Acceptance Testing - DS-1 Span

Contents

(continued)

Contents, continued

1. General

1.1 Purpose

This practice provides the procedures to follow to verify and assure that DS-1 systems meet GTE performance standards for a transmission medium as described in this practice.

NOTE: This practice is for testing the DS-1 transmission media only. Terminal testing is to be conducted by referring to the appropriate manufacturer's manual or GTE Telephone Operations' practice for guidelines.

1.2 Filing Instructions

File this practice in numerical order in your practices set.

1.3 Copyright and Responsibility

This practice contains information which is proprietary to GTE and must not be divulged to non-GTE personnel. The information has been prepared by the Network Operations Department and published by the Telephone Operations Administrative Services Department. For more information about this practice contact the Senior Administrator Network Administration.

1.4 Disclaimer

This GTE Telephone Operations Practice has been prepared for GTE, GTE customers, and end users' employees who operate and maintain the equipment engineered and installed by GTE. The information in this practice is subject to change and may not be suitable in all situations. GTE acknowledges that a customer's special requirements or practices may take precedence over those supplied in this practice if a conflict develops during installation or ongoing operation. GTE hereby disclaims any responsibility or liability for any consequential or inconsequential damages that may result from the use of this practice.

2. Overview

2.1 Introduction

The Carrier Restoration Control Center (CRCC) tests DS-1 cable spans to ensure DS-1 spans:

- Meet the criteria stated in the "Testing Requirements" section of this practice (beginning on page 13).
- Provide a quality transmission medium for GTE customers.

All tests described in this practice are to be performed prior to placing any DS-1 span in service.

CRCC personnel record test results from the required testing described in this practice on the "T1 Acceptance Form" (Form 90002529, **see** Exhibit 1, page 4). An additional form, "Fault Filter Locating Test Record" (Form 90002528, see Exhibit 2, page 20) is where CRCC personnel record fault-locating test results.

2.2 Forms

Order forms referenced in this practice from local stationary storerooms.

2.3 Records

All acceptance test records are maintained by the Carrier Restoration Control Center (CRCC). The records are accessible for those conducting the testing and trouble shooting.

GTE Telephone Operations

T1 ACCEPTANCE FORM

FORM 90002529

REF CTEP

Distribution:
White — Division Manager
Green — Manager-TSS
Yellow — Manager-Network Services
Pink — W.O. Spec
Goldenrod — Originator

T1 DESIGNATION	CA/ROUTE NO.
A-LOCATION	B-LOCATION
W.O. #	INSTALL SUPVR
DATE TO CRCC	DATE ACCEPTED
TECHNICIAN	CO SUPVR

CHECK	ENG	MEASURED LEVEL	MODEL/TYPE TEST EQ	CHECKED	ACCEPTED
DOCUMENTATION					
TEST EQUIP					
SPARE PARTS					
EQ PLACEMENT					
PWC PLACEMENT					
FUSES					
OPTIONS					
ALARMS					
BURN-IN					
CABLE TEST					
D-FACTOR					
WET CABLE					
END SECTION					
CROSS TALK					
BONDING, GROUNDING, PROTECTION	OFF HSG				
REPEATER TESTING					
REPEATER DC					
BER					
STRESS					
JITTER					
CONTINUITY					
FAULTY FILTER					
SIGNAL LEVEL					
ORDERWIRE					
AC PWR INFLUENCE					
SLIP					
PULSE SHAPE					
SPARE LINE					
TEST AND MONITOR SYS					

Exhibit 1 - T1 Acceptance Form - Form 90002529

2.4 Reason for Testing

The complexity of DS-1 networks has created the need for direct measurement of the timing impairments that contribute to degraded error performance. In OS-1 networks, the primary consequences of impairments are bit errors and slips.

Testing the existing DS-1 cable spans is to ensure that DS-1 spans meet criteria outlined in section 5, “Testing Requirements”.

NOTE: Some existing spans may not be designed to meet 10^{-9} error rate. These spans are to be referred to GTE Network Engineering for review and redesign. Existing routes will not be redesigned if bit error rate (BER) is less than 10^{-6} error rate unless there are special requirements.

Bit error measurements are performed to determine DS-1 network performance. Slip measurements are performed to confirm proper timing and proper configuration of the network equipment.

The tests outlined in this practice include the requirements to test the newly designed coding formats such as Extended Superframe (ESF) and B8ZS.

2.5 Extended Superframe

The Extended Superframe coding format “extends” the DS-1 superframe structure and redefines the eight kilobits/second (kb/s) pattern previously used for D-4 frame synchronization. The redefined format allots two kb/s for basic frame synchronization, two kb/s for cyclic redundancy check (CRC-6) code and four kb/s for a facility data link. The CRC-6 is a block of data indicating circuit performance in every superframe.

Because the CRC-6 is a logic pattern within the DS-1 bit stream, it is transmitted through the entire digital hierarchy and may be monitored at any DS-1 level access point. Where this ESF exists, use the T- BERD 209 ™ T-carrier analyzer (or its equivalent) to monitor for CRC-6 errors. This indicates the quality of the span.

For performance alarm threshold, the ESF is allowed 52,184 coding violations (CRC’s) an hour at a Bit Error Ratio benchmark of 10^{-6} as stated in Bell Communications Research, Inc., Technical Reference TR-TSY-000303, “Integrated Digital Loop Carrier Systems Generic Requirements, Objectives, and Interface”, Issue 1, Revision 1, December, 1987. This figure can be rounded without significant loss of accuracy.

2.6 B8ZS

The line coding format “bipolar with 8 zero substitution” is called B8ZS. To facilitate timing recovery and to ensure there are a sufficient number of transitions in the bipolar signal, the B8ZS format was developed. The B8ZS format introduces a bipolar violation signature into the bit stream when eight consecutive zeros are encountered. This allows the customer to send more than 15 consecutive zeros for clear channel capability. AMI-coded (alternate mark inversion coded) bipolar wave forms are restricted to contain no more than 15 consecutive zeros.)

T- BERD 209 is a trademark of Telecommunications Techniques Corporation, Germantown, Maryland.

2.7 Acronyms, Terms, and Definitions

The following chart explains acronyms and terms used in this practice. The chart lists the term on the left and its definition is on the right.

Term	Definition
AMI	Alternate Mark Inversion
BER	Bit Error Rate - The percentage of received bits in error compared to the total amount of bits received. (Usually expressed as a number to the power of lO. E.g., "10 to the fifth power" means that one in every 100,000 bits transmitted will be wrong.)
Bit Rate	The number of bits per second of data transmitted over a phone line.
BPS	Bit Per Second - A measure of transmission speed.
CRC-6	Cyclic Redundancy Code
CRCC	Carrier Restoration Control Center
CXR	Carrier Systems
DS-1 Line	The combination of facilities, including office repeaters and cables between two sites. **NOTE: A DS-1 line is also referred to as a "span line" or "span".**
DS-1 System	A series of DS-1 spans, linked together and terminated on a: • Switching system. • Pair gain system. • Multiplexer (MXU, MIS, MUX). • Digital-to-analog converter terminal (channel bank). **NOTE: All DS-1 systems furnished by GTE are to meet the standards set forth in this practice and related GTE documentation.**

(continued)

2.7 Acronyms, Terms and Definitions, continued

Term	Definition
DSX	Digital Signal Cross Connect
ECPGB	Entrance Cable Protection Ground Bar
ESF	Extended Superframe
MDF	Main Distribution Frame
PCM	Pulse Code Modulation
PDUF	Power Distribution Unit Frame
PWC	Printed Wiring Card
RMS	Root Mean Square
Repeater	A device (inserted at intervals along a DS-1 line) to regenerate the signal being transmitted.
Repeater Section	The portion cable from one repeater to the next.

3. Responsibilities

3.1 Engineering

GTE Area Transmission Engineering is responsible for:

- Preparing work orders, associated specifications, and documentation for DS- 1 carrier equipment.
- Ordering (as required):
  - Latest version of GTE standard test equipment.
  - Special equipment, e.g., printers, personal computers, specialized tools, etc.
- Notifying CRCC when:
  - Equipment has been ordered.
  - Proposed application date and estimated test-ready date are determined.
- Notifying CRCC, Network Administration and Technical Support Services on first-of-a- kind installation.
- Completing the necessary engineering work to upgrade all existing DS-1 systems not passing tests outlined in this practice.

  NOTE: Engineering determines if re-engineering is required or not.
- Providing maintenance spare parts upon installation or when any additions are made.

3.2 Network Construction or Engineer Furnish and Install Vendor

Network Construction or Engineer Furnish and Install Vendor is responsible for:

- Taking inventory of, installing, and testing all equipment and facilities.
- Notifying CRCC when DS-1 span is ready for acceptance testing.
- Updating prints and supporting documents.
- Turning over spare parts, test equipment, documentation, and other pertinent equipment to CRCC.
- Meeting established time frame or keeping CRCC updated as to the status (new time frame).
- Following-up on back ordered or missing material.
- Completing performance test(s) to ensure DS-1 span is fully operational.

  NOTE: For Engineer Furnish and Install Vendor, this may vary depending upon contract terms.
- Correcting any discrepancies noted by CRCC during acceptance testing.

3.3 Carrier Restoration Control Center

The Carrier Restoration Control Center (CRCC) is responsible for:

- Completing acceptance testing requirements.
- Testing all spare parts and test equipment for proper operation.
- Ensuring DS-1 system is fully operational.
- Turning DS-1 system up for service (if fully operational).
- Signing the DS-1 Acceptance Form (Form 90002529, see Exhibit 1, page 4), and returning a copy of the form along with a copy of the engineering specifications to the department that originally issued the engineering specifications.
- Signing the Fault Filter Locating Test Record (Form 90002528, see Exhibit 2, page 20) and returning a copy of the form to the department that originally issued the engineering specifications.
- Updating Technical Support Services on acceptance status/completion.

3.4 Technical Support Services (TSS)

Technical Support Services (TSS) is responsible for:

- Providing a second level of support to the CRCC.
- Working with CRCC on first-of-a-kind acceptance testing.
- Resolving technical problems and/or coordinating escalation of any unresolved problems to vendor and/or GTE Engineering.
- Conducting a post-acceptance-test meeting with the CRCC, Network Administration, and Engineering to discuss any problems encountered on first-of-a-kind installations.
- Forwarding information to Network Administration for inclusion in policies, practices and procedures.

3.5 Network Administration

Network Administration is responsible for:

- Developing policies, practices and procedures for operating units to follow relating to the operation, maintenance, routine maintenance, and administration of DS-1 spans.
- Working with CRCC and other GTE departments (e.g., TSS, Engineering) to establish required quantities of spare parts.
- Working with GTE Training to establish training courses.

3.6 Planning

Network Operations Planning is responsible for:

- Identifying the need for installing a DS-1 span.
- Scheduling and funding DS-1 projects.
- Determining quantity needed to provide required customer service.

3.7 Supply

Supply Operations is responsible for:

- The timely delivery of equipment.
- Processing material request/Purchase Order(s).
- Taking inventory of equipment received.

  NOTE: All departments are required to conduct an inventory of received equipment. Supply ensures all equipment is received from the vendor; Installation ensures al! equipment is received on site; CRCC ensures all equipment is installed; etc.

- Keeping Network Construction updated as to status of material, i.e., back orders.
- Maintaining an adequate stock of parts to support the CRCC
- Maintaining a sufficient quantity of spare parts in stock to support maintenance forces.

4. Pre-Test Criteria

4.1 List of Preliminaries

Prior to starting of functional acceptance testing, the following criteria must be met:

- The CRCC must have all drawings, manuals, publications directly related to the updated or changed equipment. (This includes manufacturers' instruction manuals, schematic diagrams, flow charts, equipment lists, route maps, strapping options, etc.)

  NOTE: One set of all applicable documentation per equipment location is required for initial installations. Subsequent installations of later model or issue number must include all documentation directly related to the updated or changed equipment.

- All test equipment must be in place, including necessary adaptors and cords as required by the manufacturer and/or GTE Engineering.
- Test equipment must be fully operational.
- Spare parts must be inventoried.
- All modifications to circuit boards, repeaters, etc., required by manufacturer and/or GTE Telephone Operations standards must be completed and modification documentation furnished.
- Equipment must be connected end-to-end, i.e., terminal-to-terminal, multiplexer-to-multiplexer, repeater-to-repeater, etc., with no alarm indications.

  NOTE: Testing is from DSX to DSX or equivalent point if no DSX exists.

4.2 "Burn-In" Period

Before beginning acceptance testing, all spans must be powered up for a minimum of 24 hours.

4.3 Wet Cable

Cabie sections subject to moisture problems must be checked for moisture and problem sections corrected before DS-1 system introduction and in advance of the planned cable testing.

NOTE: Refer to GTE Telephone Operations Practice 937-004-075, titled "Customer Access Facilities (CAF) Quality Provisioning Guidelines Standards – Maintenance", for wet cable and cable acceptance testing procedures.

4.4 Cable Preparation

Cable(s) used for DS- 1 systems must have bridge taps, load coils, etc., removed from the associated pairs in preparation for DS- 1 usage.

4.5 Cable Testing

Prior to carrier span transmission testing, the cable test must be completed to verify DC (direct current) and high frequency acceptability.

Use a Sierra 413 ™ test set (or its equivalent) to conduct a cable loss test. To measure the loss of the incoming signal, set the Sierra 413 ™ test set according to the steps listed in the following chart.

Cable Testing Step-by-Step
1. Toggle "Meter" switch to "Loss".
2. "Step" (turn) the "Cable Loss" control switch untill a reading appears on the meter.
3. Determine actual loss of the cable section by adding the meter reading to the setting of the "Cable Loss" control.

A Sierra 413 is a trademark of Lear Siegler, Incorporated, Menlo Park, California.

4.5 Cable Testing, continued

If the signal is too low, or doesn't arrive at all, the cable pair may have trouble such as the following:

- A load coil remains on the line to choke off high frequency energy.
- A bridge tap has been overlooked. (It acts as a trap to critical frequencies.)
- A build out capacitor has been overlooked. (Its capacitance shorts out the higher frequencies.)
- Water has entered the cable reducing insulation resistance, increasing capacitance or increasing cross talk.
- The cable pair:
  - Is crossed with another pair.
  - Is open.
  - Is shorted.
  - Has high resistance leakage between wires, or between a wire and ground.

NOTE: Cable loss is not to exceed 2.5 dB of calculated loss at 772 kHz. Considering each direction of transmission separately, the range of losses among all pairs measured are not to exceed 3.5 dB.

4.6 Problems During Testing

Problems can be encountered during acceptance testing that require a change out of a powered up component, i.e., PWC, or removal of power to the system or any part of the system. When the problem is corrected, continue acceptance testing after:

- Allowing a minimum "burn-in" period of eight hours to elapse before proceeding with acceptance testing.
- Conducting again all tests previously performed that may have been affected by the problem.

NOTE: If in doubt, retest.

5. Testing Requirements

5.1 Introduction

The following paragraphs explain the types of testing the Carrier Restoration Control Center (CRCC) is required to do. The results of the various test are recorded on the T1 Acceptance Form (Form 90002529, see Exhibit 1, page 4).

NOTE: When conducting acceptance tests as outlined in this section, o&serve existing systems (that share the same cable sheath) for any interference that could arise from adding the span being tested.

if the customer requires any additional test(s) (not outlined in this practice), contact TSS immediately. TSS is to clarify:

- How to conduct the test(s).
- What results must be achieved.

5.2 Minimum End Section Losses and Line Repeater Level Coordination

Refer to Siemens practice 836-91 O-081, titled "91048 24/48 Channel PCM Repeatered Line".

NOTE: A minimum section loss of 9 dB is necessary because of repeater design and to attenuate reflections. If the section is adjacent to a central office, the pad loss (3 dB or 7.5 dB) can be subtracted, making the minimum cable loss 6 dB or 1.5 dB.

In addition to the information contained in the aforementioned practice, apply the following guidelines:

- if the branch-receive spans share the same cable binder group within the repeater housing stub with other DS-1 spans, then the input levels of all the span lines in that repeater housing is to be within 10 dB.
- If the branch-receive spans share the same cable binder group with other DS-1 spans in a portion of the main cable and repeater housing stubs, then the input levels of all the span lines in that repeater housing is to be within 3 dB.

Verify the appropriate input levels to reduce crosstalk. If the span pads are being used to maintain level coordination protection, grounds for these pads and proper placement must be verified.

NOTE: The tests required can be conducted using a T-BERD 209 ™ T-carrier analyzer (or its equivalent).

T- BERD 209 A is a trademark of Telecommunications Techniques Corporation, Germantown, Maryland.

5.3 Crosstalk

Two types of crosstalk combine to limit the number of systems which can operate in the same cable. The two are:

- Near End Crosstalk - The powerful coupling effect between two circuits with widely differing signal levels (coupling between transmit and receive pairs).
- Far End Crosstalk - The energy coupled between circuits as the signal moves along the line (coupling between transmit pairs).

NOTE: Use a Sierra 413A ™ PCM cable test set (or its equivalent) to perform crosstalk test. Refer to test-set manufacturer's operation manual for proper setup.

5.4 Grounding, Bonding, Protection and Pressurization of Repeater Housing

To verify bonding, grounding, protection, and pressurization of repeater housing, follow procedures outlined in GTE Telephone Operations Practices:

- 795-805-073, titled, "Transmission Equipment - Central Office Grounding"
- 795-805-071, titled, "Grounding System Central Office - Engineering Applications"
- 795-805-075, titled "Remote Electronic Serving Area Grounding Systems - Engineering Considerations"

Proper grounding of an assembly is attained only by connecting the assembly to the site-ground network. The external ground lug on the repeater housing must be connected to an earth-ground of 25 ohms or less.

Bonding is the joining of two or more surfaces by mechanical and/or electrical means to achieve:

- A low impedance connection.
- Voltage equalization.

Verify bonding by inspecting to ensure the bonding of the repeater housing is complete, with:

- All connections secured tightly.
- No corrosion.

A Sierra 413A is a trademark of Lear Siegler, Incorporated, Menlo Park, California.

5.4 Grounding, Bonding, Protection and Pressurization of Repeater Housing, continued

Verify protection by measuring gas tube break down voltage with a G. W. Electronics TS5929 Arrester Tester ™ (or its equivalent). (The gas tube is considered out-of-limits and must be replaced when it fires below 300 volts or above 500 volts.)

Verify that all pairs (including spare pairs) are protected.

Verify that the repeater housing has been pressurized, if required. (An indicator of leakage is the formation of corrosion and/or moisture in the housing.) Pressurization can be by three methods:

- From the main cable stub.
- From a pressurized cable nearby ("locally").
- From a portable nitrogen cylinder.

WARNING: Before unclamping the cover of a pressurized housing, open the F-valve in the base to relieve the pressure. If the air supply is from a local source, first close the external shut-off cock.

Do not exceed maximum housing pressure of 15 psig.

Before leaving site, measure pressure and flash test for leaks around clamped joints with soap and water. An indicator of leakage is the formation of corrosion and/or moisture in the housing.

After completely verifying the bonding, grounding and protection pressurization of the repeater housing, indicate any problems on paper, attach to PCM Span Line Check List and forward to GTE Engineering.

G. W. Electronics TS9529 Arrester Tester is a trademark of G.W. Electronics, Morecross, Georgia.

5.5 Bonding, Grounding, Protection of Office Equipment (Including Office Repeaters)

To verify bonding, grounding, and protection within a Central Office, follow procedures outlined in GTE Telephone Operations Practices:

- 795-805-073, titled, "Transmission Equipment- Central Office Grounding"
- 795-805-071, titled, "Grounding System Central Office - Engineering Applications"
- 887-903-026, titled, "Five Pin Protector Module Application"

In the Single Point Ground (SPG) system, the grounded terminal of the battery, circuit ground, and discharge ground are deliberately isolated in the load equipment from its framework. All elements in the power system that require grounding are isolated from contact with other grounds, except for a single point.

All equipment frames for transmission must be grounded to the Master Ground Bar (MGB)/Floor Ground Bar (FGB) via leads 41A, 58A, and 59A. The superstructure must be grounded via lead 57A.

Lead 57A is required to bond the cable grid or runway system to the FGB.

Cables from the DSX to the transmission equipment must have shields grounded at the transmission equipment end only. Do not bridge the DSX ends of the shields across the DSX.

If the cable runs between two pieces of transmission equipment, and no DSX jack field is located within the cable run, ground the shield at only one location.

If the cable runs between the switch and the transmission equipment, and no DSX jack field is located within the cable run, ground the shield at only the transmission equipment end.

Integrated transmission equipment (vice SPG) has the battery return connected to the metal chassis (or shelf) in which it is mounted. Existing integrated, grounded transmission frames engineered prior to March 1, 1990 may remain, and additional equipment may be added to those frames. (Refer to the aforementioned GTE Telephone Operations Practices for information about integrated grounds.)

WARNING: Where older isolated, grounded transmission equipment is mixed with integrated grounding equipment, the older transmission equipment bays were bonded by Lead 50 to the MGB/FGB or ECPGB. Potential rise at the ECPGB can cause damage to transmission equipment. In all cases, reterminate the transmission equipment bays Lead 50 to ground return at transmission system's PDUF.

5.5 Bonding, Grounding, Protection of Office Equipment (Including Office Repeaters), continued

Use approved insulators to isolate the protector mounting bars on carrier high frequency line protector frames (bonded to Lead 23A):

- In the transmission equipment area.
- From the equipment frame.

Lead-sheathed cable stubs carrying high frequency lines to protector frames in the transmission area must:

- Be replaced with cable stubs having nonconductive sheaths.

OR

- Have isolated splices installed.

Verify protection of office equipment according to the steps listed in the following chart.

Verifying Protection Step-by-Step
1. Turn down the span because Step 2 will physically open the span.
2. Measure gas tube break down voltage with a G. W. Electronics TS5929 Arrester Tester ™ equivalent. (The gas tube is considered out-of-limits and must be replaced when it fires below 300 volts or above 500 volts.)
3. Verify that all pairs (including spare pairs) are protected.
4. Verify that no bridge taps exist on the span cable pairs, e.g., having the pairs present on two different frames.
5. Verify that office repeater equipment is connected to the office side of the protectors, so that removal of the protector opens the span.

5.6 Repeater

Prior to installation, each repeater must be tested with the Sierra 415A ™ test set (or its equivalent) for proper operation. All repeaters supplied DC simplex power from the same source must be of the same current type (e.g., 60 ma, 100 ma. etc.) Different type repeaters are not to be used within a system because they have different characteristics during stress testing. Refer any problems to GTE Engineering.

NOTE: If a bridging repeater is installed in the circuit, the associated office terminating repeater (OTR) must be verified that the transmit span pad is optioned to a minimum of 3 dB.

A Sierra 415A is a trademark of Lear Siegler, Incorporated, Menlo Park, California.

5.7 Repeater DC

Verify repeater DC simplex power feed strapping per the:

- Work order from GTE Engineering.
- Span Design Record from GTE Engineering.

DC simplex current readings must meet the specifications in the following chart.

Specification	Maximum Deviation
60 ma	± 3 ma
100 ma	± 5ma
120 ma	± 5ma

5.8 DS-1 Signal Continuity

To test and verify DS-1 signal continuity, refer to the Span Design Record to determine office "A" and "B" and follow these two steps:

1. At office "B" DSX or equivalent - loop the span.

2. At office "A" DSX or equivalent - test, using Sierra 415A" test set or its equivalent to verify the bit stream is being received.

5.9 Bit Error Rate

The bit error rate required for all DS-1 lines is 10^{-9}. To test the bit error rate, use the following procedure:

- Transmit End - Send Quasi-Random Signal Source (QRSS).
- Receive End - When the threshold is set at 10^{-9}, (if the test set is arranged with threshold levels) it is required there be no errors in a two-hour test period.

NOTE: If threshold-level settings are not available on the test set, users are to calculate the Bit Error Rate according to test set manufacturer's instructions.

5.10 Jitter

Jitter is the rapid variation in the data signal phase. The data pulse appears in the center of the time slot when there is no jitter. The data pulse moving rapidly from the center indicates there is jitter. If movement is sufficient to shift the pulse to an adjacent time slot, a logic error occurs.

Jitter is usually measured in unit intervals (UI) with one unit interval being equal to one complete time slot.

For Carrier-Carrier DS- 1 Network Interface, maximum permissible output jitter is as follows:

- Low (10 Hz to 8 kHz) - 5 UI
- High (8kHz to 40 kHz) - .15 UI

Use any test set that is equipped to measure jitter. See test set manufacturer's operations manual for procedures.

5.11 Stress

The test to be performed requires the looping of the DS-1 signal at the far end. (The loop may be omitted if two maintenance persons are available at each end with compatible test equipment.)

The signal continuity of the loop must be verified by observing the indications displayed on the test set when sending a test pattern.

The test signal is to be connected to the transmit span jack of the near end office terminating repeater of the span under test. The receive test set is to be connected to the receive monitor jack of the far end office repeater.

Perform the following tests:

A. Send framed all ones - no errors received for 15 minutes.

B. Send framed 1 : 1 - no errors received for 15 minutes.

C. Send framed 1 :7 - no errors received for 15 minutes. (B8ZS *Only)*

D. Send framed 3 in 24 - no errors received for 15 minutes. (AMI Only)

Remove loop from far end and return system to service.

Each test pattern must be sent for 15 minutes. Retest if marginal tests are obtained. Upon retest, if receive errors are still encountered while sending any of the test signals, corrective actions must be taken to repair the span line under test prior to continuing acceptance testing.

5.12 Fault Filter

Arrange the fault locating to locate faults in both directions, to and from the associated offices and/or pair gain unit. Arrange fault locating filters so that positive polarity will interrogate side 2. (This may not be applicable when interfacing to another company.)

Verify fault line polarity continuity. (If there is a reversal on the fault pair, the newly installed repeater(s)/adapter(s)/ housing(s) are optioned wrong and the fault tests are invalid.)

Fault locating must be performed from both ends of the span with and without the span being looped to ensure all filters are:

- Optioned with the correct polarity for the side being tested.
- Being tested.

Record the results of the fault locating tests on the "Fault Filter Locating Test Record" (Form 90002528, see Exhibit 2, page 20).

The fault locating pair must meet the cable acceptance requirements for DS-1 facility. (See "Cable Testing", 4.5, in this practice and GTE Telephone Operations Practice 937-004-075, 'Customer Access Facilities {CAF} Quality Provisioning Guidelines Standards - Maintenance" .)

GTE Telephone Operations

FAULT FILTER LOCATING TEST RECORD

FORM 90002528
HF:

DISTRIBUTION:
White - Division Manager
Green - Manager TSS
Yellow - Manager Network Services
Pink - W.O. Spec
Goldenrod - Originator

OFFICE	SPAN TO	☐ AMPLIFIED ☐ NON-AMPLIFIED	DATE

HOUSING NO.	FAULT FILTER		SETTING			PULSE PERIOD SWITCH POSITION							
	CODE	POLARITY	MEAS 1	MEAS 2	MEAS 3	11	10	9	8	7	6	5	4

FILTER FREQUENCY ASSIGNMENT		
9101 A & B 91076	9101C, 91114, 91115	HZ
-01	Code A	832
-02	B	828
-03	C	1048
-04	D	1208
-05	E	1340
-06	F	1508
-07	G	1722
-08	H	2004
-09	J	2183
-10	K	2413
-11	L	2680
-12	M	3017

Note Polarity if equipped with amplifiers

Exhibit 2 - Fault Filter Locating Test Record - Form 90002528

5.13 Order Wire

Normal cable acceptance parameters must be met for the order wire pair. The parameters are stated in GTE Telephone Operations Practice 937-004-075, "Customer Access Facilities (CAF) Quality Provisioning Guidelines Standards - Maintenance". Testing procedures includes the order wire pair be tested for:

- Message noise.
- Attenuation.

Enter the measurements on the T1 Acceptance Form (Form 90002529, see Exhibit 1, page 4).

NOTE: The order wire is to be arranged for the central office loop limits per GTE Engineering specifications.

5.14 AC Power Influence

The steps to determine AC power influence are charted on the next page. Refer to the Span Layout Record to determine office "A" and "B". Record the test results on:

- T1 Acceptance Form (Form 90002529, see Exhibit 1, page 4).
- GTE Span Design Record (or equivalent).

NOTE: When the cable span extends the full length in a conduit from office "A" to office "B":

- **Perform the tests to determine power influence using the full length of the order wire pair.**
- **Retest (only when the test fails) by opening the order wire at the loop continued around point.**

Avoid opening the seals on waterproof housings, except when necessary.

5.14 AC Power Influence, continued

AC Power Influence Check – Step-by-Step

1. Using a digital volt/ohm meter, check the cable pair for "foreign potential", i.e., the presence of voltage-to-ground of unknown origin.

   WARNING: Discontinue this test if the voltage (AC RMS) is 50 volts or more. Report the hazardous voltage levels to GTE Engineering.

2. Open the order wire cable pair at the repeater point where the DC simplex power feed loops around.

   NOTE: The pair is not considered open with the transmission bypass capacitor in the circuit because these tests will read through the capacitors.

3. Disconnect the order wire pair at each office.

4. Using a 100 ohm, 5% tolerance, 1/2 watt or greater resistor at office "A":

   - Connect one end of the resistor to the tip and ring conductors of the order wire pair that have been shorted together.
   - Connect the other end of the resistor to the local ground.

5. Measure and record AC voltage across the resistor.

6. Reverse the meter leads and verify the reading to be sure a foreign potential or meter problem does not exist.

7. The readings taken in steps five and six determine actions in step seven.

If Reading Is...	Then...
Under two volts RMS	The AC longitudinal influence is acceptable. Proceed to step eight.
Exceeds two volts RMS	Contact GTE Engineering.

8. Repeat Steps 3 through 7 at office "B".

5.15 Pattern Slip

The equipment required to perform the pattern slip test is the following:

- T-BERD 209" T-carrier analyzer (or its equivalent).
- Two WECO 310 ™ cables.

(A Telecommunications Techniques Corporation model PR-40 printer with cable (or its equivalent) is an optional piece of equipment for this test .)

NOTE: Pattern slip tests can only be performed with terminal equipment connected to the span under test. Therefore, this test must be performed only where terminal equipment is known/provided.

The result of the pattern slip test is displayed under the result '09 - SLIPS" when test is performed using a T-BERD 209 ™ T-carrier analyzer. (If other T-carrier analyzer is used, check manufacturer's manual for equivalent test set information.)

Controlled slip rate objective for digital networks is one (controlled) slip or less in five hours over an end-to-end connection. The test interval for a DS-1 span must be zero slips to meet this objective.

Set up the pattern slip test using the T-BERD 209 ™ T-carrier analyzer according to the steps listed in the following chart.

NOTE: Pattern slip test is not meaningful if the equipment on both ends (e.g., channel banks) is internally timed. This test is for loop timed and externally timed equipment only.

Setting Up Pattern Slip Test – Step-by-Step

1. Use one of the WECO 310'" cables to connect "Receive Input" port on the T-carrier analyzer to a T1 monitor jack.

2. Set the "Receive Input" switch on the T-carrier analyzer to "DSX-MON".

3. Use one of the WECO 310 ™ cables to connect 'T1 REF" port on the T-carrier analyzer to a T1 timing reference jack.

4. Select "T1" (unframed), T1 SLC, or T1 ESF (as required by the circuit) on the "MODE" switch of the T-carrier analyzer.

   NOTE: Check manufacturer's specifications to ensure acceptance of unframed data when this test involves a digital cross connect. (A digital cross connect system may not accept unframed data.) Disregard this test if unframed data is not accepted.

(continued)

WECO 310 is a trademark of AT&T Network Systems, Greensboro, North Carolina.

5.15 Pattern Slip, continued

Setting Up Pattern Slip Test - Step-by-Step
5. Select "QRSS" on the "Pattern" switch of the T-carrier analyzer. (The accepted standard for T1 testing is QRSS.)
6. Select either "INT" or "RECOVD" - as required by the circuit - on the "Timing" switch of the T-carrier analyzer. **NOTE: A connection to a digital cross connect system requires selecting " RECOVD".**
7. Select either "AMI" encoding or "B8ZS clear-channel" encoding - as required by the circuit - on the "Code" switch of the T-carrier analyzer.
8. Select the "SIG & TIME" category on the "Results I and II" switch of the T-carrier analyzer analyzer and scroll the "52 - TIMING SLIPS" result into either display window of the T-carrier analyzer.
9. If using the optional printer, select "TEST END", "2 HR", or "15 MIN" on the "Print Event" switch of the T-carrier analyzer to choose the print interval.
10. Select either "Timed Test" or Continuous" mode (as required) on the "Timed Test"/"Continuous" switch of the T-carrier analyzer. **NOTE: If "Timed Test" is chosen, use the "Time Set" and the "Results II" keys to set the test interval. Set test interval for 2 hours - with 0 slips as the objective.**
11. Check GTE Engineering/Manufacturer's specifications for acceptable pattern slip limits displayed on the test set's screen.

5.16 DSX Signal Level

The DSX signal level is tested with an oscilloscope or appropriate test set (T-Berd 209) to verify that the levels are correct to minimize crosstalk problems within an office.

To verify correct signal levels, connect the "OUT" jack of the DSX line side to an oscilloscope. The optimum signal level on the oscilloscope is:

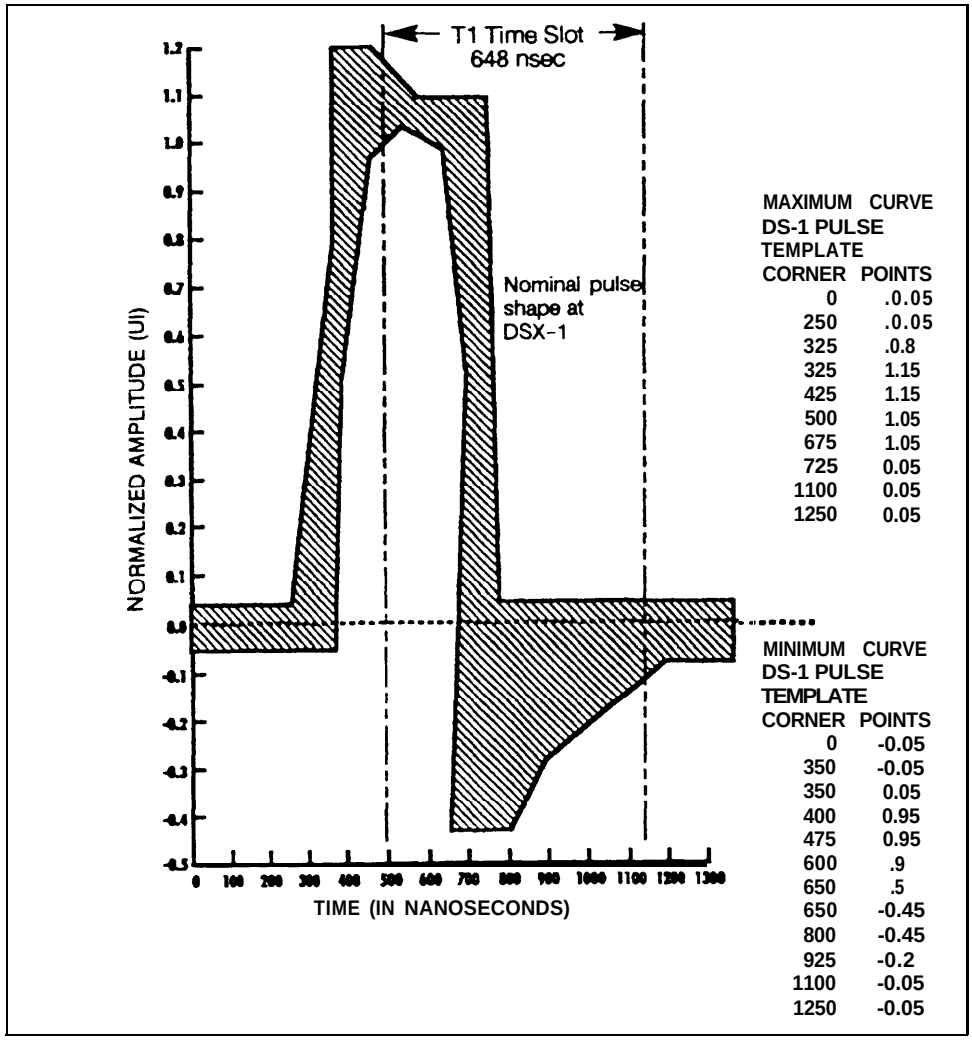
3.0 volts ± 0.6 base to peak at the "OUT" jack of the DSX.

5.17 Pulse Shape

The pulse shape of the DS-1 is to be analyzed. The pulse shape can be analyzed using a T-BERD 209 A ™ T-carrier analyzer (or its equivalent) or an oscilloscope using a 1: 1 test pattern.

An isolated pulse, both positive and inverted negative must:

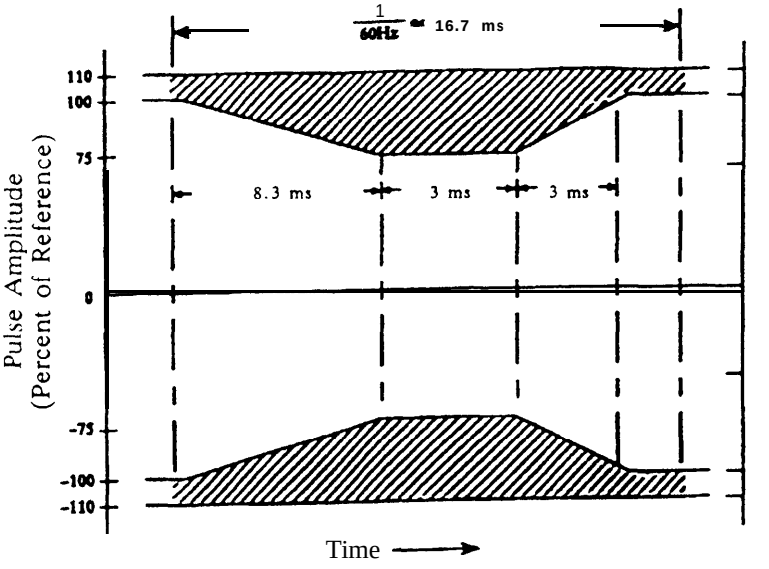
- Have an amplitude between 2.4 and 3.6 volts (measured at the center of the pulse).
- Fit the normalized template (illustrated below).



isolated Pulse Template at DSX-1 Interface

Pulse amplitude may vary at a 60 Hz rate because of 60 Hz longitudinal currents present in the powering loops of DS-1 line regenerators. In such cases, the envelope of the pulse amplitudes must be limited as illustrated on the following page (captioned “Pulse Amplitude Envelope with 60 Hz Longitudinal Currents). Any pulse amplitude in the range of 2.4 and 3.45 volts may be used as the 100% point. Use an oscilloscope to perform this test.

5.17
Pulse Shape, continued



NOTES:
(1) Envclopc of pulse amplitude must lie within the shaded area.
(2) Rcfercnce (100 percent point) may be any amplitude in the range of 2.4 to 3.45 volts.

Pulse Amplitude Envelope with 60 Hz Longitudinal Currents

The steps listed in the following chart describe how to set up the pulse shape test when using a T-BERD 209 A ™ T-carrier analyzer.

Setting Up Pulse Shape Test – Step-by-Step
1. Press the “Power” switch to apply power to the T-carrier analyzer.
2. Set the “Mode” switch on the T-carrier analyzer to the “AUX” position.
3. Use the “Pattern” switch on the T-carrier analyzer to scroll the “PLS MASK” auxiliary function into the “Results I” display on the T-carrier analyzer.
4. Use the “Results I” switch on the T-carrier analyzer to set the “PLS MASK” auxiliary function to “DSX”.
5. Use the “Pattern” switch on the T-carrier analyzer to select “AUTO” mode to automatically condition the receiver for the proper data format and data pattern (if data pattern display is present).
6. Set the “Receive Input” switch on the T-carrier analyzer to the “TERM” position.

(continued)

5.17 Pulse Shape, continued

Setting Up Pulse Shape Test – Step-by-Step

7. Connect the "Receive Input" jack on the test equipment to the DSX-OUT jack. (Use appropriate cable.)

   NOTE: If the line connection is made at non-isolated jack set the "Receive Input" switch to the "BRIDGE" position.

8. Connect the T-carrier analyzer using the appropriate cables.

After setting up the T-BERD 209 A" T-carrier analyzer for pulse shape testing the results of the test can be collected by proceeding according to the steps listed in the following chart.

Collecting Results Of Pulse Shape Test – Step-by-Step

1. Press the "Restart Switch" on the T-carrier analyzer to begin the pulse shape test.
2. Set the "Results I" switch on the T-carrier analyzer to the "SUMMARY" position.
3. Observe the display screen on the T-carrier analyzer for results of the test.

If...	Then...
If "PULSE SHAPE FAIL' does not appear in the display and the PULSE SHAPE alarm LED is not illuminated	The DS-1 pulse meets the DSX specification mask and the test is complete.
If "PULSE SHAPE FAIL' appears in the display and the PULSE SHAPE alarm LED is illuminated	The DS-1 pulse does not meet the DSX specification mask.

5.17 Pulse Shape, continued

NOTE: When the DS-1 pulse does not meet DSX specifications, set the "Results I" switch to "SIGNAL' and collect the key pulse shape measurements. The key pulse shape measurements and the display numbers for each measurement are:

- **Pulse width (45)**
- **Rise time (46)**
- **Fall time (47)**
- **Undershoot (48)**
- **Overshoot (49)**

If the Pulse Shape tests fail, refer to page 30, section 6, "Trouble Resolution", for trouble escalation procedures.

5.18 Spare Span Switching

If present, verify the automatic spare span switching priorities in the following order:

1. Digital Data Service (DDS).
2. Dedicated Special Service Systems.
3. Others as required.

Customer span(s) are placed on automated span switching only when:

- Reimbursed by the customer.
- It is part of a tariff offering.

Spare line transfer equipment must be tested after the terminal equipment has been connected to the span lines and the system alarms are normal. If required, detailed descriptions on performing these tests can be found in Lenkurt practice 342-91 O-l 03, titled "Carrier System GTE Lenkurt 91 - 9101C PCM Repeatered Line Equipment" or other manufacturer's documentation (e.g., Lynch, California Microwave, etc.)

Verify automatic spare span line transfer will occur at 10-6 error rate or lowest error rate available. Verify the system transfers to the spare line and terminal equipment remains out of alarm.

Upon successfully verifying the operation of the spare span line transfer, ensure that all systems are back on their normal spans and no alarms are indicated at either end of the systems under test.

Verify that a "keep alive signal" is present with the loss of input.

NOTE: A "keep alive signal" and how to verify it are explained in the manufacturer's documentation that is supplied with the system and listed as required. (See 4.1 "List of Preliminaries", page 10 of this practice.)

5.19 Test Monitor System

Conduct test(s) of the test and monitor system from remote location to ensure that the system can access, test, and monitor new and existing facilities, as required.

NOTE: Refer to monitor system manufacturer's operating guidelines to perform these tests.

5.20 Route Junction

A route junction is formed where lines from two or more systems enter a common sheath at different levels. All route junctions must be designated on the Span Design Record by GTE Engineering.

All levels at the route junction must be measured to ensure proper level coordination.

NOTE: If GTE Engineering determines span pads are required to maintain level coordination, proper grounds for these pads and proper placement must also be verified.

5.21 13OV Power Supplies

When 130V power supplies are equipped in the central office, the power supplies must be checked for both current and voltage values. If the limits and/or capacity are exceeded, notify Transmission Engineering immediately.

5.22 Line Loopbacks

Line loopbacks are used as maintenance tools primarily on high capacity special circuits. Where equipped, check to ensure proper operation.

The protocol used is:

1. Activate: A framed DS-1 signal consisting of repetitions of four "0s" followed by one "1 ", lasting for at least five seconds, with the framing bits overwriting the pattern.

2. Deactivate: A framed DS-1 signal consisting of repetitions of two "0s" followed by one "1 " lasting for at least five seconds, with the framing bits overwriting the pattern.

For ESF, the codes are as follows:

- Activate 0 000111 011111111
- Deactivate 0 011100 011111111

For AMI, the codes are as follows:

- Facility loop up (set) 11000
- Facility loop down (reset) 11100
- CSU loop up (set) 10000
- CSU loop down (reset) 100

NOTE: If the aforementioned code words do not activate and/or deactivate the loopback unit, refer to the operation manual from the manufacturer for the loopback unit. The manual contains activate and deactivate codes.

6. Trouble Resolution

6.1 Procedure

To resolve trouble, follow procedures in the chart below.

If...	Then...
Acceptance test measurement(s) exceeds GTE Engineering and/or manufacturer's specifications	End-to-end: • Ensure test equipment is operating properly. • Inspect all connections. • Troubleshoot DS-1 span.
The corrective measures fail, and the acceptance test measurements again exceed specifications	Notify local supervision.
Local supervision fail to resolve the problem	Local supervision notifies CRCC.
CRCC fails to resolve the problem	• CRCC notifies TSS and/or GTE Engineering. • Coordinates efforts with TSS and/or GTE Engineering to resolve problem.