0	0	01		02	27	N	
056		3	1	P	F	D	N	N	N	N	N	Y	0	0	0	01		02	27	N	

Table L-3. (Cont'd)

PRO	OLD PRO	TERTYPE	TLC	SEC	PRE	TERM CHAR MODE	MSG SW COM	NRI	PCRONGF	CALL FWD	COMM	EUB	CDL	ZONE	DAS	RE KEY ID	OLD RE KEY ID	NET ID-A	NET ID-B	BAR TRNK ACC	BARCALL
**GROUP: 010 WIRELINE DATA/ONLY																					
057		3	1	P	I	D	N	N	N	N	N	Y	0	1	0	01		02	27	N	
058		3	3	P	P	D	N	N	N	N	N	Y	0	2	0	01		02	27	N	
059		3	4	P	R	D	N	N	N	N	N	N	0	4	0	01		02	27	N	
** GROUP: 011 WIRELINE DAS P/V																					
060		3	1	P	F	V	N	N	N	N	N	Y	0	0	1	01		02	27	N	
061	37	3	1	P	I	V	N	N	N	N	N	Y	0	0	1	01	22	02	27	N	
062		3	2	P	P	V	N	N	N	N	N	Y	0	0	1	01		02	27	N	
**GROUP: 012 WIRELINE DAS R/M																					
063		3	1	R	F	M	N	N	N	N	N	Y	0	0	1	01		02	27	N	
064		3	1	R	I	M	N	N	N	N	N	Y	0	0	1	01		02	27	N	
065		3	2	R	P	M	N	N	N	N	N	Y	0	0	1	01		02	27	N	
** GROUP: 013 WIRELINE DAS R/V																					
066		3	1	R	F	V	N	N	N	N	N	Y	0	0	1	01		02	27	N	
067		3	1	R	I	V	N	N	N	N	N	Y	0	0	1	01		02	27	N	
068		3	2	R	P	V	N	N	N	N	N	Y	0	0	1	01		02	27	N	
** GROUP: 014 WIRELINE TS/V																					
069		3	1	E	F	V	N	N	Y	Y	N	Y	1	0	0	01		02	27	N	
070		3	1	E	I	V	N	N	Y	Y	N	Y	1	1	0	01		02	27	N	
071		3	1	E	P	V	N	N	Y	Y	N	Y	1	3	0	01		02	27	N	
** GROUP: 015 WIRELINE TS/M																					
072		3	1	E	I	M	Y	N	N	N	N	Y	0	1	0	01		02	27	N	
073		3	1	E	P	M	Y	N	N	N	N	Y	0	2	0	01		02	27	N	

Table L-3. (Cont'd)

PRO	OLD PRO	TERTYPE	TLC	SEC	PRE	TERM CHAR MODE	MSG SW COM	NRI	PCRONGF	CALL FWD	COMM	EUB	CDL	ZONE	DAS	RE KEY ID	OLD RE KEY ID	NET ID-A	NET ID-B	BAR TRNK ACC	BARCALL
**GROUP: 015 WIRELINE TS/M																					
074	39	3	1	E	I	M	Y	N	N	N	N	N	1	0	0	01	24	02	27	N	
075	40	3	1	E	I	M	Y	N	N	N	N	N	1	0	0	01	25	02	27	N	
076		3	2	E	P	M	Y	N	N	N	N	Y	1	2	0	01		02	27	N	
077		3	1	E	I	M	Y	N	N	N	N	Y	2	1	0	01		02	27	N	
078		3	2	E	P	M	Y	N	N	N	N	Y	2	2	0	01		02	27	N	
** GROUP: 016 WIRELINE TS/D																					
079		3	1	E	I	D	N	N	N	N	N	Y	0	2	0	01		02	27	N	
080		3	1	E	P	D	N	N	N	N	N	Y	0	4	0	01		02	27	N	
**GROUP: 117 MOBILE CD1																					
081	01	3	1	P	FO	V	N	N	Y	Y	Y	Y	1	0	0	02	01	02	27	N	
082	02	3	1	P	F	V	N	N	Y	Y	Y	Y	1	0	0	02	01	02	27	N	
083	03	3	1	P	I	V	N	N	Y	Y	Y	Y	1	1	0	02	02	02	27	N	
084	04	3	1	P	P	V	N	N	Y	Y	Y	Y	1	2	0	03	03	02	27	N	
085	05	3	2	P	R	V	N	N	Y	Y	Y	Y	1	4	0	04	04	02	27	N	
086	06	3	5	P	R	V	N	N	Y	Y	N	N	1	5	0	05	05	02	27	N	
** GROUP: 118 MOBILE CD2																					
087	07	3	1	P	F	V	N	N	Y	Y	Y	Y	2	0	0	02	06	02	27	N	
088	08	3	1	P	I	V	N	N	Y	Y	Y	Y	2	1	0	02	07	02	27	N	
089	09	3	1	P	P	V	N	N	Y	Y	Y	Y	2	2	0	06	08	02	27	N	
090	10	3	2	P	R	V	N	N	Y	Y	Y	Y	2	4	0	07	09	02	27	N	
091	11	3	5	P	R	V	N	N	Y	Y	N	N	2	5	0	08	10	02	27	N	

Table L-3. (Cont'd)

PRO	OLD PRO	TERTYPE	TLC	SEC	PRE	TERM CHAR MODE	MSG SW COM	NRI	PCONGF	CALL FWD	COMM	EUB	CDL	ZONE	DAS	REKEY ID	OLD REKEY ID	NET ID-A	NET ID-B	BAR TRNK ACC	BARCALL
**GROUP: 119 MOBILE GROUP 1																					
092		3	1	P	F	V	N	N	Y	Y	Y	Y	1	0	0	09		02	27	N	
093	12	3	1	P	I	V	N	N	Y	Y	Y	Y	1	1	0	09	11	02	27	N	
094	13	3	1	P	P	V	N	N	Y	Y	Y	Y	1	2	0	09	11	02	27	N	
095	14	3	5	P	R	V	N	N	Y	Y	N	N	1	5	0	09	11	02	27	N	
** GROUP: 120 MOBILE GROUP 2																					
096		3	1	P	F	V	N	N	Y	Y	Y	Y	1	0	0	10		02	27	N	
097	15	3	1	P	I	V	N	N	Y	Y	Y	Y	1	1	0	10	12	02	27	N	
098	16	3	1	P	P	V	N	N	Y	Y	Y	Y	1	2	0	10	12	02	27	N	
099	17	3	5	P	R	V	N	N	Y	Y	N	N	1	5	0	10	12	02	27	N	
**GROUP: 121 MOBILE GROUP 3																					
100		3	1	P	F	V	N	N	Y	Y	Y	Y	1	0	0	11		02	27	N	
101	18	3	1	P	I	V	N	N	Y	Y	Y	Y	1	1	0	11	13	02	27	N	
102	19	3	1	P	P	V	N	N	Y	Y	Y	Y	1	2	0	11	13	02	27	N	
103	20	3	5	P	R	V	N	N	Y	Y	N	N	1	5	0	11	13	02	27	N	
** GROUP: 122 MOBILE GROUP 4																					
104		3	1	P	F	V	N	N	Y	Y	Y	Y	1	0	0	12		02	27	N	
105	21	3	1	P	I	V	N	N	Y	Y	Y	Y	1	1	0	12	14	02	27	N	
106	22	3	1	P	P	V	N	N	Y	Y	Y	Y	1	2	0	12	14	02	27	N	
107	23	3	5	P	R	V	N	N	Y	Y	N	N	1	5	0	12	14	02	27	N	
** GROUP: 123 MOBILE GROUP 5																					
108		3	1	P	F	V	N	N	Y	Y	Y	Y	1	0	0	13		02	27	N	
109	24	3	1	P	I	V	N	N	Y	Y	Y	Y	1	1	0	13	15	02	27	N	

Table L-3. (Cont'd)

PRO	OLD PRO	TERTYPE	TLC	SEC	PRE	TERM CHAR MODE	MSG SW COM	NRI	PC RONG F	CALL FWD	COMM	EUB	CDL	ZONE	DAS	RE KEY ID	OLD RE KEY ID	NET ID-A	NET ID-B	BAR TRNK ACC	BARCALL
**GROUP: 123 MOBILE GROUP 5																					
110	25	3	1	P	P	V	N	N	Y	Y	Y	Y	1	2	0	13	15	02	27	N	
111	26	3	5	P	R	V	N	N	Y	Y	N	N	1	5	0	13	15	02	27	N	
** GROUP: 124 MOBILE GROUP 6																					
112		3	1	P	F	V	N	N	Y	Y	Y	Y	1	0	0	14		02	27	N	
113	27	3	1	P	I	V	N	N	Y	Y	Y	Y	1	1	0	14	16	02	27	N	
114	28	3	1	P	P	V	N	N	Y	Y	Y	Y	1	2	0	14	16	02	27	N	
115	29	3	5	P	R	V	N	N	Y	Y	N	N	1	5	0	14	16	02	27	N	
**GROUP: 125 MOBILE GROUP 7																					
116		3	1	P	F	V	N	N	Y	Y	Y	Y	1	0	0	15		02	27	N	
117	30	3	1	P	I	V	N	N	Y	Y	Y	Y	1	1	0	15	17	02	27	N	
118	31	3	1	P	P	V	N	N	Y	Y	Y	Y	1	2	0	15	17	02	27	N	
119	32	3	5	P	R	V	N	N	Y	Y	N	N	1	5	0	15	17	02	27	N	
** GROUP: 126 MOBILE GROUP 8																					
120		3	1	P	F	V	N	N	Y	Y	Y	Y	2	0	0	16		02	27	N	
121	12	3	1	P	I	V	N	N	Y	Y	Y	Y	2	1	0	16	11	02	27	N	
122	13	3	1	P	P	V	N	N	Y	Y	Y	Y	2	2	0	16	11	02	27	N	
123	14	3	5	P	R	V	N	N	Y	Y	N	N	2	5	0	16	11	02	27	N	
** GROUP: 127 MOBILE GROUP 9																					
124		3	1	P	F	V	N	N	Y	Y	Y	Y	2	0	0	17		02	27	N	
125	15	3	1	P	I	V	N	N	Y	Y	Y	Y	2	1	0	17	12	02	27	N	
126	16	3	1	P	P	V	N	N	Y	Y	Y	Y	2	2	0	17	12	02	27	N	
127	17	3	5	P	R	V	N	N	Y	Y	N	N	2	5	0	17	12	02	27	N	

Table L-3. (Cont'd)

PRO	OLD PRO	TERTYPE	TLC	SEC	PRE	TERM CHAR MODE	MSG SW COM	NRI	PCRONGF	CALL FWD	COMM	EUB	CDL	ZONE	DAS	REKEYID	OLD REKEYID	NET ID-A	NET ID-B	BAR TRNK ACC	BARCALL
** GROUP: 128 MOBILE GROUP 10																					
128		3	1	P	F	V	N	N	Y	Y	Y	Y	2	0	0	18		02	27	N	
129	18	3	1	P	I	V	N	N	Y	Y	Y	Y	2	1	0	18	13	02	27	N	
130	19	3	1	P	P	V	N	N	Y	Y	Y	Y	2	2	0	18	13	02	27	N	
131	20	3	5	P	R	V	N	N	Y	Y	N	N	2	5	0	18	13	02	27	N	
**GROUP: 129 MOBILE GROUP 11																					
132		3	1	P	F	V	N	N	Y	Y	Y	Y	2	0	0	19		02	27	N	
133	21	3	1	P	I	V	N	N	Y	Y	Y	Y	2	1	0	19	14	02	27	N	
134	22	3	1	P	P	V	N	N	Y	Y	Y	Y	2	2	0	19	14	02	27	N	
135	23	3	5	P	R	V	N	N	Y	Y	N	N	2	5	0	19	14	02	27	N	
** GROUP: 130 MOBILE GROUP 12																					
136		3	1	P	F	V	N	N	Y	Y	Y	Y	2	0	0	20		02	27	N	
137	24	3	1	P	I	V	N	N	Y	Y	Y	Y	2	1	0	20	15	02	27	N	
138	25	3	1	P	P	V	N	N	Y	Y	Y	Y	2	2	0	20	15	02	27	N	
139	26	3	5	P	R	V	N	N	Y	Y	N	N	2	5	0	20	15	02	27	N	
** GROUP: 131 MOBILE GROUP 13																					
140		3	1	P	F	V	N	N	Y	Y	Y	Y	2	0	0	21		02	27	N	
141	27	3	1	P	I	V	N	N	Y	Y	Y	Y	2	1	0	21	16	02	27	N	
142	28	3	1	P	P	V	N	N	Y	Y	Y	Y	2	2	0	21	16	02	27	N	
143	29	3	5	P	R	V	N	N	Y	Y	N	N	2	5	0	21	16	02	27	N	
**GROUP: 132 MOBILE GROUP 14																					
144		3	1	P	F	V	N	N	Y	Y	Y	Y	2	0	0	22		02	27	N	
145	30	3	1	P	I	V	N	N	Y	Y	Y	Y	2	1	0	22	17	02	27	N	

Table L-3. (Cont'd)

PRO	OLD PRO	TERTYPE	TLC	SEC	PRE	TERM CHAR MODE	MSG SW COM	NRI	PCPONGF	CALL FWD	COMM	EUB	CDL	ZONE	DAS	RE KEY ID	OLD RE KEY ID	NET ID-A	NET ID-B	BAR TRNK ACC	BARCALL
**GROUP: 132 MOBILE GROUP 14																					
146	31	3	1	P	P	V	N	N	Y	Y	Y	Y	2	2	0	22	17	02	27	N	
147	32	3	5	P	R	V	N	N	Y	Y	N	N	2	5	0	22	17	02	27	N	
** GROUP: 133 MOBILE DATA																					
148	33	3	2	P	F	M	Y	N	N	N	N	Y	0	6	0	23	18	02	27	N	
149	34	3	2	P	I	M	Y	N	N	N	N	Y	0	6	0	23	19	02	27	N	
150	35	3	3	P	P	M	Y	N	N	N	N	Y	0	6	0	23	20	02	27	N	
151	36	3	3	P	R	M	Y	N	N	N	N	N	0	6	0	23	21	02	27	N	
**GROUP: 234 DNVT DAS AF																					
152		13	1	N	I	V	N	N	N	N	N	Y	0	0	1					N	
153		13	2	N	P	V	N	N	N	N	N	Y	0	0	1					N	
154		13	3	N	R	V	N	N	N	N	N	N	0	0	1					N	
** GROUP: 235 DNVT DAS P/M																					
155		13	1	P	F	M	N	N	N	N	N	Y	0	0	1					N	
156		13	1	P	I	M	N	N	N	N	N	Y	0	1	1					N	
157		13	1	P	P	M	N	N	N	N	N	Y	0	3	1					N	
** GROUP: 236 DNVT DAS P/V																					
158		13	1	P	F	V	N	N	N	N	N	Y	0	0	1					N	
159	58	13	1	P	I	V	N	N	N	N	N	Y	0	0	1					N	
160		13	1	P	P	V	N	N	N	N	N	Y	0	0	1					N	
** GROUP: 237 DNVT AF																					
161		13	1	N	FO	V	N	N	Y	Y	Y	Y	1	0	0					N	
162		13	1	N	F	V	N	N	Y	Y	Y	Y	1	0	0					N	

Table L-3. (Cont'd)

PRO	OLD PRO	TERTYPE	TLC	SEC	PRE	TERM CHAR MODE	MSG SW COM	NRI	PCONGF	CALL FWD	COMM	EUB	CDL	ZONE	DAS	REKEY ID	OLD REKEY ID	NET ID-A	NET ID-B	BAR TRNK ACC	BARCALL
** GROUP: 237 DNVT AF																					
163		13	1	N	I	V	N	N	Y	Y	Y	Y	2	1	0					N	
164		13	2	N	P	V	N	N	Y	Y	Y	Y	3	2	0					N	
165		13	3	N	P	V	N	N	N	N	N	Y	3	2	0					N	
166		13	4	N	R	V	N	N	N	N	N	N	3	3	0					N	
167		13	3	N	R	V	N	N	N	N	N	N	4	3	0					N	
168		13	3	N	R	V	N	N	Y	N	Y	N	4	4	0					N	
169		13	4	N	R	V	N	N	N	N	N	N	4	3	0					N	
170		13	5	N	R	V	N	N	Y	N	N	N	4	3	0					N	
**GROUP: 238 DNVT P/V CD0																					
171		13	1	P	F	V	N	N	Y	Y	Y	Y	0	0	0					N	
172		13	1	P	I	V	N	N	Y	Y	Y	Y	0	1	0					N	
173		13	1	P	P	V	N	N	Y	Y	Y	N	0	3	0					N	
174		13	1	P	P	V	N	N	Y	Y	Y	Y	0	3	0					N	
175		13	1	P	R	V	N	N	Y	Y	Y	N	0	4	0					N	
176		13	2	P	R	V	N	N	N	N	N	N	0	0	0					N	
177		13	2	P	R	V	N	N	N	N	N	N	0	1	0					N	
178		13	2	P	R	V	N	N	N	N	N	N	0	2	0					N	
179		13	4	P	R	V	N	N	N	N	N	N	0	0	0					N	
180		13	4	P	R	V	N	N	N	N	N	N	0	1	0					N	
181		13	4	P	R	V	N	N	N	N	N	N	0	2	0					N	
** GROUP: 239 DNVT P/V CD1																					
182	41	13	1	P	FO	V	N	N	Y	Y	Y	Y	1	0	0					N	
183	42	13	1	P	F	V	N	N	Y	Y	Y	Y	1	0	0					N	

Table L-3. (Cont'd)

PRO	OLD PRO	TERTYPE	TLC	SEC	PRE	TERM CHAR MODE	MSG SW COM	NRI	PRONG CONF	CALL FWD	COMM	EUB	CDL	ZONE	DAS	RE KEY ID	OLD RE KEY ID	NET ID-A	NET ID-B	BAR TRNK ACC	BARCALL
** GROUP: 239 DNVT P/V CD1																					
184	43	13	1	P	I	V	N	N	Y	Y	Y	Y	1	1	0					N	
185	44	13	1	P	P	V	N	N	Y	Y	Y	Y	1	2	0					N	
186	45	13	1	P	P	V	N	N	Y	Y	N	Y	1	3	0					N	
187		13	1	P	P	V	N	N	Y	Y	Y	N	1	3	0					N	
188		13	1	P	P	V	N	N	Y	Y	Y	Y	1	3	0					N	
189		13	1	P	R	V	N	N	Y	Y	Y	N	1	4	0					N	
190	46	13	2	P	R	V	N	N	Y	Y	Y	Y	1	4	0					N	
191	47	13	5	P	R	V	N	N	Y	Y	N	N	1	5	0					N	
**GROUP: 240 DNVT P/V CD2																					
192		13	1	P	FO	V	N	N	Y	Y	Y	Y	2	0	0					N	
193	48	13	1	P	F	V	N	N	Y	Y	Y	Y	2	0	0					N	
194	49	13	1	P	I	V	N	N	Y	Y	Y	Y	2	1	0					N	
195	50	13	1	P	P	V	N	N	Y	Y	Y	Y	2	2	0					N	
196	51	13	1	P	P	V	N	N	Y	Y	N	Y	2	3	0					N	
197		13	1	P	P	V	N	N	Y	Y	Y	N	2	3	0					N	
198		13	1	P	P	V	N	N	Y	Y	Y	Y	2	3	0					N	
199	52	13	2	P	R	V	N	N	Y	N	Y	N	2	4	0					N	
200		13	3	P	R	V	N	N	Y	Y	Y	N	2	4	0					N	
201	53	13	5	P	R	V	N	N	Y	N	N	N	2	5	0					N	
** GROUP: 241 DNVT P/V CD3																					
202		13	1	P	F	V	N	N	Y	Y	Y	Y	3	0	0					N	
203		13	1	P	I	V	N	N	Y	Y	Y	Y	3	1	0					N	
204		13	1	P	P	V	N	N	Y	Y	Y	N	3	3	0					N	

Table L-3. (Cont'd)

PRO	OLD PRO	TERTYPE	TLC	SEC	PRE	TERM CHAR MODE	MSG SW COM	NRI	PCONGF	CALL FWD	COMM	EUB	CDL	ZONE	DAS	REKEY ID	OLD REKEY ID	NET ID-A	NET ID-B	BAR TRNK ACC	BARCALL
** GROUP: 241 DNVT P/V CD3																					
205		13	1	P	P	V	N	N	Y	Y	Y	Y	3	3	0					N	
206		13	3	P	R	V	N	N	Y	Y	Y	N	3	4	0					N	
**GROUP: 242 DNVT P/M																					
207		13	1	P	FO	M	Y	N	N	N	N	Y	0	0	0					N	
208		13	1	P	F	M	Y	N	N	N	N	Y	0	0	0					N	
209	54	13	2	P	F	M	N	N	N	N	N	Y	0	6	0					N	
210		13	1	P	I	M	Y	N	N	N	N	Y	0	1	0					N	
211	55	13	2	P	I	M	N	N	N	N	N	Y	0	6	0					N	
212		13	1	P	P	M	Y	N	N	N	N	Y	0	3	0					N	
213	56	13	3	P	P	M	N	N	N	N	N	Y	0	6	0					N	
214		13	1	P	R	M	Y	N	N	N	N	N	0	4	0					N	
215		13	2	P	R	M	Y	N	N	N	N	N	0	1	0					N	
216		13	2	P	R	M	Y	N	N	N	N	N	0	2	0					N	
217		13	2	P	R	M	Y	N	N	N	N	N	0	4	0					N	
218		13	2	P	R	M	Y	N	N	N	N	N	0	5	0					N	
219		13	3	P	R	M	Y	N	N	N	N	N	0	4	0					N	
220	57	13	3	P	R	M	N	N	N	N	N	N	0	6	0					N	
221		13	4	P	R	M	Y	N	N	N	N	N	0	1	0					N	
222		13	4	P	R	M	Y	N	N	N	N	N	0	2	0					N	
223		13	4	P	R	M	Y	N	N	N	N	N	0	5	0					N	
** GROUP: 243 DNVT R/V AF CD1																					
224		13	1	R	FO	V	N	N	Y	Y	N	Y	1	0	0					N	
225		13	1	R	F	V	N	N	Y	Y	N	Y	1	1	0					N	

Table L-3. (Cont'd)

PRO	OLD PRO	TER TYPE	TLC	SEC	PRE	TERM CHAR MODE	MSG SW COM	NRI	PC ROONGF	CALL FWD	COMM	EUB	CDL	ZONE	DAS	RE KEY ID	OLD RE KEY ID	NET ID-A	NET ID-B	BAR TRNK ACC	BARCALL
** GROUP: 243 DNVT R/V AF CD1																					
226		13	1	R	I	V	N	N	Y	Y	N	Y	1	1	0					N	
227		13	1	R	P	V	N	N	Y	Y	N	Y	1	1	0					N	
228		13	1	R	R	V	N	N	Y	Y	N	Y	1	1	0					N	
229		13	2	R	R	V	N	N	N	N	N	N	1	3	0					N	
**GROUP: 244 DNVT R/V CD2																					
230		13	1	R	F	V	N	N	Y	Y	N	Y	2	1	0					N	
231		13	1	R	I	V	N	N	Y	Y	N	Y	2	1	0					N	
232		13	1	R	P	V	N	N	Y	Y	N	Y	2	1	0					N	
**GROUP: 245 DNVT R/M AF ADI																					
233		13	1	R	F	M	N	N	N	N	N	Y	0	6	0					N	
**GROUP: 246 DNVT R/M AF																					
234		13	2	R	I	M	N	N	N	N	N	Y	0	6	0					N	
235		13	3	R	P	M	N	N	N	N	N	Y	0	6	0					N	
236		13	3	R	R	M	N	N	N	N	N	N	0	6	0					N	
** GROUP: 347 DTA																					
237	63	15	1	P	FO	D	N	N	N	N	N	Y	0	0	0					N	
** GROUP: 448 LG1																					
238	62	16	1	P	FO	M	N	N	N	N	N	Y	0	0	0					N	
** GROUP: 549 ALOG/STU CD1																					
239		248	1	N	FO	V	N	N	Y	Y	Y	N	1	0	0					N	
240		248	1	N	F	V	N	N	Y	Y	Y	N	1	0	0					N	
241		248	1	N	I	V	N	N	Y	Y	Y	N	1	0	0					N	
242		248	1	N	I	V	N	N	N	N	N	N	1	1	0					N	

Table L-3. (Cont'd)

PRO	OLD PRO	TER TYPE	TLC	SEC	PRE	TERM CHAR MODE	MSG SW COM	NRI	PROG CONF	CALL FWD	COMM	EUB	CDL	ZONE	DAS	RE KEY ID	OLD RE KEY ID	NET ID-A	NET ID-B	BAR TRNK ACC	BARCALL
** GROUP: 549 ALOG/STU CD1																					
243		248	1	N	P	V	N	N	Y	Y	Y	N	1	0	0					N	
244		248	1	N	P	V	N	N	N	N	N	N	1	3	0					N	
245		248	5	N	R	V	N	N	N	N	N	N	1	5	0					N	
**GROUP: 550 ALOG/STU CD2																					
246		248	1	N	F	V	N	N	Y	Y	Y	N	2	0	0					N	
247		248	1	N	I	V	N	N	Y	Y	Y	N	2	0	0					N	
248	59	248	1	N	I	V	N	N	N	N	N	N	2	1	0					N	
249		248	1	N	I	V	N	N	N	N	Y	N	2	1	0					N	
250		248	1	N	P	V	N	N	Y	Y	Y	N	2	0	0					N	

APPENDIX M

INTRODUCTION TO ASYNCHRONOUS TRANSFER MODE

1. Introduction. Asynchronous Transfer Mode (ATM) is a method of packetizing digital information by using a fixed cell construction that is independent of data rate and cell switching technology. In ATM, information is divided into short fixed-length entities, called cells, that are provided with flow identification labels, and forwarded through the network in a way similar to packet multiplexing/switching. In commercial applications, ATM works in conjunction with synchronous optical network (SONET), which permits a very wide range of data rates and services to be collectively integrated and switched within a very high data rate (Gbps) network. ATM cells can also be passed over circuit-switched networks as normal digital traffic. The ATM concept is an integrating concept in that it enables all types of information, from voice to data to video, to be handled by common transmission and switching facilities. The Department of Defense's high level of interest in ATM for tactical systems is driven by the desire for this seamless integration of fixed and deployed resources. The Services are considering the application in the tactical environment, as an example the Army's ATM Division Slice Program.

2. ATM Cell format. The ATM is based on the cell structure shown in Figure M-1. Cells are of fixed size, 53 octets, consisting of a 5-octet header field and a 48-octet user information field. Any control information pertaining to the user application is carried in the user information field.

a. Cell loss priority. The purpose of the cell loss priority (CLP) field is to indicate relative priority of cells within a single-user information stream.

b. ATM reference model. Figure M-2 depicts the ATM layered protocol reference model (ATM-RM). The specific layers related to the ATM functions are the physical layer and ATM layer, which are common to all services and provide cell transfer capabilities, and the ATM adaptation layer (AAL), which is service-dependent. The ATM layer uses cell header information to transfer the cell payload field through the ATM network. AAL layer functions are user service dependent and operate only on information contained in the payload field.

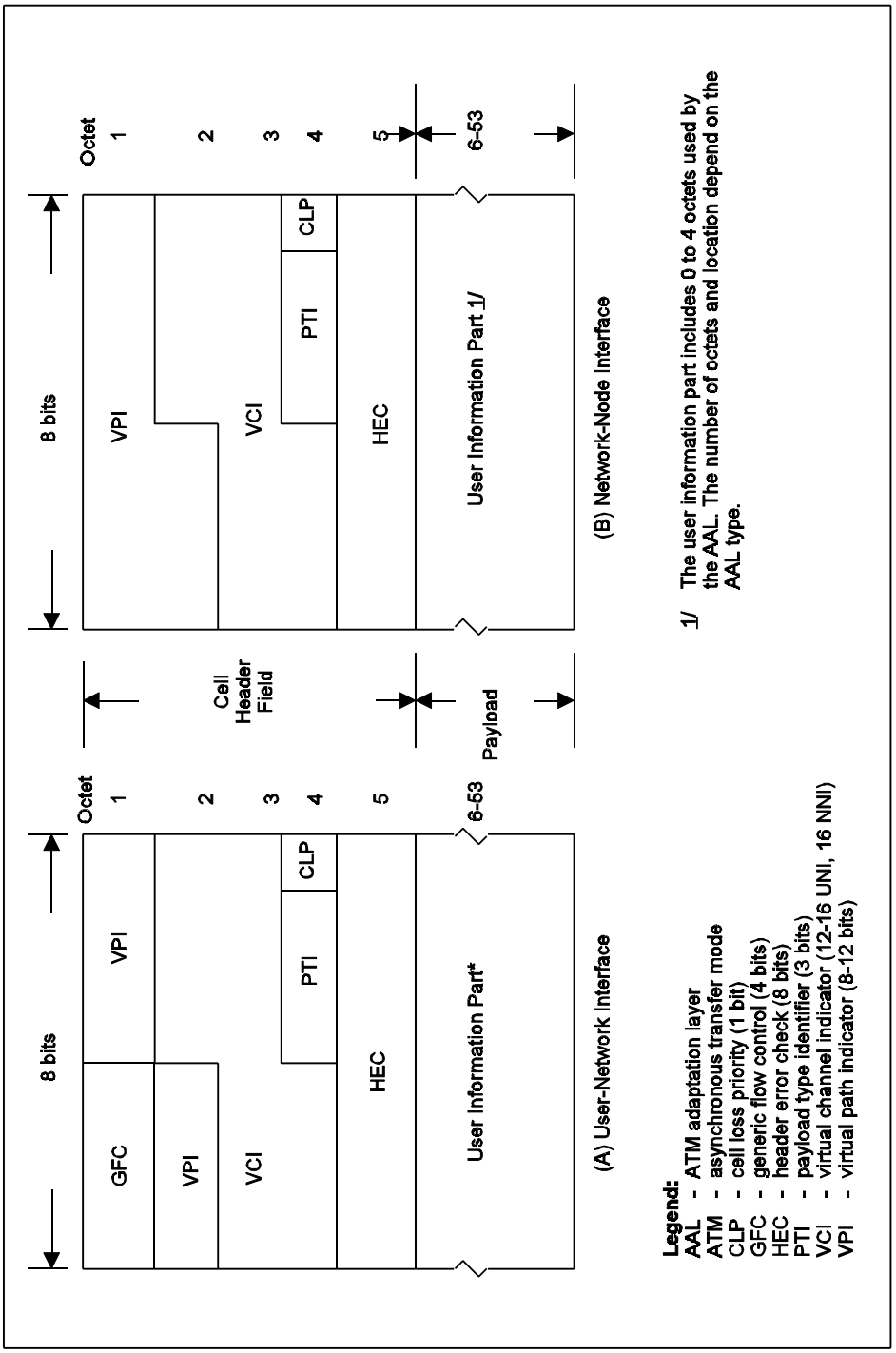

Figure M-1. ATM Cell Structure

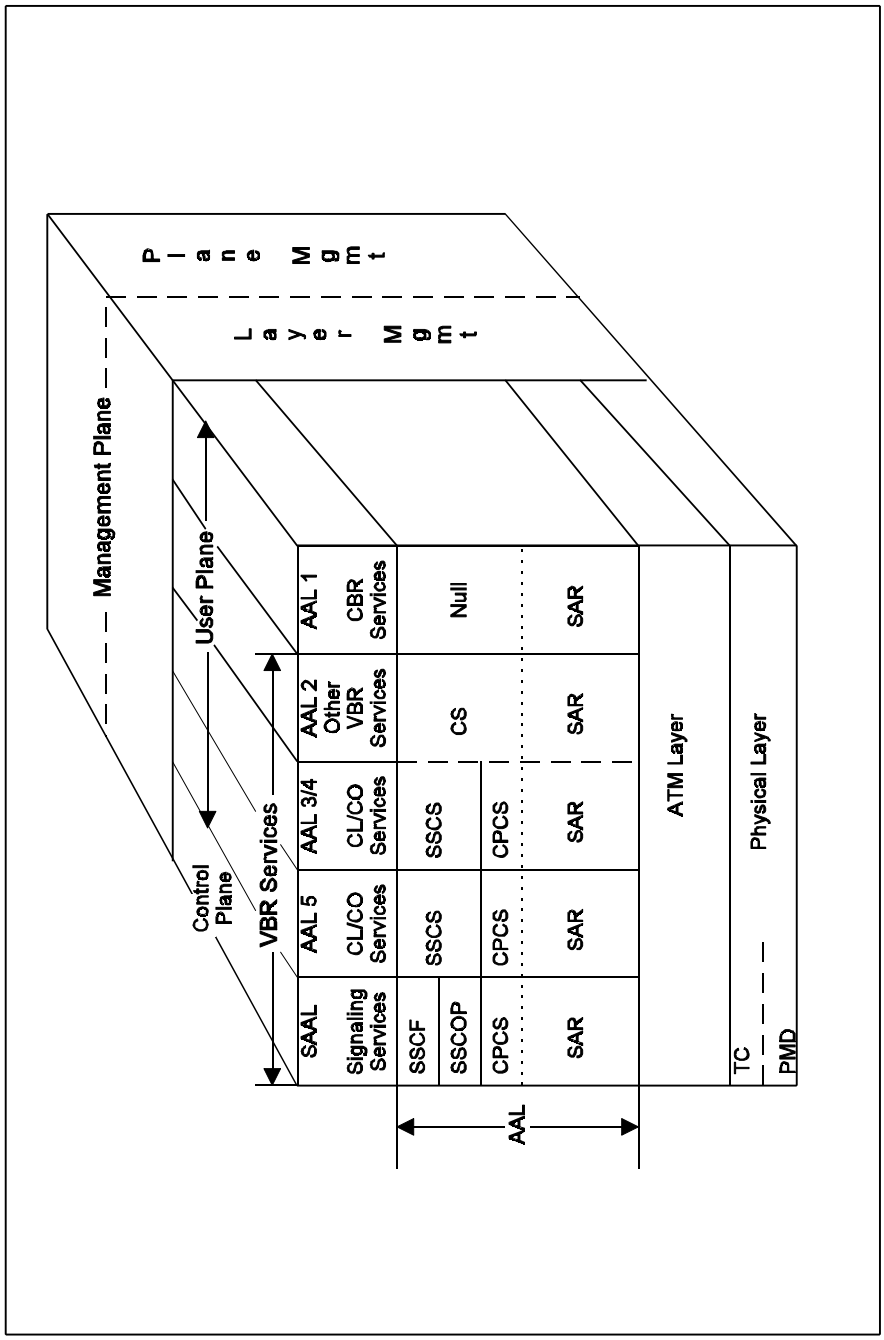

Figure M-2. ATM Reference Model.

(1) Physical Layer. The physical layer, which provides transmission services to the ATM layer, consists of two sublayers. The physical-media-dependent (PMD) sublayer includes only physical-media-dependent functions. The transmission convergence (TC) sublayer shall perform all functions required to transform a flow of cells into a flow of bits, which can be transmitted and received over a physical medium. ATM supports the following interface rates:

(a) DS3- 44.736 Mbps.

(b) 100 Mbps.

(c) OC3c-155 Mbps.

(d) UTP-25 Mbps.

(e) DS1 1.544 Mbps.

(2) ATM Layer. The ATM layer provides connection-oriented network service to the layers above. After a virtual connection has been established, the ATM layer transfers cells in accordance with their virtual path indicators (VPI) and their virtual channel indicators (VCI).

(3) ATM Adaptation Layer. The AAL process is responsible for adapting information, whether voice, data, imagery, or video and adapting it into ATM cells. Depending on the type of data, unique AAL processes will handle information differently.

(a) AAL 1. AAL 1 provides a 47-octet user payload, with a 1-octet header to support timing and sequence integrity. AAL 1 supports constant bit rate (CBR) applications in which a timing relationship is required to exist between source and destination, such as voice or compressed or uncompressed video. This mode is referred to as circuit emulation and is commonly used for transport of multiplexed circuits such as DS-1. To maintain BCI, dummy cells are inserted whenever the receiving entity identifies a lack of received cells from the ATM layer.

(b) AAL 2. AAL 2 supports variable bit rates (VBR) applications in which a timing relationship is required to exist between source and destination, such as compressed video.

(c) AAL 5. VBR may be used for compressed video and bursty connections using TCP/IP or X.25 adapted to ATM cells using AAL-5.

(d) Signaling ATM Adaptation layer. The signaling AAL (SAAL) conveys signaling information between layer 3 entities across the UNI and NNI. The SSCS is divided into two sublayers: the service-specific coordination function (SSCF) and the service-specific connection-oriented protocol (SSCOP).

c. ATM Service Support. ATM shall support a variety of transport services, such as frame relay and SMDS. These services may be provided on top of AAL 3/4 or AAL 5. ATM shall also support connection to N-ISDN services at the UNI.

d. ATM Interworking. ATM connections shall support ISDN user and signaling services. ATM networks shall support interworking with other ATM networks and non-ATM networks. Between ATM networks, interconnection will be at the cell level. When interworking with non-ATM networks, interconnection will be via an ATM adapter. Interconnection with N-ISDN networks will also require an ATM adapter. The adapter may be implemented via an external ATM device or in the ATM switch.

e. Types of ATM Switches. There are two broad categories of ATM switches.

(1) Work Group/Access ATM Switch. This category of switch is characterized as having limited ATM routing and signaling, limited ATM traffic management, and low throughput.

(2) WAN ATM Switch. The WAN ATM switch provides:

(a) Sophisticated ATM routing and signaling, private network-to-node interface (PNNI).

(b) Sophisticated ATM traffic management, connection admission control (CAC), usage parameter control (UPC), and available bit rate (ABR).

(c) Supports a wide range of interface rates (generally from T1 up to optical carrier (OC)12, 622.08 Mbps).

(d) Throughputs of 2 Gbps and higher.

f. Application of ATM in Tactical Systems. Commercial standards for ATM are based on the availability of highly reliable (BER = 10^{-11}), high bandwidth (50 Mbps to Gbps) transmission facilities (fiber, cable, SONET). However, tactical channels may be characterized as low bandwidth and unreliable. These include radio links in the low Mbps range (DS1) with BERs of 10^{-5} or worse. Tactical radio links at VHF and HF have even less bandwidth and worse BERs. In traditional packet-switched networks, data links are made reliable by means of error detection and retransmission at each network node. In ATM networks, retransmission is not done at each node; it is done only end-to-end across the network, or end-to-end between user end devices. The connections through deployed ATM networks are likely to traverse multiple radio links. The end-to-end error probability will approach the sum of the individual link error probabilities, causing excessive retransmission and severe reduction of throughput when deployed radios are used. For this reason, FEC needs be provided in deployed radio links to reduce the number of retransmissions. Selection of a commercially available FEC method (1/2 rate convolutional or Reed Solomon) for deployed ATM networks depends on the transmission media. Commercial ATM products do not support dynamic bandwidth allocation (DBA), such as provided by such devices as IDNX. DBA is considered an important capability on tactical links where there are idle channels in a DTG.

APPENDIX N

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GLOSSARY

ABBREVIATIONS AND ACRONYMS

4WLTU	four-wire line termination unit
2WLTU	two-wire line termination unit
AAA	assign alternate routing
AAL	assign affiliation lists, ATM adaptation level
AAP	assign alternate parent
AAR	assign, accommodate, and restore received bypass lists
AAU	analog applique unit
ABD	assign bypass and duplication transfer
ABL	assign blacklist deletion
ABR	assign bypass reception, available bit rate
ABT	assign bulk transfer
ac	alternating current
ACC	assign SCC trunks
ACI	assign call inhibit
ACN	assign commercial network routing
ACP	assign common-pool compressed dial list
ACR	assign channel reassignment
ACV	assign corrupted variables
A/D	analog-to-digital
ADB	assign data base transfer
ADOCU	air defense orderwire control unit
ADPCM	adaptive differental pulse code modulation
ADE	assign digit editing lists
ADT	assign digital transmission group
AEI	assign equipment in/out-of-service
AEM	assign EMP mode
AEU	assign essential users bypass
AFB	Air Force base
AFD	assign fixed-directory routing
AFFOR	Air Force forces
AFR	assign and display frequency for network reporting
AFSOF	Air Force special operations forces
AGC	assign gateway and commercial office routing
AIC	assign individual compressed dial list
AIL	assign interswitch link initialization
AIRK	area interswitch rekeying key
AIRV	area interswitch rekeying variable
AIRTERM	airborne terminal
AIU	AUTOVON interface unit
AKDC	automatic key distribution center
ALCG	analog line conditioning group

ALTG	auxiliary line termination group
ALD	assign local duplication
ALS	assign analog loop signaling
ALTU	analog line termination unit
AMA	assign manual affiliation
AMD	assign memory display
amp	ampere, amplifier
AMT	assign multiple trunks
AN	analog nonsecure
ANDVT	advanced narrowband digital terminal
ANN	assign NNX routing
ANR	assign net rekeying
ANX	assign NNXX routing
ANY	assign NYX routing
AOI	assign other equipment in/out-of-service
AOD	assign on-line diagnostics
AOR	assign and display unstaffed operator routing, area of responsibility
AP	alternate parent
APC	assign preprogrammed conference
APF	assign profile
APL	assign preaffiliation list
APR	assign PR (NN) routing, assign packet switch routing
APS	alternate parent switch
APV	assign password verification
ARB	assign received bypass list
ARC	assign remote connection
ARD	assign/display routing subsystem downsized (RSSD) download
ARFOR	Army forces
ARR	assign remote release
ARSOF	Army special operations forces
AS	analog secure
ASC	assign and display switch classmarks
ASI	assign and display switch initialization
ASL	assign XX (SL) routing
ASR	assign SEN/RAU
AST	assign secondary traffic channels
ATB	all trunks busy
ATG	assign trunk group cluster
ATH	assign and display thresholds
ATL	assign transfer and activation lists
ATM	assign traffic metering, asynchronous transfer mode
ATS	assign terminal service
ATT	assign terminal type
AUTODIN	Automatic Digital Network
AUTOVON	Automatic Voice Network

AVDTG	analog via DTG
AVL	assign variable location
AVLTU	AUTOVON line termination unit
AVOW	analog voice orderwire
AXL	assign transfer list
AXX	assign XXX routing
AZR	assign zone restriction
BCI	bit count integrity
BCS	baseband communications system
BDI	BLACK digital interface
BER	bit error rate, bit error ratio
BG	battle group
BIT	built-in test
BITE	built-in test equipment
BS-LA	bit select address-location address
BSBP	block-step-back parameter
BSU	bulk storage unit
BT	bulk transfer
C2	command and control
C4	command, control, communications, and computers
CAC	connection admission control
CADCI	common air defense communications interface
CAM	customer access module
CAP	control and alarm panel
CAP/CEM	CAP and control electronics module
CAPLP	CAP line driver
CB	common battery
CBCS	common baseline circuit switch
CBLTU	common battery line termination unit
CBR	constant bit rate
CBS	common battery signaling
CBT	common battery terminal
CBU	conference bridge unit
CC	communications central
CCA	circuit card assembly
CCES	contingency communications extension switch
CCI	controlled COMSEC item
CCSD	command communications service designator
CCIS	common channel interswitch signaling
CCP	contingency communications package
CCPS	contingency communications parent switch
CCS	common-channel signaling
CCSQ	combat communications squadron
CDMGB	cable driver modem group buffer
CDN	compressed dial number
CDS	compact digital switch

CEF	common equipment facility
CEG	common equipment group
CELP	code excited linear prediction
CEM	control electronics module
CENTAG	Central Army Group
Ch	channel
CINC	commander of a combatant command
CIRK	common interswitch rekeying key
CIRV	common interswitch rekeying variable
CIS	combat intelligence system
CL	connectionless
CLP	cell loss priority
CLTU	control line termination unit
CMU	control and matrix unit
CNCE	communications nodal control element
CNRI	combat net radio interface
CNV	common net variable
CO	central office
COMSA	comsec controller A
COMSB	comsec controller B
COMSEC	communications security
COMPLAN	communications plan
CON	controller
CONUS	Continental United States
CP	command post
CPG	central processing group
CPU	central processing unit
CRF	channel reassignment function
CS	circuit switch
CSCE	communications system control element
CSIPG	circuit switch interface planning guide
CSOLOP	circuit switch on-line operating system
CSP	call service position
CSPMD	call service position modem
CSR	circuit switch routing
CSR TEP	circuit switch routing task execution plan
CSS	COMSEC subordinate switch
CSU	call service unit
CT	communications terminal
CTAPS	Contingency Tactical Air Control System (TACS) Automated Planning System
CTLR	controller
CTLU6	controller configuration (processor control unit 6)
CTOC	corps tactical operations center
CVDOW	combined voice and data orderwire
CVSD	continuously variable slope delta
CVSDA	CVSD altered

D/A	digital-to-analog
DAC	direct access capability
DAMA	demand assigned multiple access
DAS	direct access service
DATU	data adapter termination unit
DB	data base
dB	decibel
DBA	dynamic bandwidth allocation
DBD	display bypass and duplication
dBm	dB reference one milliwatt
DBR	display bypass reception
dc	direct current
DC	down converter
DCC	direct current closure adapter
DCATS	digital code analog tone synthesizer
DCBU	digital conference bridge unit
DCCLR	dc closure
DCEC	Defense Communications Engineering Center
DCO	dial central office
DCS	Defense Communications System
DDDZ	direct DSVT dialing zone
DDS	display directory status
DECPU	DSDI enhanced CPU
DEINT	DSDI enhanced interface
DEMUX	demultiplex or demultiplexer
DES	downsized extension switch
det	detector
DGM	digital group multiplex
DGS	display group status
DIBTS	digital in-band trunk signaling
DILPA	diphase loop modem A
DIPGM	diphase group modem
DISA	Defense Information Systems Agency
DISDI	digital simple data interface
DISGM	diphase supergroup modem
DLPMA	diphase loop modem A
DLTU	digital line termination unit
DMS	Defense Message System
DN	digital nonsecure
DNI	digital NATO interface
DNGPM	digital NATO group modem
DNTGM	digital NATO transmission group module
DNVT	digital nonsecure voice terminal
DOW	digital orderwire
DP	dial pulse
DPA	dual phone adapters
DPBX	digital private branch exchange
DRREC	driver-receiver interface
DRS	deployable Red switch

DRSN	Defense Red Switch Network
DS	digital switch
DSB	digital in-band trunk signaling buffer
DSCNA	digital scanner A
DSCNB	digital scanner B
DSDI	digital simple data interface
DSIGA	digital signal generator
DSG	digital signal generator
DSN	Defense Switched Network
DSNET	Defense Secure Network
DSP	digital signaling process
DSS-1	digital small switch-1
DSSCS	Defense Special Security Communications System
DSVT	digital subscriber voice terminal
DT	dial tone
DTA	digital trunk adapters, dual trunk adapters
DTG	digital transmission group, digital trunk group
DTMF	dual-tone multifrequency
DTMFB	dual-tone multifrequency type B card
DVOWs	digital voice orderwires
E	eliminate, elimination mark
E-E	end-to-end
EAC	echelons above corps
E&M	ear and mouth, recEive and transMit
EMLTU	E&M line termination unit
ECB	echelons corps and below
ECU	environmental control unit
EEPROM	electrically erasable and programmable read-only memory
EHF	extremely high frequency
e-mail	electronic mail
EMP	electromagnetic pulse
EOD	end of dial
EOW	engineering orderwire
ESOP	enhanced switch operations program
EU	essential user
EUB	essential user bypass
EUBSA	EUB selector A
EUBSB	EUB selector B
EUN	essential user net
EURV	essential user rekey variable
F	Flash, foreign classmark
FAM	fault assist module
FAX	facsimile
FCFS	first come first serve

FDL	fixed directory list
FDSL	fixed directory subscriber list
FDUL	fixed directory unit list
FDX	full duplex
FES	force entry switch
FIFO	first-in-first-out
FLTCA	fault controller
FLTCB	fault controller
FMOC	fleet mobile operations center
FO	Flash Override
FOCA	fiber optic cable assembly
FOBC	fiber optic bulkhead connector
FOL	forward operating location
FOM	fiber optic modem
FORSCOM	Forces Command
FOTS	fiber optic transmission system
FRC	frame recovery circuit
FRO	frequency reference oscillator
FSK	frequency shift keying
FTP	file transfer protocol
FWA	four-wire adapter
FWD	forward
GBNP	global block numbering plan
Gen	generator
GFC	generic flow control
GFE	government furnished equipment
GLU	group logic unit
GM	group modem
GMF	ground mobile forces
GPMDM	group modem
GSPM	global standard profile matrix
GXX	format for a user's telephone number, 4/3 numbering plan
GXXX	format for a user's telephone number, 3/4 numbering plan
H	home classmark
HDPLX	half duplex
HDX	half duplex
HEC	header errror check
HF	high frequency
HN	home net
HRV	home rekey variable
HTML	hypertext markup language
HUS	hardened unique storage
Hz	hertz
HZG	hertz generator

HZX	hertz crossover
I	Immediate
IAP	international access prefix
IAUR	interarea unique interswitch rekeying variable
ICAP	intergrated communications access package
ID	identification
IDNX	Intergrated Digital Network Exchange
IDSN	Indirect Defense Switched Network
IDX	index
IDX	ISDN gateway exchange
IEEE	Institute of Electrical and Electronics Engineers
IJC3S	initial joint command, control, and communications system
IMLTU	intermatrix line termination unit
IMU	intermatrix unit
INB	internodal buffer
INID	intercept network in dialing
INMARSAT	International Maritime Satellite
IOC	input/output controller
IOE	input and output extender
IOEIX	input output expander/exchanger
IOSL	input/output SCSI link controller
IOU	input/output unit
IOX	input output exchange
INB	internodal buffer
IP	interface protocol
IPL	interprocessor link
ISDN	Integrated Services Digital Network
IST	interswitch trunk, integrated services telephone
ITG	interswitch trunk group
IVCS	interior voice communications system
IWF	internetworking function
IXX	format for a user's telephone number
JCCC	Joint Communications Control Center
JCSE	Joint Communications Support Element
JOC	joint operations center
JPAL	joint preaffiliation list
JSOTF	joint special operations task force
JTF	joint task force
JTFPAL	joint task force preaffiliation list
kbps	kilobits per second
kHz	kilohertz
km	kilometer

KNX	DSN switch code
KP	key pulse
kW	kilowatt
KXX	format for a user's telephone number
L	LEN bulk transfer variable
LAN	local area network
LB	local battery
LBT1	limited bandwidth T1
LCSP	local call service position
LED	light emitting diode
LPC	linear predictive coding
LPCS	lateral parent COMSEC switch
LDI	line driver interface
LENS	large extension node switch
LGM	loop group multiplexer
LINT	line interface number
LKG	loop key generator
LM	loop modem
LSAT	light multi-band satellite terminal
LMD	loop mux/demux
LNX	flood search numbering plan prefix
LNX+XXXX	format for a MSE user's telephone number
LOC	location
LOS	line-of-sight
LPC	linear predictive coding
LPCLK	loop clock
LRM	low-rate multiplexer
LSB	least significant bit
LSCDM	low-speed cable driver modem
LTG	local timing generator
LT	local timing, line type
LTA	local timing card
LTBF	local timing buffer
LTC	line termination circuit
LTU	line termination unit
LVDTC	local video display terminal controller
M	MSRT/RAU key
MA	master
mA	milliamperes
MARFOR	Marine Forces
MAX	maximum
Mbps	megabits per second
MCLDR	matrix controller line driver
MCPU	maintenance control processor unit
MDMDX	multiplex/demultiplex
MDTG	multiplexed DTG
MEM	memory

MESM	message memory
MF	multifrequency
MFLTU	multifrequency line termination unit
MHz	megahertz
MINTERM	miniaturized terminal
MNI	man-machine interface
MMT	multimedia terminal
MOD 8	Modulo 8 (TRI-TAC rate family)
MOD 9	Modulo 9 (ATACS rate family)
MPN	MSE packet network
MPU/VDU	modem-only plug-in unit/voice processor-only unit
MRVC	multiple rate voice coding
MS	message switch
ms	milliseconds
M/S	maintenance/supervisor
MSE	mobile subscriber equipment
MSF	multiplex signal format
MSRT	mobile subscriber radiotelephone terminal
MSNV	message switch LKG net variable
MSRV	message switch rekeying variable
MTC	magnetic tape controller
MTG	master timing generator
MTGDR	MTG driver
MTGSY	MTG synthesizer
MTT	magnetic tape transport
MUX	multiplex or multiplexer
mv	millivolts
MXRCA	matrix receiver controller A
MXXCA	matrix transmit controller A
MYX	tactical area code
NA	not applicable
NAC	national access code
NAI	NATO analog interface
NANP	North American Numbering Plan
NATO	North Atlantic Treaty Organization
NAVFOR	Navy forces
NBST	narrowband secure terminal
NCMD	nine-channel multiplex/demultiplex
NCS	node center switch
NCT	network control terminal
NCTAMS	naval computer and telecommunications area master station
NDI	NATO digital interface
NES	network encryption system
NESP	Navy EHF SATCOM program
NI	nationality identifier
NICS	NATO Integrated Communications System

NILTU	NATO interface line termination unit
NIU	NATO interface unit
NMF	node management facility
NMT	node management terminal
NN	tactical area code
NNX	format for a switch code, 3/4 numbering plan
NNXX	format for a switch code, 4/3 numbering plan
NORM	normal
NS	nonsecure
NSB	NATO signaling buffer
NSW	nonsecure warning
NSWT	nonsecure warning tone
NSWTG	Naval Special Warfare Task Group
NTCAMS	naval computer and telecommunications master station
NTSC	National Television Systems Committee
NWB	normal wideband
NWLTU	normal wideband line termination unit
NWT	Normal wideband terminal
NXX	switch code (commercial plan)
NYX	area code (commercial and DCS)
OA	operating assembly
OCONUS	outside the CONUS
OCU	orderwire control unit
OOS	out-of-service
OPG	operator equipment group
OPLAN	operations plan
OW	orderwire
P	Priority
PA	power amplifier
PABX	private automatic branch exchange
PAL	Preaffiliation List
PBX	private branch exchange
PCB	printed circuit board
PCM	pulse code modulation
PCMCIA	Personal Computer Memory Card Interface Association
PCS	processor controlled strapping
PDS	protected distribution system
PDSS	post-deployment software support
PEP	power entry panel
PIC	peripheral interface controller
PLL	phased-locked loop
PLT	program library tape
PMD	physical medium dependent
PNERK	post nuclear event rekeying key
PNID	precedence network in dialing

PNNI	private network-to-node interface
p-p	peak-to-peak
pps	pulses per second
PQPSK	PCM-encoded phase shift keying
POTS	plain old telephone system
PR	primary zone, pair
PRI	primary
PROM	programmable read only memory
PRS	primary switch
PRSL	primary zone/switch location
PS	packet switch
PSHTI	packet switch host trunk interface
PSTN	public switched telephone network
PSWD	password
PTC	primary traffic channel
PTI	payload type identifier
PTT	push-to-talk, postal telephone and telegraph
PWB	printed wiring board
PXJXZ	format for an FDSL
QPSK	quadriphase shift keying
R	Routine
RAM	random access memory
RAU	radio access unit
RB-STD	rubidium standard
RCLTR	receiver controller
RCSP	remote call service position
RCU	rate changer unit
RCV	receive
RD	ringdown
RELPM	residual excited linear phase modulation
REMFM	remote fault multiplexer
REV	revision number
RH	reentry home
RLGM	remote loop group multiplexer
rlse	release
RM	reference model
RMC	remote multiplexer combiner
rms	root mean square
RMU	receiver matrix unit
ROA	remote optical assembly
ROM	read only memory
RSBC	routing signaling buffer controller
RSB/DA	routing signaling buffer/data adapter
RSBIN	remote signaling buffer
RSCD	RS-423 to CDϕ card
RSNOC	RES switch operations center
RSP	readiness spare packet

RSU	routing signaling unit
RSS	routing subsystem
RST	resistor terminal card
R/T	receive/transmit
RTTY	remote teletypewriter
RV	rekeying variable
RVDT	remote visual display terminal
RWI	radio wire integration
RX	receive
SAAL	signaling AAL
SAR	segmentation and reassembly
SAS	single audio system
SAT	satellite
SBC	signaling buffer controller
SBCC	SBC card
SCC	system control center
SCG	switching controller group
SCNRC	scanner controller
SCPU	switch control processor unit
SCS	silicon-controlled switch
SCSI	small computer system interface bus
SDC	signal data converter
SEC	second(s)
SDMX	space division matrix
SDNRIU	secure digital net radio interface unit
SDSG	space division switching group
SDSM	space division switching matrix
SEN	small extension node
SENDC	sender controller
SENS	SEN switch
SEP	signal entry panel
S&F	store and forward
SF	single frequency
SFOB	special forces operating base
SHF	superhigh frequency
SIB	system interface bus
SIPRNET	Secret Internet Protocol Router Network
SL	switch location
SMD	switch mux/demux
SMU	switch multiplexer unit
SN	SEN home net
SNAP	switched network automated planner
SNV	SEN rekeying variable
SOCLIN	special operations command light initial communications module
SOF	special operations forces
SONET	synchronous optical network
SP	security preferred

SPDVA	special devices controller
SPDVC	remote special devices controller
SPDVD	remote special devices demultiplexer
SPEED	system planning, engineering, and evaluation device
SR	security required
SRN	EAC SEN home net variable, single row nest
SRV	EAC SEN home rekeying variable
SSB	single sideband
SSCF	service-specific coordinating function
SSCS	service-specific convergence sublayer
SSI	single subscriber interface
SSO	special security office
STA	system tape A
STANAG	Standardization Agreement
STDIS	STM timing distributor
STC	secondary traffic channel
STE	secure terminal equipment
STI	summing telephone interface
SUBS	subscriber
SVLTU	service line termination unit
SW	switch
SYSCON	systems control
sz	seize
T	trunk key
TAB	target acquisition battery
TACC	tactical air control center
TACLS	tactical loop signaling
TACSAT	tactical satellite
TACTERM	tactical terminal
TACTS	tactical trunk signaling
TASDAC	tactical secure data communications system
TBD	to be determined
TC	transmission convergence
TCCF	tactical communications control facility
TCLTU	twenty hertz/contact closure LTU
TCP	transmission control protocol
TDC	theater deployable communications
TDFLC	time division fault collector
TDM	time division multiplex(er)
TDMF	time division matrix function
TDMM	time division memory module
TDMX	time division matrix
TDSG	time division switching group
TDSGM	time division switching group modified
TECH	technical
TED	trunk encryption device
TEM	trunk encryption module

TEP	task execution plan
TERM	terminal
TGC	trunk group cluster, test generator controller
TGM	trunk group multiplexer
TGMOW	transmission group module orderwire
TGU	trunk compatibility unit
T1CEPT	commercial standard T1 or E1 groups
TIM	trunk interface module
TLC	traffic load control
TM	technical manual
TO	technical order
TPA	terminal privilege authority, tactical packet adapter
TRANSEC	transmission security
TRI-TAC	Tri-Service Tactical Communications Program
TROPO	tropospheric scatter
TSB	trunk signaling buffer
TSBFB	trunk signaling buffer "B"
TSC	TROJAN switching center
TSD	trunk signaling device
TSSP	tactical satellite signaling processor
TSSR	tropo-satellite support radio
TSTC	test generator controller
TT	terminal type
TTL	transistor-transistor logic
TTY	teletypewriter
TU	timing unit
TUNA	transition unit nest assembly
TX	transmit
UC	up converter
UHF	ultrahigh frequency
UIRV	unique interswitch rekeying variable
ULCS	Unit Level Circuit Switch
ULTU	universal LTU
UPC	usage parameter control
USACOM	United States Atlantic Command
USAFE	United States Air Forces in Europe
USCENTCOM	United States Central Command
USEUCOM	United States European Command
USPACOM	United States Pacific Command
USSOCOM	United States Special Operations Command
USSOUTHCOM	United States Southern Command
USMC	United States Marine Corps
V	volt
VCO	voltage controlled oscillator
VDC	volts direct current

VDR	voice digitization
VDS	voice data switch
VDT	visual display terminal
VDTG	virtual DTG
VDU	visual display unit, video docking unit
VDUC	visual display unit controller
VF	voice frequency
VOCU	voice orderwire control unit
VOX	voice actuation
VPI	virtual path indicator
V_{rms}	voltage root mean square
VTC	video teleconferencing
VTTYC	VDT/TTY controller
W	watts, wire
WIC	workstation interface controller
WX	weather
WRSK	war readiness spares kit
WWMCCS	Worldwide Military Command and Control System
XFMR	transformer
XXIXX	format for an FDUL