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SLC® Series 5 Carrier System

AUA93 BRITE II Channel Unit for ISDN

Installation and Maintenance

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SLC® SERIES 5 CARRIER SYSTEM
AUA93 BRITE II CHANNEL UNIT FOR ISDN
INSTALLATION AND MAINTENANCE

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1. ABOUT THIS DOCUMENT

This document contains installation and testing procedures for the *SLC* Series 5 carrier system **AUA93** basic rate interface transmission extension - second generation (BRITE II) channel unit for integrated services digital network (ISDN). It is divided into the following parts: **AUA93** BRITE II channel unit applications, ISDN service prerequisites, transmission equipment preparation, ISDN channel unit installation, test sets, and maintenance procedures. The procedures in this document tell how to install the **AUA93** BRITE II channel unit(s), do acceptance tests or verify certain requirements of the ISDN circuit, and locate and clear trouble at the BRITE II channel unit level. This document is easier to understand with a working knowledge of: the *SLC* Series 5 carrier system, ISDN, and the **950A** test set.

References: The following documents provide additional information and details on the **AUA93** BRITE II channel unit and related equipment. Also, references to these and other documents are provided in the text as applicable.

DOCUMENT	TITLE
AT&T 235-105-220	*5ESS*® Switch - Corrective Maintenance Procedures (5E6 generic)
AT&T 235-900-321	*5ESS* Switch ISDN Basic Rate Interface Specification (5E6 generic)
AT&T 363-005-131	AUA93 BRITE II Channel Unit - Data Sheet
AT&T 363-005-238	950A Test Set - Data Sheet
AT&T 365-170-503	AHG18 and AHG28 BRITE II Channel Units for ISDN Applications - Installation and Testing
AT&T 533-700-100	ISDN Customer Premises Planning Guide

2. INTRODUCTION

The **AUA93** BRITE II is a 2-wire channel unit that complies with the TI.601-1988 American National Standards Institute (ANSI) for the U interface digital subscriber line (U-DSL). The BRITE II channel units are not compatible with the BRITE alternate mark inversion (AMI) channel units. The **AUA93** channel unit provides ISDN basic access in the line terminating mode (LT-mode) to the NT1 (network termination type 1) at the customer location (Figure 1). The DSL is a technology that provides full-duplex service on a single twisted metallic pair at a rate sufficient to support ISDN basic access and additional framing, timing recovery and operations functions. The U interface is a reference point on the transmission line between the network termination (NT) (on the customer side) and the line termination (LT) (on the network side, for example, a channel unit). Thus, U-DSL refers to the physical and electrical connection between the LT and the NT. The NT1 is a device that terminates layer 1. [The BRITE II channel units use three layers for ISDN service: layer 1 (physical layer), layer 2 (data link layer), and layer 3 (network layer).]

The ISDN basic rate interface (BRI) is defined as 2B+D (two 64 kb/s B-channels and one 16 kb/s D-channel). The **AUA93** channel unit provides up to three time slots (B1, B2, and D+) and four types of service (D-only, B1+D, B2+D, or 2B+D). The B-channels communicate

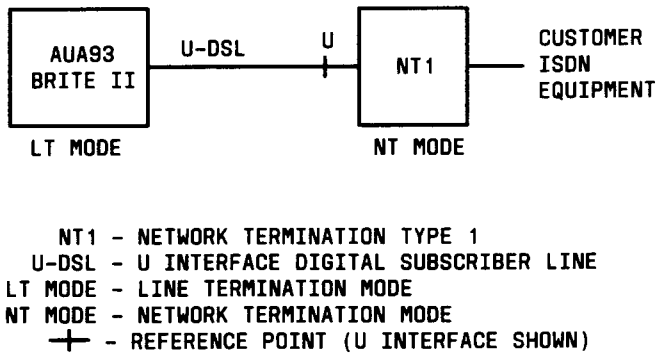

Figure 1 — U Interface Digital Subscriber Line (U-DSL)

digitized voice or data. The D-channel communicates control signaling and low speed packet-switched data. An option switch is provided on the channel unit to select the type of service.

3. AUA93 BRITE II CHANNEL UNIT APPLICATIONS

The **AUA93** BRITE II channel unit is a 2-wire circuit that supports ISDN D-only, B1+D, B2+D, or 2B+D service. The **AUA93** channel unit provides a U-DSL interface between the NT1 and the BRITE II channel unit at the far end of the DS1 facility. Figure 2 shows typical applications of BRITE II channel units providing ISDN basic rate service. In the circuit, the **AUA93** channel unit functions as a line termination unit. At the far end of the DS1 facility, it interfaces with the D4/*SLC* 96 carrier **AHG18** BRITE II channel unit. The **AHG18** channel unit functions as a network termination unit and typically interfaces the serving switch and the DS1 facility.

A. Tandem Carrier Arrangements

In a tandem carrier arrangement (Figure 2), the **AUA93** channel unit still provides line termination, but the **AHG18** interfaces an **AHG28** BRITE II channel unit instead of the serving switch. (The **AHG28** channel unit also functions as a line termination unit.) Up to 6 BRITE II channel units can be maintained in a tandem arrangement. (Figure 2 shows only four BRITE II channel units in tandem).

B. The Series 5 Feature Package B (FPB) Remote Terminal (RT)

The **AUA93** channel unit may be used in the Series 5 RT as follows:

- A Series 5 FPB universal mode 1 (FPB/U/M1) RT equipped with the MC97771A1 bank control unit (BCU) and the AUB24 alarm display unit (ADU)
- A Series 5 FPB with special services option, universal mode 1 (FPB/SS/U/M1) RT equipped with the MC97771A1 BCU and the AUB27 ADU.

This system arrangement is compatible with the TR-08 (Bellcore TR-TSY 000008) interface, including framing format (F_s), data link, and protection switching. Refer to customer information release (CIR) AT&T 363-099-111TD (technical description) for a description of modes and general information on the Series 5 FPB RT.

C. ISDN Serving Switch

The BRITE II channel units are compatible with any digital switch that complies with the T1.601-1988 ANSI U interface. The *5ESS* switch with Generic 5E6 or later is a typical example. Procedures that refer to the *5ESS* switch may not be applicable to other types of serving switches.

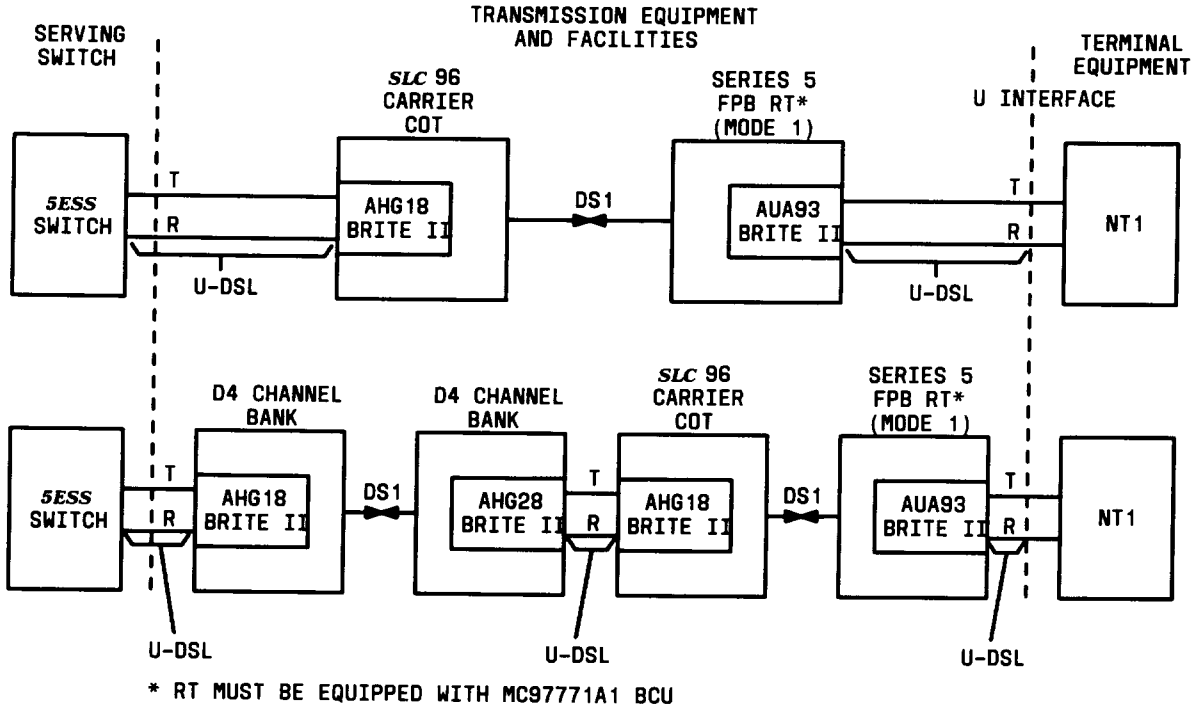

Figure 2 — Typical ISDN Application With AUA93 BRITE II in a Series 5 FPB RT

4. ISDN SERVICE PREREQUISITES

Before ISDN service can be provided to a remote location, several prerequisites must be met. The prerequisites are divided into three areas: the serving switch, transmission equipment, and customer-owned equipment.

No loop qualification is required with BRITE II channel units. The BRITE II channel units can be used on any loop that follows carrier serving area (CSA) design guidelines. The CSA guidelines are given in AT&T 915-710-115, Series 5 Carrier System Application Engineering. For more information about ISDN customer premises equipment and loop qualification, refer to AT&T 533-700-100, ISDN Customer Premises Planning Guide, and AT&T 235-900-321, *5ESS* Switch ISDN Basic Rate Interface Specification (5E6).

A. Serving Switch

ISDN service prerequisites at the serving switch are as follows:

- An ANSI standard U-DSL line termination unit (**not a channel unit**) must be installed in the serving switch and made available for service. For example, an ANSI standard U-DSL integrated services line unit (ISLU) card or remote integrated services line unit (RISLU) card must be installed in the *5ESS* switch and made available for service.

- Tip and ring cable from the switch must be connected to the distribution frame where the carrier terminal tip and ring cable terminates. (The polarity of tip and ring is not important with BRITE II channel units.) In a tandem carrier arrangement, tip and ring connections must be made between the back-to-back carrier terminals.

- The proper switch translations for the line must be administered. For the *5ESS* switch, translations are made using the proper switch generic software release (**5E6 or later**) translations data and the *5ESS* switch translations guide (a set of volumes labeled TG-5).

- The B-channel assignments (voice or data) must be made according to the engineering work order, facilities work order, circuit/service order, work order record and details (WORD) document, or other type of document that specifies the service.

- **A common timing source must be used by the switch and transmission equipment so that synchronization will exist throughout the ISDN circuit.** Composite clock (64 kHz) must be used to time the transmission equipment. Figure 3 shows a suggested timing and synchronization method for a typical application. Other methods may be used to obtain a common timing source to synchronize the ISDN circuit(s).

Figure 3 shows that the serving switch receives the clock source from the DS1 facility. The DS1 output is taken to the DSX terminating field where the synchronization distribution expanders (SDEs) in Office A and Office B extract timing from the DS1 facility and generate the composite clock. The SDEs distribute the 64-kHz composite clock to the D4 channel banks or *SLC* 96 carrier central office terminals (COTs) in both offices. The Series 5 FPB RT is always loop timed to the *SLC* 96 carrier COT for BRITE II applications.

B. Transmission Equipment

The transmission equipment provides the connection between the ISDN serving switch and the NT1 and transports ISDN services to remote customers.

The requirements of the transmission equipment to transport the services are as follows:

- The tip and ring cable from the transmission equipment must be connected to the appropriate distribution frame or cross-connect blocks. (Connection to serving switch must exist but tip and ring polarity is not important.)

- Transmission path continuity must exist from the serving switch to the NT1 equipment.

- The carrier terminal connected to the serving switch **must be properly timed and synchronized** to the same clock source that provides timing to the serving switch.

- An **AHG18** BRITE II channel unit must be properly optioned and installed into each *SLC* 96 COT opposite the Series 5 FPB RT for each ISDN circuit. The **AUA93** BRITE II channel unit must be properly optioned and installed in the Series 5 FPB RT. In tandem carrier applications, the **AHG18** and **AHG28** BRITE II channel units must be properly optioned and installed into each D4 channel bank as required. (See Figure 2.)

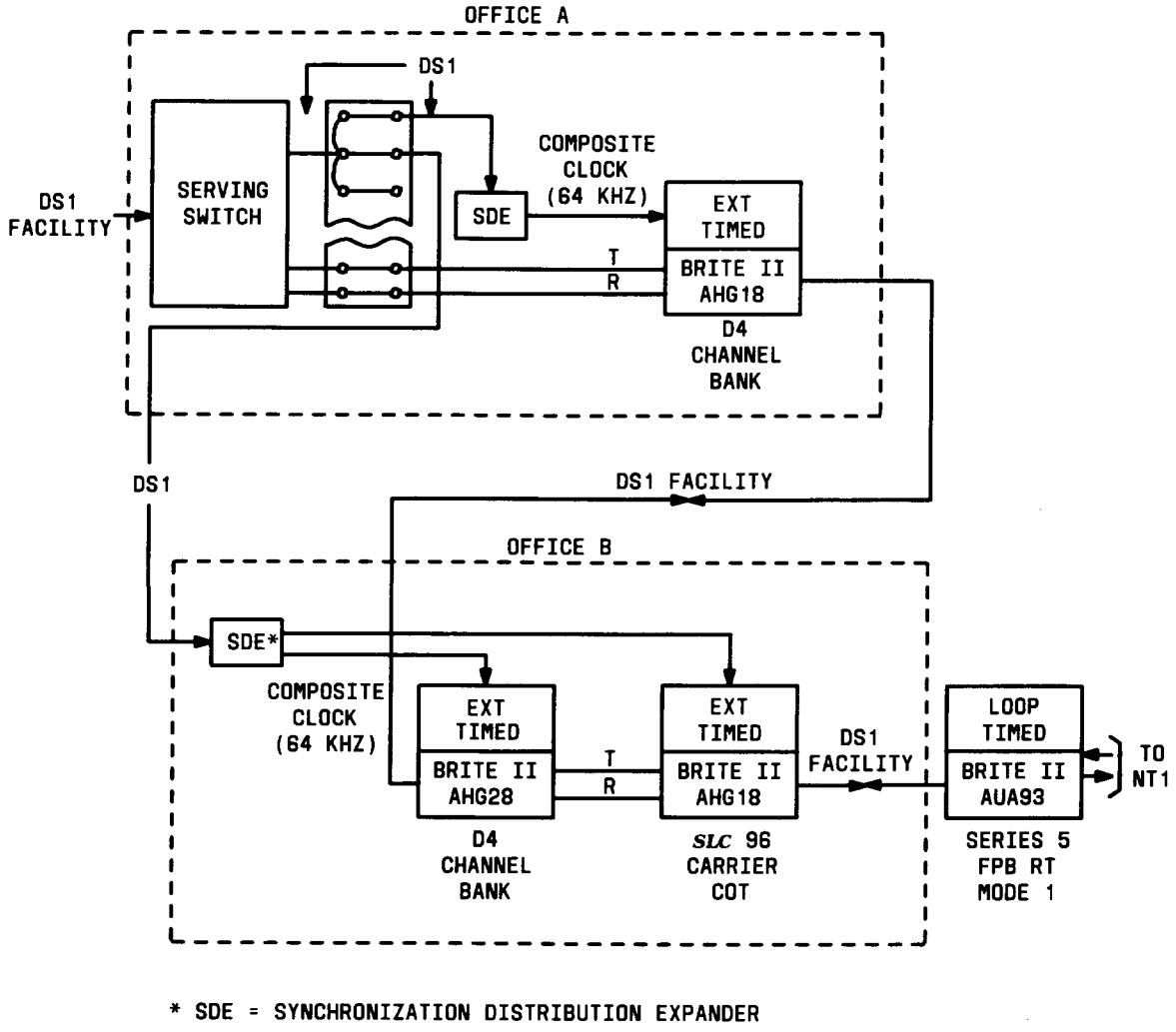

Figure 3 — Suggested Methods of Timing and Synchronization for ISDN Circuits

- The B channels and D channel must be properly assigned according to the engineering work order, facilities work order, circuit/service order, WORD document, or other type of document that specifies the service.

- Proper counting sequence and time-slot alignment for the channel assignment must exist. The 2B+D channel services uses a 3-slot format on the DS1 facility. The first time slot carries the B1 channel, the second time slot (D+) carries the D channel and other channels (used for maintenance purposes, path performance monitoring, etc.), and the third time slot carries the B2 channel. In B1+D or B2+D channel services, the first time slot carries the B1 or B2 channel and the second time slot (D+) carries the D channel. With D-only service, the first time slot (D+) carries the D channel.

If a Digital Access Cross-Connect System (DACS) is in the ISDN circuit, time slot placement is critical for the B and D channels. The order in which the time slots enter the DACS must be the same when leaving the DACS.

Service Restrictions and Limitations at the Far End Channel Bank

For a description of requirements at the far end *SLC* 96 carrier COT, refer to AT&T 365-170-503.

AUA93 BRITE II Placement Rules in the Series 5 FPB RT

When optioned for B1+D, B2+D, or D-only service, the **AUA93** may be mixed with any other channel unit (except 2B+D) without restriction. When mixed with 2B+D service, the B1+D, B2+D, or D-only **AUA93** BRITE II channel unit should **not** be placed in the slot to the immediate right of an **AUA90** T-BRITE channel unit or a 2B+D **AUA93** BRITE II channel unit.

For 2B+D service, the placement of **AUA93** BRITE II channel units is restricted because ISDN 2B+D service requires three time slots per channel unit. Placement rules for BRITE II channel units (2B+D option) are based on a 3-slot (**tri-slot**) group. Each digroup of 12 **physical** slots is divided into 4 tri-slot groups. The tri-slot groups are physical slots 1, 2 and 3; 4, 5 and 6; 7, 8 and 9; and 10, 11 and 12. Figure 4 illustrates the following placement rules for BRITE II channel units optioned for 2B+D service in a Series 5 FPB RT:

A. A 2B+D **AUA93** BRITE II channel unit must not occupy the last slot in a tri-slot group. Therefore, a 2B+D **AUA93** BRITE II channel unit must not be installed in physical slots 3, 6, 9, or 12 in any digroup.

B. Only another 2B+D channel unit (**AUA93** or **AUA90**) may occupy the slot to the immediate right of a 2B+D **AUA93** BRITE II channel unit. A B1+D, B2+D, or D-only **AUA93** BRITE II channel unit (or any other single or dual channel unit) should **not** be placed in the slot to the immediate right of a 2B+D **AUA93** BRITE II channel unit.

Power Requirements

There are no power consumption limitations associated with **AUA93** BRITE II channel units. The **AUA93** BRITE II channel unit requires about 2 W of power. The **950A** test set uses about 0.4 W of power through the **AUA93** channel unit.

C. Customer Owned Equipment

At the customer location, the ANSI NT1 equipment must connect to the tip and ring cable from the transmission equipment for ISDN services. The NT1 equipment provides the 2-wire to 4-wire interface for ISDN terminals. Some ISDN terminals have a built-in NT1 so that a stand-alone NT1 is not needed.

5. TRANSMISSION EQUIPMENT PREPARATION

This part contains general information needed to prepare the Series 5 FPB RT and the *SLC* 96 carrier system COT for ISDN service.

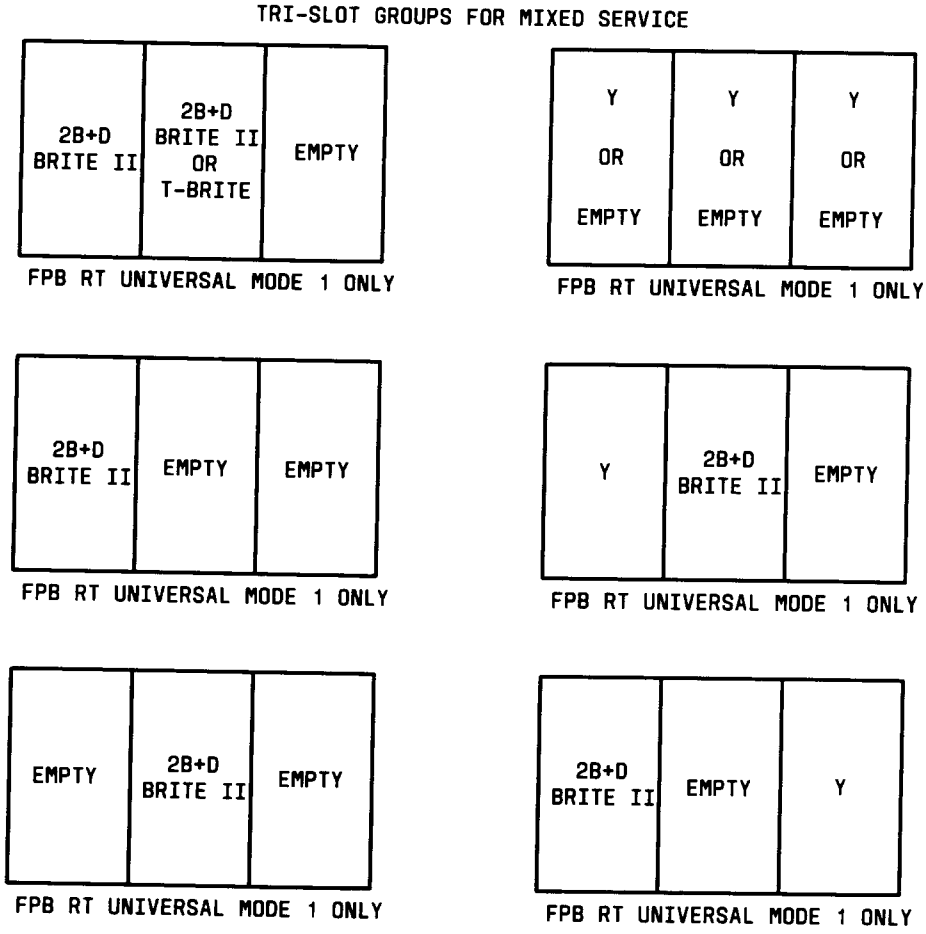

Figure 4 — Placement Rules for Mixing AUA93 BRITE II Channel Units

A. Series 5 FPB RT Preparation

The line interface units (**LIUs**) installed in the FPB Series 5 RT provide loop timing derived from the DS1 facility. The loop timing is automatic and no special action is needed at the RT to activate it. The MC97771A1 **BCU** must be installed in the Series 5 FPB RT to use the **AUA93** channel unit.

B. *SLC* 96 Carrier System COT Preparation

An engineering work order or other similar document must be issued to establish proper timing for the ISDN circuit. For *SLC* 96 carrier terminals, a special service unit (**SSU**), a transmission receive unit (**TRU**), and other common plug-in units must be installed. The **SSU** should be a **WP2C**, S5 (series 5) or later and must be optioned for external timing in the COT. The **TRU** must be a **WM1D**, S2 (series 2) or later.

Caution: Digital service will be interrupted in a SLC 96 carrier COT if the SSU plug-in has to be replaced or removed to change the timing option.

Procedures to select the options for internal/external timing at the *SLC* 96 carrier COT are contained in the detailed level procedures (DLPs) of AT&T 363-202-400 (task oriented practice).

6. AUA93 BRITE II CHANNEL UNIT INSTALLATION AND VERIFICATION TESTS

This part contains the procedures to install the **AUA93** BRITE II channel unit in the Series 5 FPB Mode 1 RT and test the circuit to make sure it works. These procedures assume that the ISDN circuit is complete except for installing the RT channel unit.

Note: To verify that the circuit is synchronized, verify continuity between the *5ESS* switch and the transmission equipment, install the **AHG18** channel unit in the *SLC* 96 COT, install the **AHG28** channel unit in the D4 channel bank (if required), and test the circuit, refer to AT&T 365-170-503 AHG18 and AHG28 BRITE II Channel Units for ISDN Applications - Installation and Testing.

Procedure 1 may be used to install the **AUA93** BRITE II channel unit in the Series 5 RT. Procedure 2 checks the complete ISDN circuit for proper operation. Test equipment required for Procedure 2 is an ISDN terminal. The ISDN terminal should include an ISDN telephone, an NT1 termination (ANSI standard), power supply, and connecting cables.

An electrostatic discharge (ESD) wrist strap should be worn when handling Series 5 circuit packs to prevent possible damage to the circuit packs.

PROCEDURE 1 — INSTALL AUA93 BRITE II CHANNEL UNIT IN SERIES 5 FPB RT

Application

This procedure may be used to install and verify placement of the **AUA93** BRITE II channel unit in the Series 5 FPB RT.

Summary

The **AUA93** BRITE II channel unit has an option switch that must be set correctly before installation. Verify that the channel unit slot number is correct. Install the **AUA93** BRITE II channel unit. Verify that channel unit placement is correct (no indicators blinking or lighted).

STEP **PROCEDURE 1 — INSTALL AUA93 BRITE II CHANNEL UNIT IN SERIES 5 FPB RT**

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1. ***Warning: An electrostatic discharge wrist strap, with a minimum resistance of 250k ohms, should be worn when handling Series 5 circuit packs to prevent possible damage to the circuit packs. Before using the wrist strap, check it for opens, shorts, and minimum resistance value. If the strap does not pass these checks, it should not be used. To avoid possible personal injury while using the wrist strap, connect only to*** ESD GRD ***jack on the fan unit.***

   Obtain **AUA93** BRITE II channel unit for each ISDN service specified in the circuit/service order or WORD document.

2. Set **SERVICE** option switch (Figure 5) to **D**, **B1+D**, **B2+D**, or **2B+D** as specified on the WORD document.

3. Verify that channel slot number specified on circuit/service order or WORD document conforms to the placement rules (See Figure 4).

4. Install the **AUA93** channel unit into the specified channel slot.

   Response: Channel unit **FAIL** indicator lights for about 2 seconds (channel unit self test), then goes off.

5. Did the channel unit **FAIL** indicator light and go off as specified in the response?

   If **YES,** then proceed to Step **9.**

   If **NO,** then continue with Step **6.**

6. ***Note:*** The purpose of the light-emitting diode (LED) test is to verify the **FAIL** indication. Table A lists the **FAIL** LED states and describes the corresponding indication.

   On the **ADU**, press the **LED TEST** pushbutton and hold it down. Refer to Table A for list of **AUA93 FAIL** indications. Does the **FAIL** indicator show placement violation?

   If **YES,** then continue with Step **7.**

   If **NO,** then proceed to Step **8.**

STEP PROCEDURE 1 — INSTALL AUA93 BRITE II CHANNEL UNIT IN SERIES 5 FPB RT

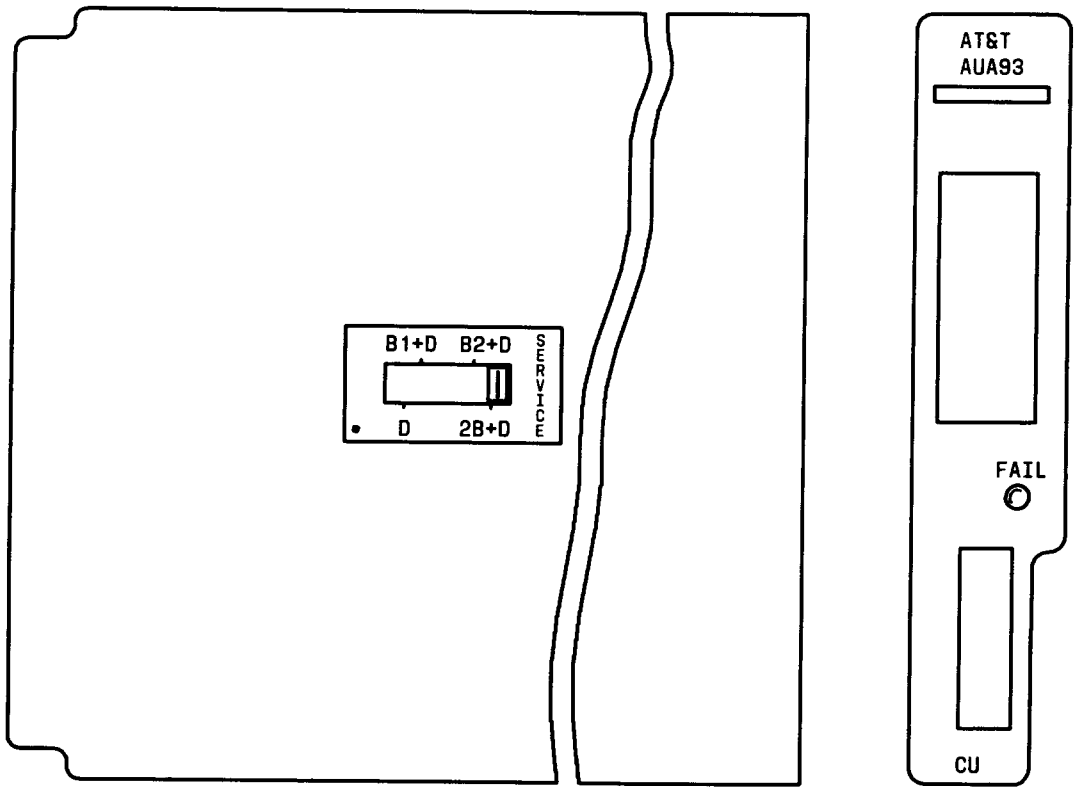


Figure 5 — AUA93 Channel Unit Option Switch Location

TABLE A
AUA93 BRITE II Channel Unit FAIL LED Indications

Before LED Test	LED TEST Depressed	Indication
off	blinking	B1+D, B2+D, or D service channel unit, normal operation (no placement violation)
off	on	2B+D service channel unit, normal operation
on	blinking	placement violation of a B1+D, B2+D, or D service channel unit
on	off	placement violation of a 2B+D service channel unit
on	on	failed channel unit (2B+D, B1+D, B2+D, or D service)

STEP	PROCEDURE 1 — INSTALL AUA93 BRITE II CHANNEL UNIT IN SERIES 5 FPB RT

7. Channel unit placement is incorrect according to placement rules (Figure 4). Make sure channel unit is installed in channel slot specified on circuit/service order or WORD document. If channel unit is installed in specified slot, refer trouble to installation and maintenance or to the circuit provisioning center. If channel unit is not installed as specified, remove it and return to Step **4.**

8. Channel unit is failed. Replace channel unit; if **FAIL** indicator remains lighted, refer trouble to installation and maintenance. Otherwise, continue with Step **9.**

9. Perform Procedure 2 as required to verify BRITE II circuit operation after the **AUA93** channel unit is installed.

STOP. YOU HAVE COMPLETED THIS PROCEDURE.

PROCEDURE 2 — TEST BRITE II CIRCUIT FOR OPERATION

Application

This procedure verifies that the BRITE II circuit is operational and error-free from the Series 5 RT to the ISDN serving switch. The tests should be done after the serving switch translations are complete and the BRITE II channel units are optioned and installed in the circuit.

Summary

Data transmission may be verified with a loopback test of the NT1 from the serving switch. (*5ESS* switch commands are given.) Voice transmission is verified using the basic rate interface test line (BRITL) number (*5ESS* switch) and an ISDN terminal at the RT cross-connect.

Test Equipment Required at RT

- 353A power unit
- AT&T NT1U-200 NT1 unit
- ISDN telephone
- Modified telephone cord (8-pin) about 8 feet long or long enough to reach the protector block or cross-connect terminals at the top shelf of a 7-foot RT bay. The T and R leads (pins 4 and 5) of the 8-pin modular telephone plug must have clip leads at the other end of the cable for connecting to tip and ring. (Polarity of tip and ring does not matter with BRITE II channel units.)
- Two D8W-87 cords.

STEP	PROCEDURE 2 — TEST BRITE II CIRCUIT FOR OPERATION

1. Is *5ESS* switch trunk/line work station available for testing?

   If **YES,** then continue with Step **2.**

   If **NO,** then proceed to Step **5.**

2. At the *5ESS* switch trunk/line work station, run the basic rate interface (BRI) integrity tests to the NT1 on the channels assigned for service according to work order or WORD document (2B+D, B1+D, B2+D, or D-only).

3. Did tests result in no errors or in a bit error rate (BER) better than 10^{-7}?

   If **YES,** then proceed to Step **5.**

   If **NO,** then continue with Step **4.**

4. At trunk/line work station, run the **TST:DSL** command with the argument **TEST=SECT** until a passing result is obtained. This test should isolate the failed section. If results show possible failure at the RT, replace **AUA93** channel unit and repeat BRI integrity test. If test then passes, continue with Step **5.** If test still fails, refer trouble to appropriate repair forces.

STEP	PROCEDURE 2 — TEST BRITE II CIRCUIT FOR OPERATION

5. Obtain test equipment (shown in Figure 6):

   - 353A power unit
   - AT&T NT1U-200 NT1 unit
   - ISDN telephone
   - Modified telephone cord (8-pin) about 8 feet long or long enough to reach the top shelf of a 7-foot RT bay. The T and R leads (pins 4 and 5) of the 8-pin modular telephone plug must have clip leads at the other end of the cable for connecting to tip and ring. (Polarity of tip and ring does not matter with BRITE II channel units.) See Figure 6.
   - Two D8W-87 cords.

6. ***Note:*** The test setup of Figure 6 is a temporary arrangement and should be disconnected as soon as the test is finished.

   Disconnect the loop at the protector block and connect test equipment (Figure 6) to RT cross-connect or protector block.

7. From ISDN terminal, dial *5ESS* switch BRITL access code [the directory number (DN) assigned through recent change/verify (RC/V)]. Do you hear dial tone (indicating successful origination)?

   If **YES,** then circuit is complete and working; continue with Step 8.

   If **NO,** then **STOP.** Circuit is not working: problem may be in test connections, **AUA93**, RT wiring, or elsewhere in the circuit. The problem may be *5ESS* switch translations that are not correct. Refer trouble to switching control center (SCC) or to appropriate organization according to local procedures. Refer to Part 8, Maintenance, in this document for trouble clearing independent of the switch.

8. If desired, further tests may be run as specified in the DSL BRI dial up test in AT&T 235-105-220, *5ESS* Switch Corrective Maintenance Procedures. When testing is finished or if no further tests are required, disconnect test equipment from RT cross-connect and reconnect loop.

STOP. YOU HAVE COMPLETED THIS PROCEDURE.

STEP PROCEDURE 2 — TEST BRITE II CIRCUIT FOR OPERATION

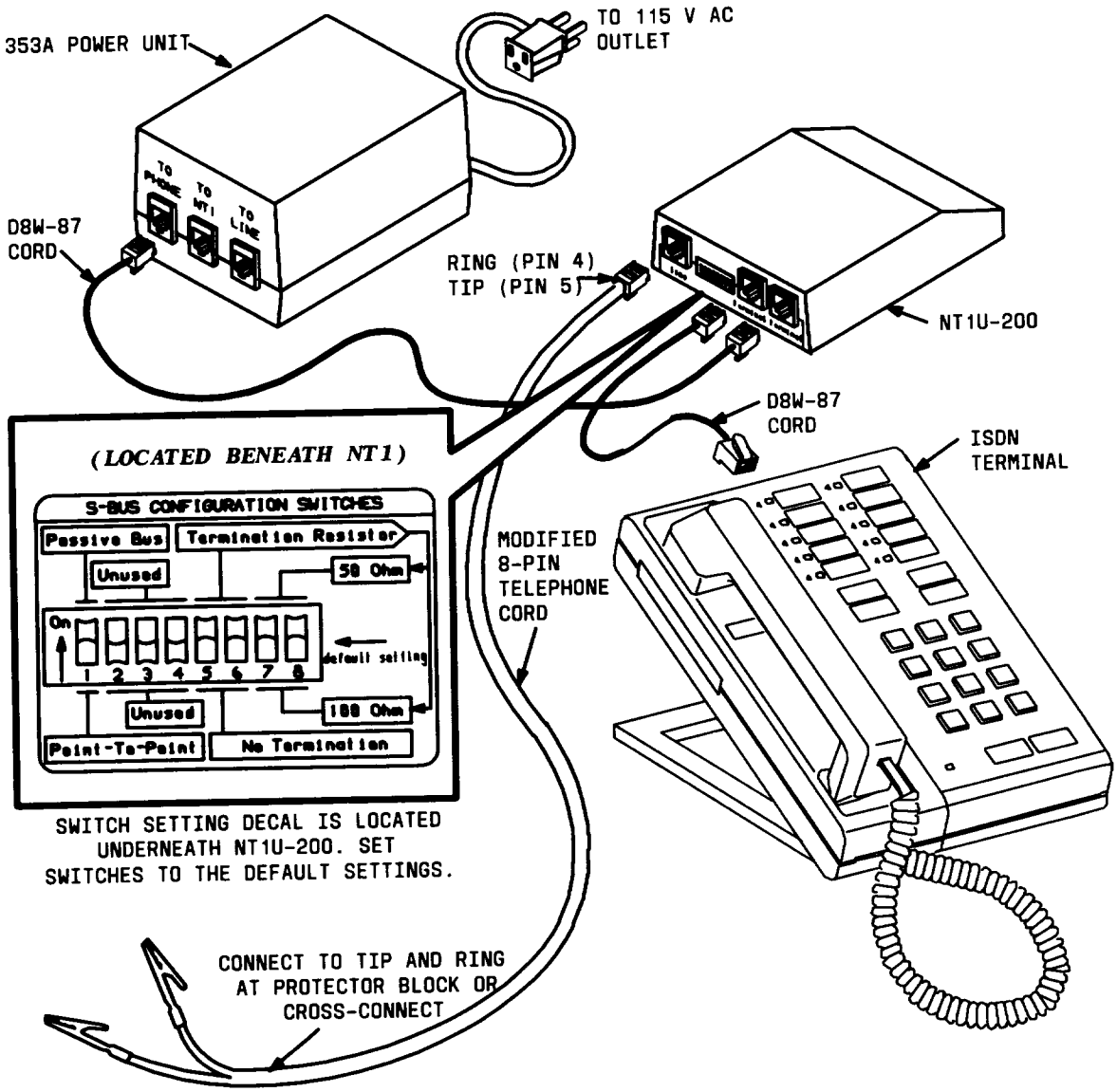


Figure 6 — Test Connections at the Series 5 RT Cross-Connect

7. TEST EQUIPMENT

A. Test Sets

Test sets may be used in BRITE II circuits to verify trouble or to isolate trouble independent of the serving switch. The **950A** test set (Figure 7) can be used by itself or with other test sets (**946A** or data test sets). The **946A** test set (Figure 8) is used with the data test sets and may be used for end-to-end testing with the **950A** test set. The **KS-20908** receiver and **KS-20909** transmitter data test sets must be used with the **946A** test set to generate data for loopback testing. Although the **KS-20908** receiver and **KS-20909** transmitter data test sets may be used with either test set to verify data transmission, they are not required with the **950A** test set.

The **950A** and **946A** test sets are functionally similar, contain similar test and status indicators, and have control switches and jacks for connecting the **KS-20908** receiver and **KS-20909** transmitter data test sets. AT&T 363-005-238 (data sheet) provides a detailed description of the **950A** test set indicators and switches. AT&T 365-170-503 describes how to use the **946A** test set. The data test sets are described in AT&T 107-600-100 (transmitter) and AT&T 107-601-100 (receiver).

The **946A** and **950A** test sets provide the following features for testing BRITE II channel units:

- Check the condition of remote access loops [up to three channel units (**946A**) or up to five channel units (**950A**) beyond the channel unit connected to the test set]
- Set up 2B+D loopback tests
- Insert pseudorandom data patterns into the customer's data channels (B1 or B2)
- Monitor channel unit slips (momentary loss of synchronization in data transmitted to/from the BRITE II channel unit).

Once the appropriate switches are set and the test set is activated, a loopback connection can be established in the BRITE II channel unit connected to the test set or in any other BRITE II channel unit in the circuit. The loopback allows data transmitted from the test set to be sent back to the test set and checked for errors. Also, the **946A** and **950A** test sets have status indicators that can show various conditions in the circuit. (The test set indicators are interpreted differently for BRITE II tests than for BRITE or T-BRITE tests.)

950A Test Set (Figure 7)

The **950A** can be inserted into any vacant slot in the Series 5 FPB RT and connected to any **AUA93** BRITE II channel unit (within reach of the connectorized cable). The test set should be used fully seated in a channel unit slot so that it is grounded through the backplane connector (ground pin). The **950A** test set will operate in a common unit slot but cannot be seated fully (into the backplane connector). When the test set is not grounded through the backplane connector, an ESD wrist strap should be worn for protection.

The **950A** test set can generate pseudorandom data patterns and display resulting errors during loopback testing. The data test sets should be used with the **950A** test set to check low (displayed) error rates or when the customer complains of errors that are not easily diagnosed using only the **950A** test set.

All indicators on the **950A** light momentarily (LED test) when the test set is first plugged into a BRITE II channel unit.

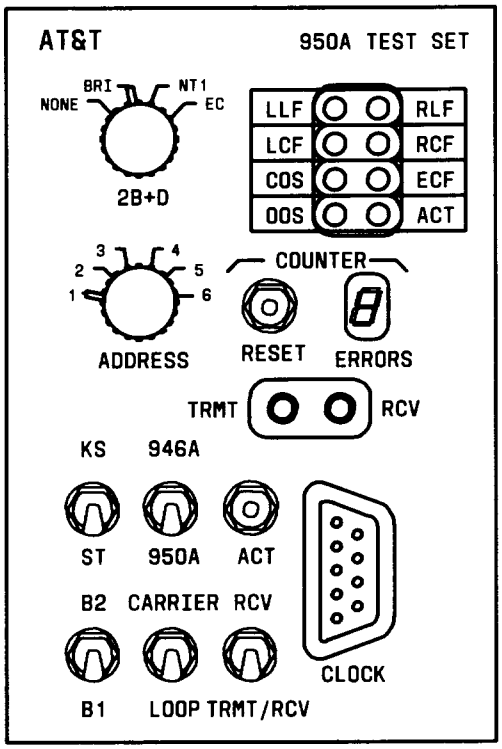


Figure 7 — 950A Test Set Faceplate

946A Test Set (Figure 8)

The **946A** test set is used in a *SLC* 96 carrier COT or D4 channel bank and connected to any **AHG18** or **AHG28** BRITE II channel unit (within reach of the **946A** test cord). The **946A** test set has a backplane connector and should be plugged into a channel unit slot until fully seated in the backplane (grounded). Using the **946A** test set in a vacant channel unit slot does not affect service.

B. Using an ISDN Terminal for Testing

Testing for dial tone, ringing, ring trip, and voice transmission on a BRITE II circuit requires an ISDN terminal or ISDN telephone. For testing purposes, the ISDN terminal is equivalent to the customer premises equipment connected to the digital interface (for example, the U interface or T interface) for an ISDN application. It usually includes an ISDN telephone, which may be a digital telephone set or an integrated voice/data terminal. Depending on the interface, an NT1 termination may be required for 2-wire to 4-wire conversion (for example, to a U interface). Some terminals have a built-in NT1 so that a separate NT1 is not needed.

For testing on a BRITE II circuit, the ISDN terminal should include an ISDN telephone, an NT1 termination (ANSI standard), power supply (for the NT1 and phone), and connecting cables. A modified telephone cord (8-pin) with clip leads is required to connect the ISDN terminal to tip and ring at the RT. Procedure 2 in Part 6 (Installation Tests) describes changes to the telephone cord.

The basic rate interface (BRI) test line (BRITL) number is a feature of the *5ESS* switch (generic 5E5 and later) that allows digital testing of a channel (B1 or B2) from an ISDN terminal. Refer to AT&T 235-105-220 *5ESS* Switch Corrective Maintenance Procedures (5E6 generic), Part 2 — Hardware Maintenance Procedures, in the section on line maintenance using the trunk/line work station.

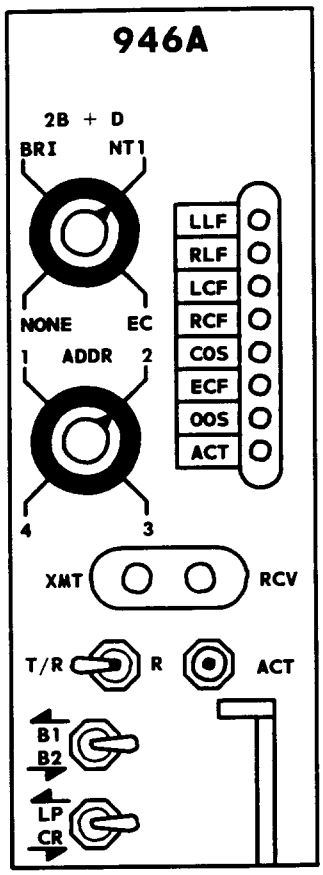


Figure 8 — 946A Test Set Faceplate

8. MAINTENANCE ON BRITE II CIRCUITS

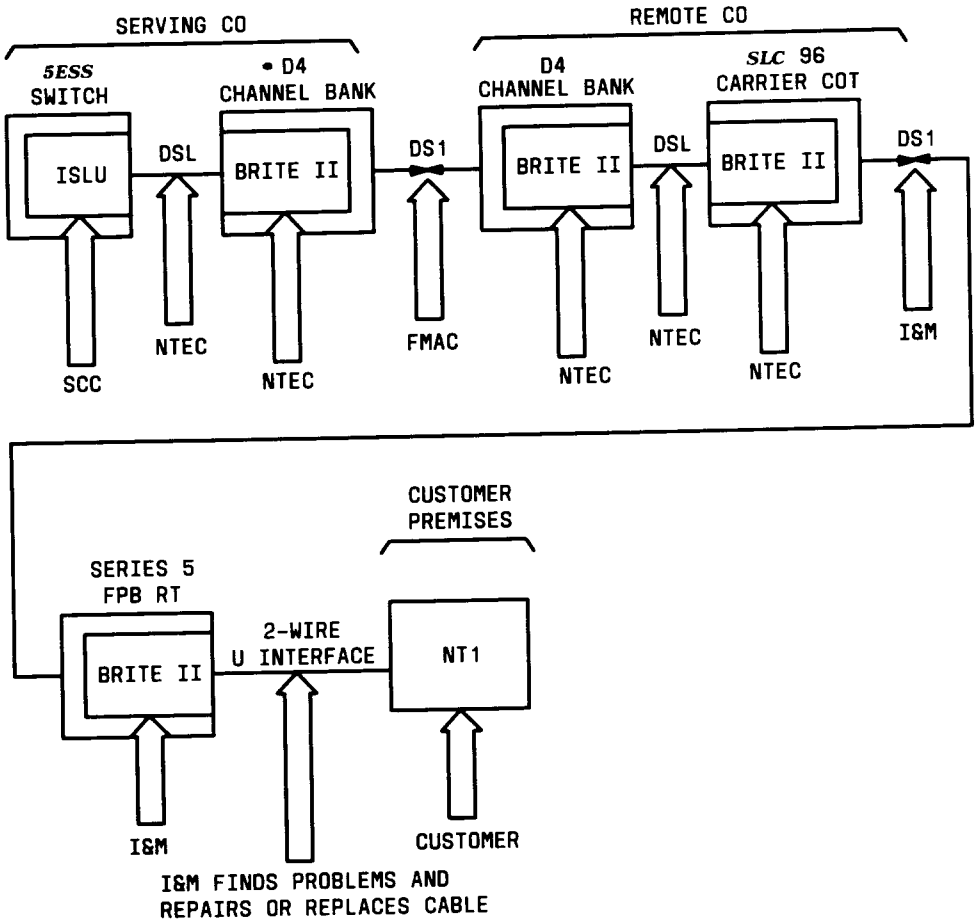
A. Overview

This part provides maintenance information for the **AUA93** BRITE II channel unit. Procedure 3 is a loopback test that may be helpful in isolating and clearing trouble in BRITE II circuits. Procedure 4 should be used when the **950A** test set shows a low error rate during a loopback test. Refer to AT&T 365-170-503 for procedures used at the central office if further testing is needed there.

B. General Information

Maintenance on BRITE II channel units is normally a reaction to a customer complaint. The goal for ISDN circuits is to use existing procedures for POTS (plain old telephone service) to handle trouble. The ISDN customer may dial 611 to report trouble or may have to call the telephone center in charge of maintaining the BRITE II circuit in that area.

The telephone company's response varies. Some companies have the maintenance center handle the problem; other companies may dispatch a technician to clear the trouble and get the circuit working. Depending on local procedures, maintenance may require coordination of several groups (switching, central office, and outside plant forces). Figure 9 shows one example of organizations responsible for maintenance of different portions of an ISDN circuit.



LEGEND:

BRITE II - BASIC RATE INTERFACE TRANSMISSION EXTENSION (ANSI)
DS1 - DIGITAL SIGNAL 1 (DS1 FACILITIES)
DSL - DIGITAL SUBSCRIBER LINE
FMAC - FACILITIES MAINTENANCE & ADMINISTRATION CENTER
I&M - INSTALLATION & MAINTENANCE
ISLU - INTEGRATED SERVICES LINE UNIT
NTEC - NETWORK TERMINAL EQUIPMENT CENTER
SCC - SWITCHING CONTROL CENTER

Figure 9 — Typical Maintenance and Installation Organizations Responsible for an ISDN Circuit

The first step in maintenance of an ISDN circuit is to isolate the trouble to:

(a) switch equipment

(b) synchronization equipment

(c) transmission equipment (including the loop), and/or

(d) customer-owned equipment.

If the problem is isolated to the serving switch, the responsible organization [for example, the switching control center (SCC)] usually makes arrangements to fix the problem. For customer-owned equipment trouble, the customer should be informed about the problem so that

equipment can be repaired or replaced. If trouble is diagnosed in the transmission or synchronization equipment, further tests must be run to isolate the trouble.

C. BRITE II Channel Unit Maintenance Features

The BRITE II channel units contain counters for recording cyclic redundancy check (CRC) block errors (which are transmission errors), errored seconds, and severely errored seconds in each direction. These statistics are recorded during specified time periods under control of the serving switch. The serving switch also can control the interval for reading and resetting the counters. The switch requests the performance monitoring statistics and resets the counters via the embedded operations channel (eoc). (The eoc abbreviation is lower case to distinguish it from the EOC on the carrier facility.) The eoc is an additional out-of-band maintenance channel specified by the ANSI standard (TI.601-1988).

For testing and trouble isolation, the BRITE II channel units provide six different loopbacks (Figure 10) as follows:

- a 2B+D , B1, or B2 loopback toward the loop side (drop side or customer interface)
- a 2B+D , B1, or B2 loopback toward the carrier side (line or facility interface).

The B channel loopbacks are transparent: the channel unit maintains normal operation except on the channel (B1 or B2) being looped back. The 2B+D loopback is nontransparent: the channel unit is disconnected from the link on the side opposite the loopback. These loopbacks are activated by codes sent over the eoc from the serving switch or test sets.

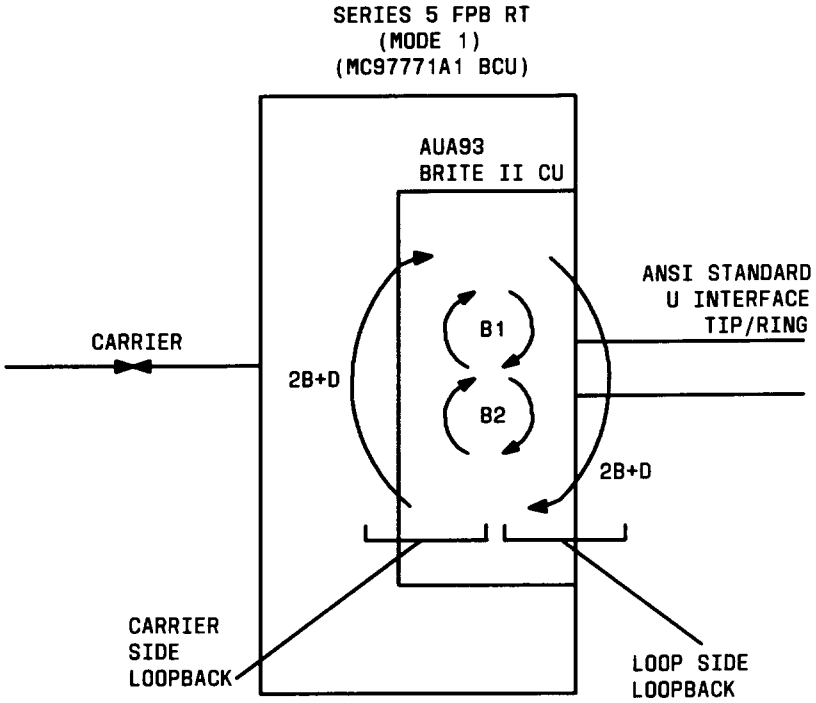


Figure 10 — BRITE II Channel Unit Loopbacks

Loopback Test Applications

A basic rate interface (BRI) loopback test (requested by the serving switch or a test set) sets up a 2B+D loopback in the circuit at the addressed BRITE II channel unit. An NT1 loopback test (requested by the serving switch or a test set) sets up a 2B+D loopback at the NT1.

The serving switch can request a B1 or B2 channel loopback and can perform packet switching tests using the eoc to determine if the D channel is operating properly. The test sets can request the BRI loopback test; no capability is provided for the test sets to test a single channel. (However, test results are displayed one channel at a time.) The test sets have priority over the switch when requesting a loopback in the BRITE II circuit. The test sets have equal priority with the Mechanized Loop Testing (MLT) system: test access is provided on a first-come, first-served basis. If MLT is testing, the **950A** test set will show errors (test failed) during loopback tests.

Note: When the **946A** or **950A** test set is being used, the network termination (NT) test mode indication (ntmod) is sent toward the switch. This signals the switch that NT or channel unit testing is in progress. This indication tells the *5ESS* switch that the test sets (or the NT) are performing tests that take precedence.

Other Test Applications

The echo canceler test does not apply to BRITE II channel units (it will always pass), even if the channel unit echo canceler is faulty. The **AUA93** channel unit always gives a fail result on channel unit tests by the PGTC (pair gain test controller) or XTC (extended test controller). However, MLT system access to the loop for testing is allowed through the PGTC or XTC (via the test pair and channel test relays).

D. Maintenance From the Central Office

Using the eoc, the *5ESS* switch (with the 5E6 generic) can do B1, B2, or 2B+D loopbacks at any BRITE II channel unit or at the NT1 and packet switching tests on the D channel. The switch also collects and records performance monitoring statistics from the BRITE II channel units.

The MLT system with MLT/ISDN Feature Package Two supports testing of ANSI BRITE II circuits. Some changes to the Loop Management Operations System (LMOS) may be required to interface MLT/ISDN Feature Package Two. MLT-2 can perform metallic testing of the loop connected to the **AUA93** channel unit and can interface with the *5ESS* switch for its test results. Using these systems, trouble can be isolated and cleared without using the test sets.

The customer should be notified before any tests are done; most of the tests will interrupt service on the circuit. The easiest way to start sectionalizing the problem is using loopback tests from the *5ESS* switch. Loopbacks can be done at the channel units in position 1 through position 6 in the circuit and at the NT1. From the switch, position 1 refers to the first BRITE II channel unit connected to the switch. The switch can loopback test up to the sixth channel unit away from the switch in the circuit. (The positions are numbered relative to the test unit; from a test set, position 1 refers to the channel unit connected to the test set.) If necessary, drop tests can be done by MLT-2 between the **AUA93** channel unit and the NT1 to further isolate the problem. If the problem appears to be in the NT1, a call to the customer to make sure the NT1 has power (green light on) may save a dispatch. Finally, a technician may be dispatched to the suspected location. By checking failure indication(s) on the **950A** test set, the technician can verify that there is loop, carrier, channel unit, or possibly intermittent trouble. The problem can then be corrected.

E. Installation Trouble Clearing

Most telephone companies have their own procedures for fixing a problem that occurs during installation. Some companies may prefer to let the maintenance center handle the problem like a customer-reported trouble. Other companies may expect the installation technician to clear the trouble and get the circuit working. Since the installation of a BRITE II circuit usually involves coordination of several groups (switching, central office, and outside plant forces), it is difficult to specify a starting point that applies to every case for trouble clearing.

If an ISDN terminal connected at the Series 5 RT is not getting dial tone, check first with switching (to verify translations) then verify that equipment has been installed in the rest of the circuit. If the translations are correct (proper assignment has been made in recent change/verify menus) and channel units are installed, the next step might be to check synchronization. AT&T 365-170-503 contains procedures that can be used at the central office to verify synchronization and continuity between the serving switch and the transmission equipment (D4 channel bank or *SLC* 96 carrier COT). If the central office equipment appears to be operating properly, a loopback test from the *SLC* 96 carrier COT should show whether a problem exists in the carrier system, the **AUA93** BRITE II channel unit, or the NT1. The ability to clear and read performance monitoring (pm) counts from the *5ESS* switch may be helpful in isolating bit error rate problems in a single direction or in both directions.

F. 950A Test Set

See Part 6 - Test Sets for a brief functional description of the **946A** and **950A** test sets. The detailed description of the **946A** test set is given in AT&T 365-170-503. The BRITE II applications of the switches and jacks on the **950A** faceplate are described below. TABLE B lists the indicators on the **950A** test set and what each indicator means when lighted.

2B+D: This switch has four positions:

NONE In this position, the test set can do circuit monitoring or end-to-end testing, but no BRI loopback is established. This switch position is used with the **TRMT/RCV - RCV** switch.

BRI In this position, a 2B+D (BRI) loopback is set up in a BRITE II channel unit. The specific channel unit is determined by the **LOOP-CARRIER** switch and **ADDRESS** switch.

NT1 In this position, the test set requests a loopback at the NT1.

EC This position (echo canceler test) is neutral (cannot affect the circuit) when used with BRITE II channel units. It is useful for clearing a **COS** indication.

ADDRESS: This switch selects the address of the applicable BRITE II channel unit in the circuit for test. Position **1** selects the channel unit connected to the **950A** test set. Position **2** selects the next BRITE II channel unit in the circuit in the direction specified by the **LOOP-CARRIER** switch. Position **3** selects the BRITE II channel unit beyond the position **2** channel unit, and positions **4**, **5**, and **6** do likewise.

COUNTER-RESET: This momentary pushbutton type switch resets the **COUNTER-ERRORS** display to zero.

CLOCK: This 9-pin clock connector provides the 8 kHz and 64 kHz clocks to the data test sets via the ED-3C792 test unit and a cable assembly (COMCODE 842725111).

TABLE B

950A TEST SET INDICATORS (NOTE)

INDICATOR	BRITE II FUNCTION	DESCRIPTION (BRITE II APPLICATIONS)
LLF	Local Loop Failure	U-DSL* link in reset has occurred on the U interface of the **AUA93** BRITE II channel unit (no NT1 connection).
RLF	Remote Loop Failure	Not valid (never lighted) with an **AUA93** channel unit.
LCF	Local Channel Failure	Loss of carrier (TSL* interface in reset) has occurred on the carrier side of the **AUA93** BRITE II channel unit (no communication with the **AHG18** channel unit in the COT).
RCF	Remote Channel Failure	Not valid (never lighted) with an **AUA93** channel unit.
COS	Circuit Out-of-Synch	A timing error has occurred in the channel unit elastic store (an interface between the channel unit microprocessor and the backplane). This is a latching indication; in other words, a single error will cause the indicator to light and stay lighted until cleared.
ECF	Echo Canceler Failure	Not valid (never lighted) on BRITE II channel units. If the echo canceler test is requested on a BRITE II channel unit, the result generated is always passing (even if the channel unit echo canceler is faulty).
OOS	Out-of-Service	The *5ESS* switch is not communicating at layer 2 (data link layer) (the switch does not recognize the **AUA93** channel unit).
ACT	Active	A test has been started (test active) by depressing the **ACT** switch. The indicator goes off when the **ACT** switch is depressed again.
COUNTER - ERRORS	Error Counter	This 7-segment display shows the number of errors in the received data compared to the expected sequence. The counter will count to nine and hold the count until reset by the **COUNTER RESET** button. This display is active only in the self-test mode.

Note: All indicators off means that the ISDN circuit operation is normal and the BRITE II channel units are working. The description applies to the lighted indicator. All indicators on the **950A** light momentarily (LED test) when the test set is first plugged into the **AUA93** BRITE II channel unit.

* U-DSL = U interface digital subscriber line, TSL = three-slot link

TRMT-RCV: The **TRMT** jack provides access for the **KS-20909** transmitter data test set. The **RCV** jack provides access for the **KS-20908** receiver data test set.

KS-ST: This switch selects the source for the data to be transmitted and monitored by the test set. The **KS** position selects the **TRMT-RCV** jacks as the data source for the channel unit. The **ST** position selects a self-test mode that generates data on the test set to send to the channel unit.

946A-950A: When set to the **946A** position, this switch allows the **950A** test set to communicate end-to-end with a **946A** test set. To communicate with a **950A** or equivalent test set, the switch should be set to the **950A** position. For single-ended loopback testing, this switch may be set to the **950A** position.

ACT: After the test set is connected to the channel unit, this momentary pushbutton type switch starts the test and lights the **ACT** (active) lamp. Service will be interrupted when a loopback test is started.

B1-B2: This switch selects the channel (B1 or B2) to be monitored during loopback or end-to-end testing.

LOOP-CARRIER: This 2-position switch sends the loopback code either toward the loop side (**LOOP** position) or toward the carrier side (**CARRIER** position) (relative to the **AUA93** channel unit).

TRMT/RCV - RCV: This switch enables loopback testing when used with the **2B+D** switch. For all BRI and NT1 testing, this switch should be set to **TRMT/RCV**. The **RCV** position only monitors the channel. With the **2B+D** switch in the **NONE** position, the **TRMT/RCV** switch position allows the **950A** to transmit and monitor data on the B channels (via the **KS-ST** switch).

Clearing the Circuit Out-of-Synch (COS) Indication

The COS indicator is a latching indication and may be lighted even though the circuit is working properly. The recommended way to turn off the COS indication is to set the **2B+D** switch to the **EC** position and press the **ACT** button. (The **EC** position is used because it cannot affect the circuit.) The COS indication can be cleared in any mode by pressing the **ACT** button.

G. Trouble Isolation Using the Test Sets

The test sets may be used primarily or additionally to isolate and clear trouble on the BRITE II circuit. Usually, the tester will need a complete facility record of the circuit to sectionalize the trouble. The facility record should show how many BRITE II channel units are in the circuit; these numbers are used to address channel units for loopback testing.

Figure 11 shows an example of an ISDN circuit with tandem offices between a serving *5ESS* switch and the NT1. Each channel bank and channel unit shown in the circuit is numbered corresponding to the **ADDR** switch positions on the test set. In Figure 11, the **946A** test set is connected to the BRITE II channel unit in the D4 channel bank at the *5ESS* switch office. The **KS-20908** receiver data test set and a **KS-20909** transmitter data test set are connected to the **946A** test set. This test arrangement may be used for loopback testing from the central office or as part of an end-to-end test setup. Procedures for using the **946A** test set are given in AT&T 365-170-503.

The **950A** test set may be used in a similar manner. Figure 12 shows the **950A** test set connected to the BRITE II channel unit in the Series 5 FPB RT. With the **950A** test set, the data test sets are not needed.

To verify the trouble from the Series 5 RT with the **950A** test set, test the BRITE II channel unit closest to the switch with a BRI loopback test on the carrier side. (Figure 12 shows an example of this labeled as address 2 carrier loopback.) If it fails, repeat the BRI loopback test on the next BRITE II channel unit in the circuit. (Figure 12 shows this labeled as address 1 carrier loopback of the **AUA93** channel unit.) This sequence is repeated until the BRI loopback test passes. The

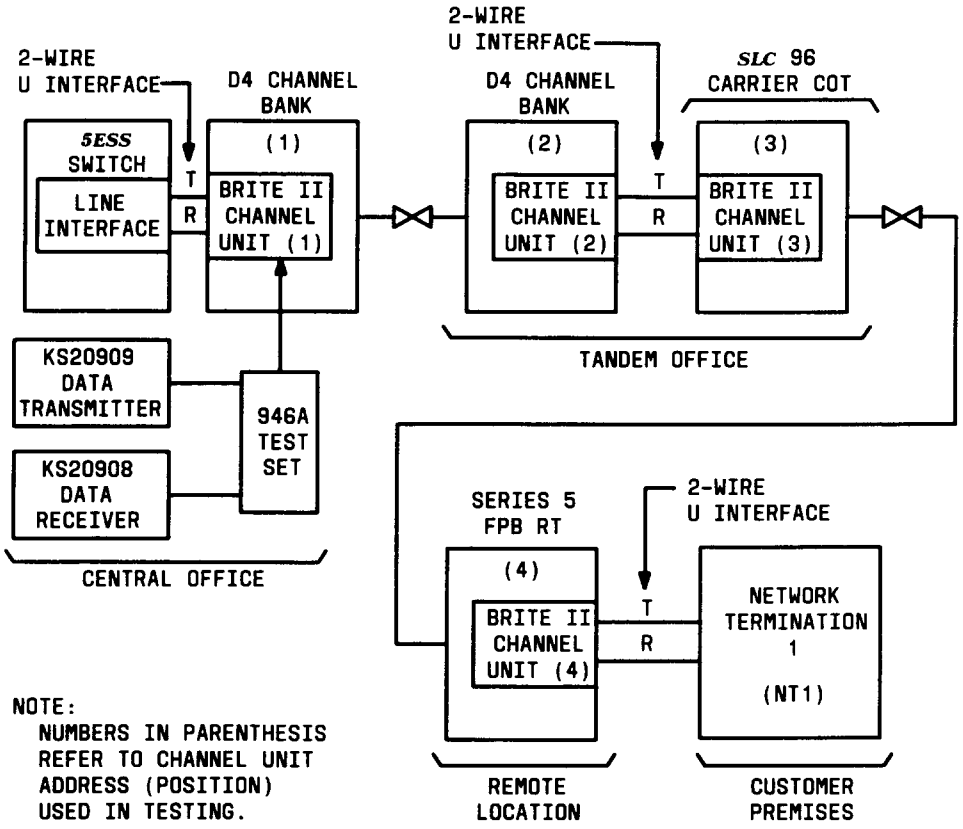


Figure 11 — ISDN Circuit With Tandem D4 Channel Banks

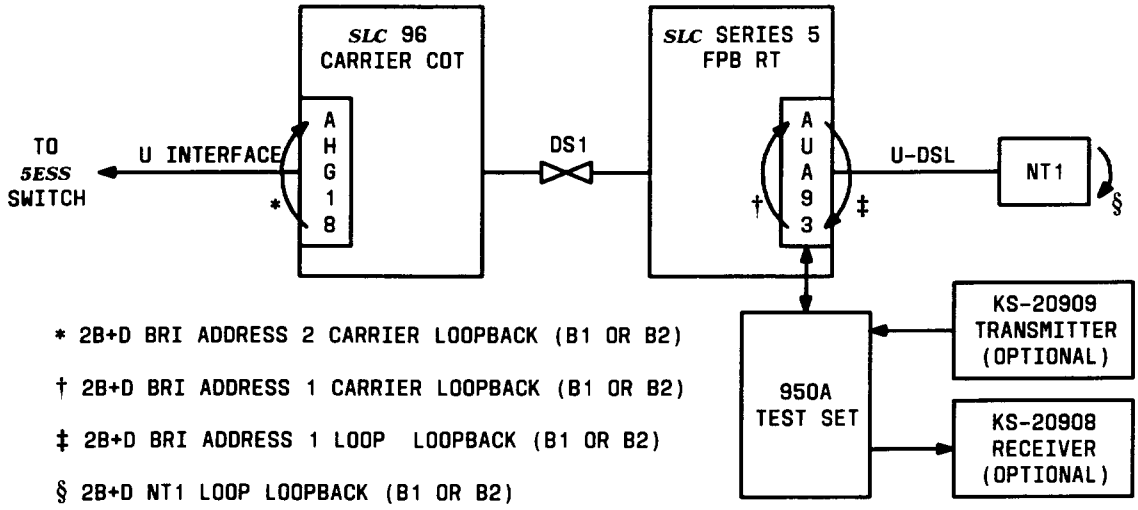


Figure 12 — 950A Loopback Test Arrangement

circuit can then be checked from the passing point back toward the serving switch to correct the failure. If all the BRI loopback tests pass, test the loop side of the **AUA93** channel unit (in Figure 12 labeled as address 1 loop loopback) and test the NT1 (in Figure 12 labeled as NT1 loop loopback).

The BRITE II channel units always should be tested from the furthest channel unit to the local channel unit (channel unit number 6 to channel unit number 1). Testing in the reverse direction (address 1 to address 6) requires a 15-second reset period between loopbacks to allow the U-DSL to reframe (otherwise the test set will show a false failure).

H. Interpreting Test Results

A passing test result from the BRI loopback test is shown by zero errors on the test set. Normally, zero errors in at least a 3-minute period corresponds to a bit error rate better than 10^{-7}. For a failure, the **950A** test set typically shows a gross error rate on the **COUNTER-ERRORS** display (by immediately counting up to 9). Any test that fails should be repeated after waiting a minute or so to make sure it really failed. (If the green **BUSY** indicator is lighted on the channel test unit (CTU) in the Series 5 dual bank, MLT testing on the channel may have caused the loopback test to fail.)

Low Error Rate

If the **COUNTER-ERRORS** display counts up slowly with one or two seconds between increments (low error rate), or if the display shows less than 10 errors during the test, an intermittent failure may be the cause. The data test sets may be used to get a more detailed error count when the **950A** shows a low error rate.

Lighted indicators on the **946A** or **950A** test set for trouble conditions depend on the position of the BRITE II channel unit to which the test set is connected. BRITE II channel units only send *link in reset* (DSL or TSL) message upstream toward the switch. A *link in reset* message is a failure of the connection to the BRITE II channel unit on the carrier side (TSL) or on the line side (DSL). A BRITE II channel unit that is downstream (toward the NT1) from the failure cannot know that the upstream link has failed. The test set connected to the channel unit in the failed link will show the failure, or can show a failure of a downstream link.

Failures

Normally, the **AUA93** channel unit **FAIL** indicator lights if the channel unit fails or a placement violation occurs. The local loop failure (LLF) indication means that the NT1 connection is missing. This could mean a wiring problem between the channel unit and the customer, or the NT1 could be missing or incompatible. The local channel failure (LCF) indication means that the **AUA93** channel unit cannot communicate with the COT channel unit for some reason. This could be mean a carrier failure, COT or RT channel unit failure, or incompatibility (wrong channel unit or options).

COS Indication

The COS indication may be ignored or cleared before testing. If it is cleared and reappears during a testing session, there may be a problem in the circuit. If it is cleared again and reappears during the same test session, there is a problem in the circuit that needs to be resolved. The COS indication is independent of any other indications, and it may be difficult to isolate the cause. If loopback testing does not show where the problem is, replacing the channel unit (that the test set is connected to) may clear the problem.

OOS Indication

If the D channel fails the switch will take the circuit out of service. The out-of-service (OOS) indication is a status indication that means communication has failed between the **AUA93** channel unit and the switch. If the LCF indicator is lighted, the OOS indication should be ignored. Otherwise, loopback testing or further analysis is needed to determine if the OOS indication is caused by a problem in a link or at the switch. The OOS indication prevents dial tone on the circuit, but loopback testing is not affected.

I. End-to-End Testing

Single-ended testing is recommended because it is easier and requires less coordination and equipment. End-to-end testing may be used according to local procedures. It requires communication between the COT and RT and test sets at both ends. The test setup at each end is the same as for single-ended testing (refer to AT&T 365-170-503 for the **946A** test setup).

For end-to-end testing, condition the **950A** test set as follows:

- Set the **2B+D** switch to the **NONE** position.
- Set the **ADDRESS** switch to **1** (for the **AUA93** BRITE II channel unit).
- Set the **LOOP-CARRIER** switch to the **CARRIER** position.
- Set the **TRMT/RCV - RCV** switch to the **TRMT/RCV** position.
- Set the **B1-B2** switch to select the channel for testing.
- Set the **KS-ST** switch to the **KS** position.
- Set the **946A-950A** switch to the **946A** position.

J. Test Procedures

The single-ended test arrangement is used for loopback testing. Procedure 3 is a BRI/NT1 loopback test from the **950A** at the Series 5 RT that may be used to verify trouble or to isolate trouble in the circuit. Procedure 4 should be used when the **950A** test set shows a low error rate during a loopback test. (A low error rate is 1 or more seconds between increments on the display or less than 10 errors during the test.) The data test sets are used in Procedure 4 to obtain the specific error rate. If the **950A** test set is used in any slot besides a channel unit slot (not fully seated), an ESD wrist strap should be worn for protection. For maintenance procedures using the **946A** test set at an **AHG18** or **AHG28** BRITE II channel unit, refer to AT&T 365-170-503.

PROCEDURE 3 — BRI / NT1 LOOPBACK TESTS FROM SERIES 5 FPB RT

Application

This procedure uses the **950A** test set at the Series 5 FPB RT to check the BRITE II channel units and the NT1. If service is 2B+D, both B1 and B2 channels should be tested. (If service is D-only, the serving switch or maintenance center will have to test the channel; the test set cannot test the D channel.) These tests will interrupt service.

Summary

Look for **FAIL** indication on the channel unit. Indicators on the **950A** test set may light as described in TABLE B if there is a problem in the circuit. Perform BRI loopback test on B channel(s) optioned for service at the BRITE II channel unit (switch end) and at the NT1.

The **ACT** indicator will light the first time the **ACT** pushbutton is pressed and go off when it is pressed again.

Test Equipment Required at RT

This test uses the **950A** test set with the cable for connecting it to the **AUA93** channel unit.

STEP	PROCEDURE 3 — BRI / NT1 LOOPBACK TEST FROM SERIES 5 FPB RT

1. Establish communication with a person at the central office who can check the equipment status there as needed.

2. Is the **FAIL** indicator lighted on the **AUA93** channel unit?

   If **YES,** then continue with Step **3.**

   If **NO,** then proceed to Step **4.**

3. Press **LED TEST** pushbutton and note the effect on the **AUA93** channel unit **FAIL** indicator. Refer to Procedure 1, TABLE A to determine if the channel unit has failed or a placement violation has occurred. If failure is shown, replace the **AUA93** channel unit. If placement violation is shown, make sure all affected channels are out of service before removing any channel units. When problem has been corrected (**FAIL** off), continue with Step **4.**

4. ***Warning: An electrostatic discharge wrist strap, with a minimum resistance of 250k ohms, should be worn when handling Series 5 circuit packs to prevent possible damage to the circuit packs. Before using the wrist strap, check it for opens, shorts, and minimum resistance value. If the strap does not pass these checks, it should not be used. To avoid possible personal injury while using the wrist strap, connect only to*** ESD GRD ***jack on the fan unit.***

   Insert **950A** test set into any convenient unused channel slot relative to channel unit in circuit to be tested. (It will seat in the backplane connector when inserted in a channel slot.) If channel slot is not available, test set may be inserted into any other slot, but cannot be inserted into the backplane connector. If the test set is used in a channel unit slot, the wrist strap is not required.

STEP	PROCEDURE 3 — BRI / NT1 LOOPBACK TEST FROM SERIES 5 FPB RT

5. Plug cable from **950A** test set into connector on faceplate of **AUA93** BRITE II channel unit in circuit to be tested.

   Response: All indicators on **950A** test set light momentarily. The indicators should go off unless circuit conditions cause them to remain lighted.

6. Is the LLF or LCF indicator lighted on the **950A** test set?

   If **YES,** then continue with Step **7.**

   If **NO,** then proceed to Step **8.**

7. If LLF is lighted, make sure NT1 is connected and powered or check RT wiring and the loop to customer premises. If LCF is lighted, check Series 5 system indications for carrier line failure (CLF on the line interface units) or check with the central office and make sure the COT channel unit is properly optioned, installed, and working normally. When problem is cleared (no LLF or LCF indicator lighted), continue with Step **8.**

8. Condition **950A** test set (Figure 7) as follows:

   - Set the **946A-950A** switch to the **950A** position.
   - Set the **2B+D** switch to the **BRI** position.
   - Set the **ADDRESS** switch to **6, 4,** or **2,** corresponding to the address of the farthest channel unit from the test set. Refer to facility record of the circuit to determine address number.
   - Set the **LOOP-CARRIER** switch to the **CARRIER** position.
   - Set the **TRMT/RCV - RCV** switch to the **TRMT/RCV** position.
   - Set the **B1-B2** switch to select channel to be tested. If service is 2B+D, set switch to **B1** (it will be reset later to test the B2 channel). If service is B1+D, set switch to **B1**. If service is B2+D, set switch to **B2**. If service is D-only, testing should be performed from the serving switch or maintenance center.
   - Set the **KS-ST** switch to the **ST** position.

9. On the **950A** test set, press the **ACT** button and the **COUNTER-RESET** button. (ACT starts the BRI loopback test; COUNTER-RESET clears the error display.)

10. ***Note:*** No errors in 3 minutes corresponds to a bit error rate better than 10^{-7}, which is suitable for data transmission. For a more accurate measure, a longer test may be run. No errors in 26 minutes corresponds to a bit error rate of almost 10^{-8}.

    After 3 minutes, press the **ACT** button to end the test. Observe the **COUNTER-ERRORS** display. Does the **COUNTER-ERRORS** display show errors?

    If **YES,** then continue with Step **11.**

STEP	PROCEDURE 3 — BRI / NT1 LOOPBACK TEST FROM SERIES 5 FPB RT

If **NO,** then proceed to Step **17.**

11. Repeat test to verify errors. (Press **ACT** and **COUNTER-RESET** to start, wait 3 minutes, then press **ACT** again to stop.) Does the **COUNTER-ERRORS** display still show errors?

    If **YES,** then continue with Step **12.**

    If **NO,** then proceed to Step **17.**

12. ***Note:*** At this point, at least one channel has failed the loopback test. If the test set displays a low error rate (1 or more seconds between increments on display), the data test sets may be used to obtain a more specific error rate (Procedure 4).

    Set the **ADDRESS** switch to the number representing the position of the next lower-numbered BRITE II channel unit in the circuit. Verify the **LOOP-CARRIER** switch is set to the **CARRIER** position.

13. Repeat loopback test at next address: on the **950A** test set, press the **ACT** button and the **COUNTER-RESET** button. After 3 minutes, press the **ACT** button to end the test. Observe the **COUNTER-ERRORS** display. Does the **COUNTER-ERRORS** display show errors?

    If **YES,** then continue with Step **14.**

    If **NO,** then proceed to Step **16.**

14. Repeat test to verify errors. (Press **ACT** and **COUNTER-RESET** to start, wait 3 minutes, then press **ACT** again to stop.) Does the **COUNTER-ERRORS** display still show errors?

    If **YES,** then continue with Step **15.**

    If **NO,** then proceed to Step **16.**

15. Does the **ADDRESS** switch setting = **1** (for **AUA93** channel unit)?

    If **YES,** then replace the **AUA93** and return to Step **2.**

    If **NO,** then return to Step **12.**

16. ***Note:*** If desired, the data test sets may be used to obtain a more specific error rate (Procedure 4) for any loopback that resulted in a low error rate on the **950A** test set.

    Note the address of the channel unit that passed the loopback test (displayed no errors). Report that circuit operates properly up to the channel unit that passed loopback test. Further testing in the circuit beyond the passing channel unit will be needed to identify and clear trouble.

    STOP. YOU HAVE COMPLETED THIS PROCEDURE.

17. If service on circuit is 2B+D and the B2 channel has not been tested, set **B1-B2** switch to **B2** and return to Step **9.** If B2 channel has been tested (or service is not 2B+D), continue with Step **18.**

STEP	PROCEDURE 3 — BRI / NT1 LOOPBACK TEST FROM SERIES 5 FPB RT

18. ***Note:*** Circuit is working all the way back to the transmission equipment connected to the switch. (Connection to the switch cannot be verified using the **950A** test set.)

    Condition **950A** test set to test NT1 as follows:

    - Set the **LOOP-CARRIER** switch to the **LOOP** position.
    - Set the **2B+D** switch to the **NT1** position.
    - Verify **B1-B2** switch is set to **B2**.
    - Verify **TRMT/RCV - RCV** switch is set to the **TRMT/RCV** position.

19. On the **950A** test set, press the **ACT** button and the **COUNTER-RESET** button. (ACT starts the NT1 loopback test; COUNTER-RESET clears the error display.)

20. After 3 minutes, press the **ACT** button to end the test. Observe the **COUNTER-ERRORS** display. Does the **COUNTER-ERRORS** display show errors?

    If **YES,** then continue with Step **21.**

    If **NO,** then proceed to Step **27.**

21. Repeat test to verify errors. (Press **ACT** and **COUNTER-RESET** to start, wait 3 minutes, then press **ACT** again to stop.) Does the **COUNTER-ERRORS** display still show errors?

    If **YES,** then continue with Step **22.**

    If **NO,** then proceed to Step **27.**

22. Reset switches to test **AUA93** as follows:

    - Set the **2B+D** switch to the **BRI** position.
    - Set the **ADDRESS** switch setting to **1** (for **AUA93 channel unit)**
    - **Verify B1-B2** switch is set to **B2** and the **LOOP-CARRIER** switch is set to the **LOOP** position.
    - Verify **TRMT/RCV - RCV** switch is set to the **TRMT/RCV** position.

23. On the **950A** test set, press the **ACT** button and the **COUNTER-RESET** button.

24. After 3 minutes, press the **ACT** button to end the test. Observe the **COUNTER-ERRORS** display. Does the **COUNTER-ERRORS** display show errors?

    If **YES,** then continue with Step **25.**

    If **NO,** then proceed to Step **26.**

25. Repeat test to verify errors. (Press **ACT** and **COUNTER-RESET** to start, wait 3 minutes, then press **ACT** again to stop.) Does the **COUNTER-ERRORS** display still show errors?

STEP	PROCEDURE 3 — BRI / NT1 LOOPBACK TEST FROM SERIES 5 FPB RT

If **YES,** then replace **AUA93** channel unit and return to Step **2.**

If **NO,** then continue with Step **26.**

26. ***Note:*** If desired, the data test sets may be used to obtain a more specific error rate (Procedure 4) for any loopback that resulted in a low error rate on the **950A** test set.

    Report that circuit operates properly up to the **AUA93** channel unit; problem most likely in the NT1.

    STOP. YOU HAVE COMPLETED THIS PROCEDURE.

27. If service on circuit is 2B+D and the B1 channel has not been tested, set **B1-B2** switch to **B1**, verify **TRMT/RCV - RCV** switch is set to the **TRMT/RCV** position, and return to Step **19.** If B1 channel has been tested (or service is not 2B+D), continue with Step **28.**

28. Circuit is working properly in both directions. Verify **ACT** indicator is *not* lighted and disconnect test set.

    STOP. YOU HAVE COMPLETED THIS PROCEDURE.

PROCEDURE 4 — TEST FOR DETAILS OF LOW ERROR RATE ON 950A TEST SET

Application

This procedure may be used when the **COUNTER-ERRORS** display counts up slowly with 1 or more seconds between increments or when the display shows less than 10 errors during a loopback test. A low error rate may be caused by an intermittent failure. The data test sets are used to get a more detailed error count when the **950A** shows a low error rate.

Summary

Repeat loopback test that showed the low error rate and note errors displayed on the data test set receiver. This test will interrupt service. The **ACT** indicator will light the first time the **ACT** pushbutton is pressed and go off when it is pressed again.

Test Equipment Required at RT

- **950A** test set and connecting cable
- Data test sets: **KS-20909 TRANSMITTER** and **KS-20908 RECEIVER**
- **ED-3C792 TEST UNIT**

STEP	PROCEDURE 4 — TEST FOR DETAILS OF LOW ERROR RATE ON 950A TEST SET

1. On the **950A** test set, set switches or verify switches are set for the loopback test that resulted in a low error rate.
2. On the **950A** test set, set the **KS-ST** switch to the **KS** position. Connect the data test sets (Figure 13) to the **950A** test set as follows:
   - **KS-20909 TRANSMITTER** clock cord to **TMT** on **ED-3C792 TEST UNIT**
   - **KS-20908 RECEIVER** clock cord to **REC** on **ED-3C792 TEST UNIT**
   - Cable assembly between **ED-3C792 TEST UNIT** and **CLOCK** on **950A** test set
   - **KS-20909 TRANSMITTER** signal cord to **TRMT** jack on **950A** test set
   - **KS-20908 RECEIVER** signal cord to **RCV** jack on **950A** test set.
3. Depress **POWER** switches on **TRANSMITTER** and **RECEIVER** and verify **CLOCK** indicators are lighted.
4. Set switches on **TRANSMITTER** and **RECEIVER** as follows:
   - **TRANSMITTER MODE** to **REPEAT**
   - **TRANSMITTER FUNCTION** to **2047**

STEP PROCEDURE 4 — TEST FOR DETAILS OF LOW ERROR RATE ON 950A TEST SET

- **DATA RATE** to **56** (kb/s) on both test sets
- **TRANSMITTER OUTPUT** to **LOGIC NEAR**
- **RECEIVER INPUT** to **LOGIC NEAR**
- **RECEIVER CHANNEL** to **SINGLE** (or any position; it does not matter)
- **RECEIVER TEST WORD** to **2047**
- **RECEIVER COUNTER** to **BIT ERRORS**.

5. On the **950A** test set, press the **ACT** button to start the test.

6. On the **RECEIVER**, operate **COUNTER MODE** to **RESET**.

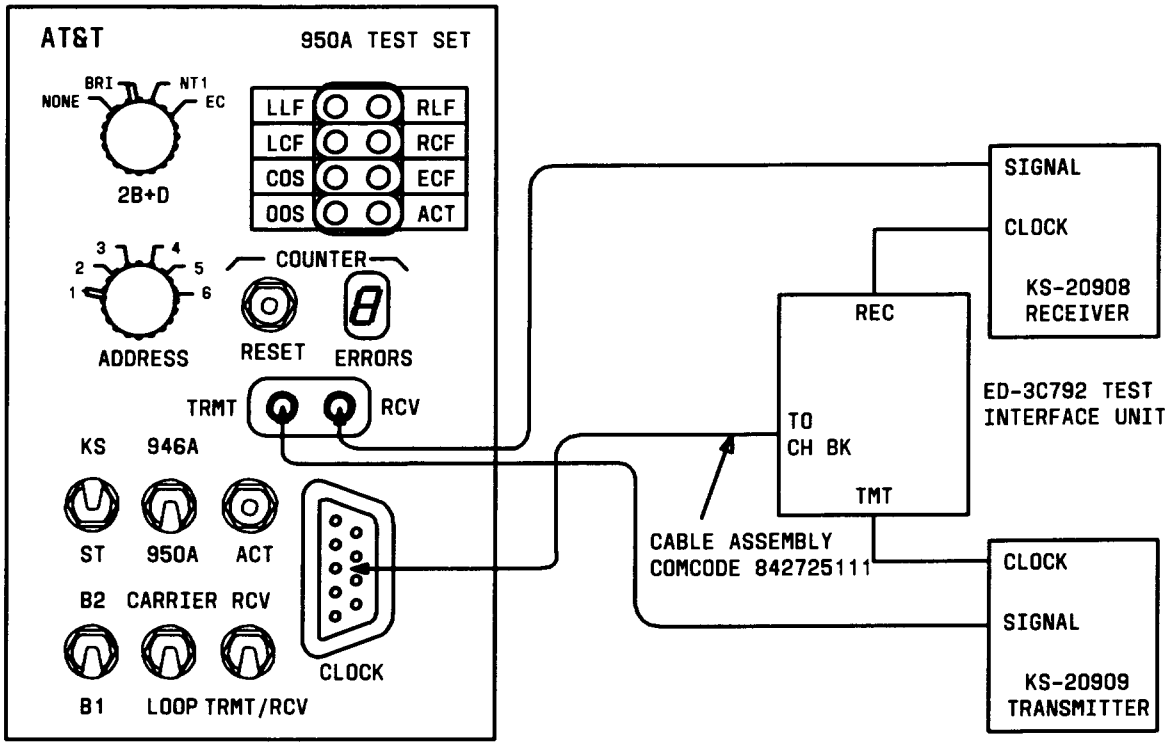


Figure 13 — Test Connections for Data Test Sets

7. After 3 minutes, press the **ACT** button on the **950A** test set to end the test. Note the number of errors displayed on the **RECEIVER.** Trouble may be an intermittent failure; clear according to local procedures.

STOP. YOU HAVE COMPLETED THIS PROCEDURE.