J99403TA L2 TRANSPONDER
DESCRIPTION AND OPERATION
TRANSMISSION TEST EQUIPMENT

CONTENTS PAGE

1. GENERAL

1.01 This practice provides a description and an operation procedure for the J99403TA L2 transponder. The transponder is used with the D5 system controller to provision D5 channel units by measurement.

1.02 This practice is reissued to provide updated information on the transponder and to add information on in-band transponder detection. Revision arrows are used to identify the significant changes.

1.03 The transponder is used at the customer end of the metallic loop. It is controlled by commands received over the loop from the D5 system controller. The D5 system controller computes and inserts the best set of gain, equalization and, when applicable, balance values in the D5 channel units based on the results of the automated tests. All the transmit and receive operations in these tests are performed automatically by the automatic test unit (ATU) in the D5 system controller and by the transponder. The transponder is connected to the circuit at the customer location and activated. The results are displayed by its status indicators. The D5 system controller detects the presence of the transponder, directs the tests, and computes and sets the channel unit values. This method of provisioning takes less than 10 minutes and normally does not require the assistance of a technician at the office end. ▶All generic channel units except the 2W-0 can be provisioned using the transponder.◀

1.04 There are two exceptions for using the transponder to provision D5 circuits. One exception is when circuits contain external equipment that performs a 4-wire to 2-wire conversion. Some types of network channel terminating equipment (NCTE) and metallic facility terminal (MFT) units perform a 4-wire to 2-wire conversion. When these are used, the circuit cannot be transponder provisioned. Another exception to transponder provisioning is in some applications where a transponder is used to equalize a loop through a SLC® 96 carrier system. An example of this is a foreign exchange circuit consisting of a D5 2-wire FXS channel unit connected in tandem to a SLC 96 carrier system FXO to FXS circuit. In this application, the transponder is not capable of applying the proper signaling conditions to enable the transmission path through the entire SLC 96 carrier system/D5 circuit.

1.05 A transponder can be used in some applications to provision SLC 96 carrier terminal/D5 circuits. However, two requirements must be met. They are (1) transmission must be enabled through the circuit independent of signaling status, and (2) the SLC 96 and D5 channel units must all be either 4- or 2-wire. If they are mixed, a 4-wire to 2-wire conversion prohibits transponder provisioning. Also, if the transponder is used to equalize a loop through a SLC 96 carrier system, the provisioning can result in nonstandard carrier levels.

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1.06 ▶When a transponder is connected to a customer loop, its presence must be detected by the system controller before the provisioning operation can begin. In systems with generic 2.0 and earlier software, this is accomplished by detecting dc loop current. However, some loops do not pass dc current and, therefore, cannot permit detection unless a MEASURE command is entered into the D5 system controller after the transponder is connected to the customer loop.

1.07 A new optional feature, in-band transponder detection, is available on systems with generic 2.1 or later software. With this feature, the system controller can detect the presence of a transponder by its ac alerting tones. This eliminates the need for the MEASURE command on loops that cannot pass dc current.

1.08 The in-band transponder detection feature is implemented by installing an in-band transponder detector (ITD) circuit pack (AEK15) into slot L of the D5 banks and provisioning the D5 banks for the ITD using the INSTALL command. If the ITD feature is not used on systems with generic 2.1 or later software or if the systems have software earlier than generic 2.1, the dc loop current detection method is used and when applicable, the MEASURE command.◀

1.09 ▶Without the ITD feature, two D5 channel units, the 4W-0 and 4-wire SF, require a MEASURE command for transponder provisioning.◀ Also, a MEASURE command is required when network channel terminating equipment (NCTE) is used at the customer location. The MEASURE command must be entered into the D5 system controller either at the central office or at the network terminal equipment center (NTEC) after the transponder is connected and energized at the customer location.

1.10 Provisioning with the transponder is intended for use when prescription values loaded into the channel unit are to be improved to obtain the optimum working values for a circuit. Prescription values and the transmission level points at the customer equipment are entered into the D5 system controller by a PROVISION command from an input/output terminal before the transponder is connected. The prescription values can be entered either locally (at the central office) or remotely (at the NTEC location). The prescription values must be entered into the D5 system and the channel unit must be in place before transponder provisioning can be accomplished. The WORD document will specify the prescription values and whether the transponder provisioning process (M=T) is to be performed.

1.11 The transponder options that appear in channel unit provisioning dialogues where applicable are M=P or T; TZ=600, 900, or 1200; TLPA=−25.5 to 25.5; and TLPZ=−25.5 to 25.5. The M=P or T option determines whether a transponder will be used for final provisioning. Enter M=P if a transponder will not be used. Enter T if a transponder will be used. When T is selected, the channel unit cannot be put into service until transponder provisioning is successfully executed. The TZ option is the impedance of the circuit at the customer's location where the transponder will be connected — 600, 900, or 1200 ohms. ▶For 2-wire units, the TZ will be 600 or 900 ohms. For 4-wire units, the TZ will be 600 or 1200 ohms.◀ The TLPA option is the TLP level toward the central office at the customer's location where the transponder will be connected. The TLPZ option is the TLP level received from the central office at the customer's location where the transponder will be connected. ▶Since most TLP values are negative, an unsigned number is assumed by D5 to be negative. If a positive TLP value for A or Z is required, a "+" sign must be entered before the value. For a negative TLP value, enter the value with no sign.

1.12 For generic 2.1 and later software, the ADJUST command allows an added choice for the provisioning mode (M) option. In addition to adjusting from M=P to M=T and vice-versa, the ADJUST command allows an M=R (repeat) choice. This allows a channel unit that has already been transponder provisioned, to be provisioned by the transponder again. Selecting M=R will change the state of the channel unit to OUT OF SERVICE AND PROVISIONED — AWAITING TRANSPONDER.◀

1.13 Data circuit levels are 13 dB lower than message circuit levels. ▶When the WORD document shows that data circuit levels are "OFFSET FROM TLP BY 13.0 dB", the value entered by the PROVISION command for transponder options TLPA and TLPZ must be 13 dB higher than the data circuit level. If this is not done, transponder settings for attenuators will be in error by 13 dB.◀

1.14 The transponder is designed for stable operation over a temperature range of −4°C to +49°C (26°F to 120°F) and with relative humidity from 5 to 95 percent. No periodic maintenance is required on the transponder.

2. PHYSICAL DESCRIPTION

2.01 The transponder is a portable test set which measures 4 inches, by 8 inches, by 13-1/4 inches with the lid closed and weighs approximately 10 pounds. The front panel, with switches and indicators, is shown in Fig. 1. The ac power and test cords are stored in the removable lid. The test set is powered from a commerical 60-Hz 110-Vac source or it can be powered by KS-23497 rechargeable battery pack. The battery pack will be available during the first quarter of 1988. The fuse for the powering circuit is mounted on the back of the transponder. Connection to the metallic pairs to be tested is made with test cords which have a 310 plug on one end and alligator clips on the other. Two 310 type jacks are provided on the transponder to allow test access to 4-wire and 2-wire circuits.

2.02 Table A lists the front panel switches and indicators and their functions. All indicators are long-life light emitting diodes (LEDs). Replacement of LEDs in the field is not recommended. Guidelines are given in the operating considerations portion of this document about using the test set if certain LEDs are not lighting.

3. FUNCTIONAL DESCRIPTION

3.01 The alligator clip ends of the test cord(s) are connected to the tip and ring leads of the customer loop at a distributing frame or other access point on the customer's premises. The connections must be made on the customer side of any network channel terminating equipment (such as amplifiers or equalizers) connected to the customer loop. The network channel terminating equipment must be adjusted prior to the use of the transponder. Customer equipment must be disconnected while using the transponder. Figure 2 shows the use of the transponder with the D5 system controller. Each loop is tested separately.

3.02 Communications between the D5 system controller and the transponder are audio tones sent over the loop. These tones contain the command and response information. Frequency shift keying (FSK) is used to send the binary-coded information of the commands and responses. Upon command, the transponder generates the test tones required by the D5 system controller to provision channel units by measurement.

3.03 The transponder provides loop current and the terminations required during testing. A switch on the transponder is set to the type of loop (2-wire or 4-wire). The termination impedance of the loop (600, 900, or 1200) is selected by received commands from the D5 system controller based on the TZ value entered during provisioning. For 2-wire loops, 600 or 900 ohms in series with 2.15 microfarad capacitance are used for balance tests and as a quiet termination. For 4-wire loops, 600 or 1200 ohm terminations are used. The transmit path gain and equalization are set based on tones sent by the transponder. The receive path gain and equalization are set based on tones sent by the system controller and looped back at the transponder.

3.04 ▶The D5 system controller recognizes the presence of the transponder by detecting the loop current or ac alerting tones if the ITD circuit pack is used.◀ Communications are then established by the FSK tones. Loop current is discontinued once FSK communications are established. If the automatic detection process fails repeated attempts, the NTEC or central office technician must initiate transponder provisioning by inputting a MEASURE command. ▶As explained earlier, this is necessary for a 4W-0 and 4-wire SF channel unit or when NCTE equipment is used at the customer location unless the bank is equipped with an ITD circuit pack.◀

4. OPERATION CONSIDERATIONS

4.01 When the power switch is operated, the transponder goes through a series of self tests. The self tests check the internal power supply voltages, the capability to generate and receive tones, and the capability to produce loop signaling states and loop terminations. The self tests take less than 5 seconds. ▶The transponder should not be connected to the loop during the self tests.◀ A PASS or FAIL indicator will light showing the results of the self tests. The LAMP TEST switch is used to check all the indicators.

4.02 Figure 3 shows the interaction between the D5 system controller and the transponder. The sequence and events are as follows.

4.03 When the SELF TEST PASS indicator is lighted and the START switch is depressed, the transponder applies loop closure, then source voltage and alerting tones to the loop. ▶The D5 system detects loop current or alerting tones.◀ When the transponder is detected by the system controller, data transmission begins using FSK tones. The system controller uses the

automatic test unit (ATU) to receive and send FSK tones. The transponder has a time-out interval of 4 minutes as the interval to receive this communication. If communications are not established, the TIME OUT indicator lights. However, the TIME OUT indication does not prevent subsequent initiation and transponder provisioning unless the connections to the loop are disconnected. If communications are established, the IN PROGRESS indicator lights and the measurement process begins. During this time, the transponder and system controller must communicate at least every 4 minutes. If communication is lost for over 4 minutes, both the TIME OUT and IN PROGRESS indicators will light. An initial time-out will occur if the channel unit has not been provisioned for use with the transponder — M=T, if the system controller is serving another transponder, or if the customer loop is faulty. A time-out with the IN PROGRESS indicator on will occur anytime communications are interrupted. Noisy or faulty transmission of either a command or a reply message will result in a retransmit request. The message will then be retransmitted three times. If unsuccessful, a time-out will occur.

4.04 ▶Upon completion of the provisioning tests, the D5 system controller calculates the proper channel unit coefficients and sends a status message to the transponder and to the input/output terminals at the central office and at the remote operations center. The status message will be SATISFACTORY, CONDITIONAL, or UNSATISFACTORY depending on the results of the provisioning tests. The D5 system controller determines the status by calculations based on certain criteria. In addition to the status message, a transponder provisioning report appears at the input/output terminals. The report contains the results of transponder provisioning listing the actual settings in the channel unit and any failed transponder provisioning tests (results out of the prescribed tolerances).◀

4.05 One criterion used is a comparison of the actual measured loss (AML) or final transponder settings to the expected measured loss (EML) or prescription settings. This compares the AML to EML attenuator and equalizer settings at 1 kHz. The tolerance for this comparison is entered into the system controller at the time of original installation by the CONFIGURE command. The parameter is called the T PROV LIMIT. If the provisioning results are within the T PROV LIMIT, a SATISFACTORY message is sent to the transponder, to the input/output terminal at the central office, and to the remote operations center. ▶If the tolerance is exceeded but within the channel unit adjustment range, and no other status calculations fail, either a SATISFACTORY (green lamp) or a CONDITIONAL (yellow lamp) status message will be sent. The status message choice is made by selecting one of the STATUS parameters (SATISFACTORY or CONDITIONAL) in the CONFIGURE command. Also, a message will appear at the input/output terminals showing the difference between the transponder provisioned attenuator and equalizer settings and the prescription provisioned settings.◀

4.06 In addition to the AML/EML comparison, the system controller performs other tests on a transponder-provisioned circuit that determines the SATISFACTORY or CONDITIONAL status. If all the tests result within the prescribed tolerances, a SATISFACTORY status is reported. ▶If any test fails (results out of the prescribed tolerance) the channel used is placed in-service but a CONDITIONAL status is reported.◀

4.07 ▶If there is an interruption or breakdown in system controller to transponder communication or if provisioning results are beyond the range of the channel unit or the automatic test unit (ATU), an UNSATISFACTORY status message is sent.◀ If UNSATISFACTORY, the channel unit status remains AWAITING TRANSPONDER and cannot be put into service unless the provisioning method is changed to prescription — M=P.

4.08 The tests and their tolerances are as follows:

(a) ***ATTENUATION DISTORTION MEASUREMENT:*** This test verifies that the 0 TLP level (within some acceptable tolerance) has been achieved at the upper and lower ends of the voiceband spectrum based on desired customer levels. ▶The channel unit transmit and receive attenuator settings are evaluated for a –0.5 dB to a +1.5 dB tolerance using a 403.2-Hz tone and for a –0.5 dB to a +2.25 dB using a 2822-Hz tone. The attenuation distortion measurement is not calculated for the 4W-0 function codes and the nonequalized single frequency function codes.◀

(b) ▶***BALANCE ERROR:*** This test is performed on 2-wire units.◀ It verifies adequate echo return loss in 2-wire channel units.

(c) ***TRANS-HYBRID LOSS:*** This test measures the hybrid loss of 2-wire channel units at the 403.2-Hz and 2822-Hz frequencies. If there is less than 10 dB of measured loss at either frequency, a CONDITIONAL status is reported.

▶(d) ***CHANNEL UNIT CROSSTALK:*** This test verifies that the input and output transmission levels do not exceed crosstalk limits. The input TLP level is −6.0 dB to +9.0 dB and the output TLP level is −9.0 dB to +6.0 dB. The crosstalk test is not calculated for 4W-0 function codes and the nonequalized single frequency function codes.◀

4.09 In addition, the provisioning process measures C-message idle channel noise. This test is performed on both 2- and 4-wire channel units at the digital carrier (transmit direction) side and the result is reported. No criterion is applied to this measurement; therefore, it has no bearing on the status messages.

5. OPERATION PROCEDURE

5.01 The following is a procedure to provision a D5 channel unit using the J99403TA, L2 transponder. The procedure for provisioning with the J99403TA, L1 transponder is contained in the Issue 1 April 1985 version of this document and in the D5 Digital Terminal System Generic 1.1 Software Task Oriented Practices (TOP) document, 365-190-000. Procedures for both transponder types (L1 and L2) are contained in the D5 Digital Terminal System Generic 2.0 Software Task Oriented Practices (TOP) document 365-190-002.

▶PROVISION CHANNEL UNIT USING J99403TA, L2 TRANSPONDER◀

STEP	PROCEDURE
1	***Caution: Connections between transponder and loop must be on customer side of any network channel terminating equipment (NCTE) such as amplifiers or equalizers connected to the customer loop. The transponder will not operate properly if connections are incorrect. If a 4W-0 or 4SF unit is to be provisioned or if NCTE is connected at customer location, a MEASURE command is necessary to initiate transponder provisioning ▶unless in-band transponder detector (AEK15) circuit pack is installed in slot L of the D5 bank being provisioned.◀***
	Note: Data circuit levels are 13 dB lower than message circuit levels. If provisioning a data circuit, the value entered by the PROVISION command for TLPA and TLPZ must be +13 dB higher than message circuit level. If this was not done during prescription provisioning, transponder settings for channel unit attenuators will be in error by 13 dB.
2	Open transponder and remove cords from lid.
3	Connect power cord to P5 jack on back of transponder and to a standard 110 volt ac outlet. If using KS-23497 battery pack, connect to J1 and depress battery pack POWER switch to ON position.
4	***Note:*** When transponder POWER ON switch is depressed for power on, transponder will go through a series of self tests for approximately 5 seconds. Depress transponder POWER ON switch, wait 5 seconds, and depress LAMP TEST switch.
5	Does PASS lamp light in approximately 5 seconds and do all lamps light when LAMP TEST is depressed? IF YES, then proceed to Step 7. If NO, then continue with Step 6.
6	Check power connections and if applicable, battery pack. If necessary, obtain another transponder and repeat from Step 2.
7	Are you going to connect to a 2-wire or a 4-wire circuit?

STEP	PROCEDURE
	If 2-WIRE, then continue with Step 8.
	If 4-WIRE, then proceed to Step 9.
8	Set 2W-4W switch to 2W. Connect one test cord to T/R jack of transponder. Connect other end of cord to customer loop at distribution frame or other access point as follows: black clip lead to T and red clip lead to R. Proceed to Step 10.
9	Set 2W-4W switch to 4W. Connect both test cords to transponder — one to T/R jack and other to T1/R1 jack. Connect other end of cords to customer loop at distribution frame or other access point as follows: cord from T/R jack — black clip lead to T1 and red clip lead to R1; cord from T1/R1 jack — black clip lead to T and red clip lead to R.
10	Verify customer equipment is disconnected.
11	Is unit to be provisioned either a 4W-0 or 4SF, or is NCTE connected at customer location?
	If YES, then proceed to Step 12.
	If NO, then continue with Step 13.
12	Is in-band transponder detector installed in slot L of D5 bank being provisioned?
	If YES, then continue with Step 13.
	If NO, then proceed to Step 18.
13	***Note:*** When START switch is depressed, transponder will look for communications signal from system controller. If no signal is received within 4 minutes, TIME OUT lamp will light. When signal is received, IN PROGRESS lamp will light and START lamp will extinguish.
	Depress START switch.
	Response: Lamp lighted on START switch.
14	Which lamp lights, TIME OUT or IN PROGRESS?
	If TIME OUT lights, then continue with Step 15.
	If IN PROGRESS lights, then proceed to Step 24.
15	Verify that connections to customer loop are correct. Refer to previous steps for connection of 2-wire or 4-wire circuits. Check for T/R reversal on 2-wire circuits or for pair reversal of T/R and T1/R1 on 4-wire circuits. Also, verify that 2W or 4W switch is in correct position and that all cross-connections are made.
16	***Note:*** Depressing START switch resets the transponder from a TIME OUT status for another provisioning operation attempt.
	Depress START switch.
17	Which lamp lights — TIME OUT or IN PROGRESS?

STEP	PROCEDURE
	If TIME OUT lights, then proceed to Step 32.
	If IN PROGRESS lights, then proceed to Step 24.
18	Depress START switch on transponder. Contact central office or SCC/NTEC. Have them enter a MEASURE command for channel unit you are provisioning. Make sure that at least 10 seconds have elapsed between depressing START switch and entering MEASURE command.
19	Ignore TIME OUT lamp. Does IN PROGRESS lamp light within 60 seconds after MEASURE command is entered?
	If YES, then proceed to Step 24.
	If NO, then continue with Step 20.
20	Verify connections to customer loop are correct. Check for T/R reversal on 2-wire circuits or for pair reversal of T/R and T1/R1 on 4-wire circuits. Also verify that 2W or 4W switch is in correct position, that NCTE is working properly, and that all cross-connections are made.
21	Depress START switch.
22	Wait approximately 10 seconds and have MEASURE command reentered.
23	Does IN PROGRESS lamp light within 60 seconds after MEASURE command is entered?
	If YES, then continue with Step 24.
	If NO, then proceed to Step 32.
24	Does one of the status lamps (SATISFACTORY, CONDITIONAL, or UNSATISFACTORY) light within 7 minutes?
	If YES, then proceed to Step 30.
	If NO, then continue with Step 25.
25	Depress START switch.
26	Is 4W-0 or 4SF unit being provisioned or is NCTE connected at customer location?
	If YES, then continue with Step 27.
	If NO, then proceed to Step 28.
27	Wait approximately 10 seconds and have MEASURE command reentered if applicable.
28	◗Which lamp lights, TIME OUT or IN PROGRESS?

STEP	PROCEDURE
	If IN PROGRESS, then continue with Step 29.
	If TIME OUT, then proceed to Step 32.
29	Does one of the status lamps (SATISFACTORY, CONDITIONAL, or UNCONDITIONAL) light within 7 minutes?
	If YES, then continue with Step 30.
	If NO, then proceed to Step 32.
30	Which status lamp lights?
	If SATISFACTORY or CONDITIONAL, then continue with Step 31.
	If UNSATISFACTORY, then proceed to Step 32.
31	Remove test connections from customer loop as channel unit is properly provisioned. Completion status is automatically reported by D5 controller to central office and SCC/NTEC. If the CONDITIONAL status lamp lights, follow local procedures for corrective action. Proceed to Step 33.
32	Remove test connections from customer loop as channel unit cannot be provisioned with transponder at this time. Some causes of this can be faulty customer loop, D5 controller busy provisioning another circuit, NCTE incompatible with this process, or faulty transponder.
33	Depress POWER switch.
	Response: All lamps extinguish.
34	Are other circuits to be provisioned with transponder at this time?
	If YES, then repeat from Step 4.
	If NO, then continue with Step 35.
35	Disconnect test cords and power cord from transponder. Store test and ac cords in transponder lid.
36	Secure lid to transponder.
	STOP: YOU HAVE COMPLETED THIS PROCEDURE.

6. REFERENCES

6.01 Additional description and operation information on the D5 system using the transponder is contained in the following practices.

PRACTICE	SUBJECT
365-190-000	D5 Digital Terminal System—Generic 1.1 Software—Task Oriented Practices (TOP)
▶365-190-000	D5 Digital Terminal System—Generic 1.2 Software—Task Oriented Practices (TOP)—Addendum Issue 1A◀
365-190-002	D5 Digital Terminal System—Generic 2.0 Software—Task Oriented Practices (TOP) Issue 1
▶365-190-002	D5 Digital Terminal System—Generic 2.1 Software—Task Oriented Practices (TOP)—Issue 2◀
365-190-100	D5 Digital Terminal System Description
855-351-120	D5 Channel Units Application Engineering—Carrier Engineering

7. FEDERAL COMMUNICATIONS COMMISSION (FCC) REQUIREMENTS

7.01 The Federal Communications Commission (FCC) has established rules which permit this device to be directly connected to the telephone network.

7.02 If this device is malfunctioning, it may also be causing harm to the telephone network. In this event, this device should be disconnected until the source of the problem can be determined and until repair has been made.

8. CLASS A COMPUTING DEVICE INFORMATION TO USER

8.01 This equipment generates, uses, and can radiate radio frequency energy. If it is not connected and used in accordance with this AT&T Practice, it may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of the FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential environment is likely to cause interference, in which case, the user at his own expense, will be required to take whatever measures necessary to correct the interference.

9. SERVICE REQUIREMENTS

9.01 In the event of equipment malfunction, all repairs should be performed by our Company or an authorized agent. It is the responsibility of users requiring service to report the need for service to our Company or to one of our authorized agents. Service can be obtained at:

AT&T Network Systems
3300 Lexington Road
Winston-Salem, NC 27102

10. ISSUING ORGANIZATION

Published by
The AT&T Documentation Management Organization

TABLE A
FRONT PANEL SWITCHES AND INDICATORS

SWITCH/INDICATOR	FUNCTION
POWER ON Switch	Applies power to transponder.
POWER ON Indicator	Shows adequate output in powering circuit self-check. This light will extinguish if adequate power is not present.
2W and 4W Switch	Selects interface to match type of customer loop.
LAMP TEST Switch	Lights all indicators when depressed.
START Switch	Initiates transponder communication with D5 controller.
IN PROGRESS Indicator	Shows that communication between transponder and controller has occurred within 4-minute timeout interval.
TIME OUT Indicator	Shows that no communication between transponder and controller has occurred within 4-minute timeout interval or that communications were lost during provisioning after 4 minutes.
SELF TEST; PASS and FAIL Indicators	Show results of transponder self-tests.
SATISFACTORY Indicator	Shows that provisioning has been successfully completed within prescribed tolerances.
CONDITIONAL Indicator	Shows that provisioning has been completed within channel unit adjustment range but outside of prescribed tolerances.
UNSATISFACTORY Indicator	Shows that provisioning could not be completed within channel unit adjustment range and process has been aborted.

RUN 3 SLOP FREQ. TEST ON CKT

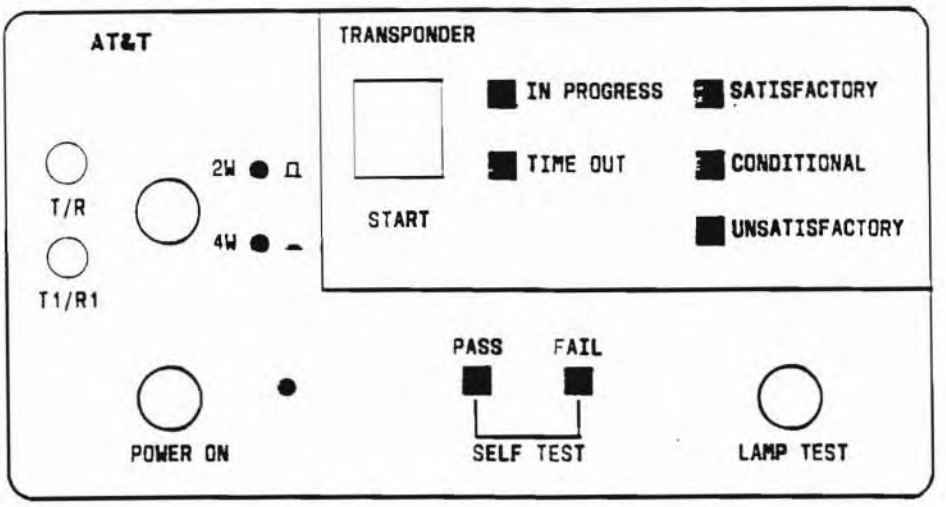

Fig. 1—J99403TA Transponder

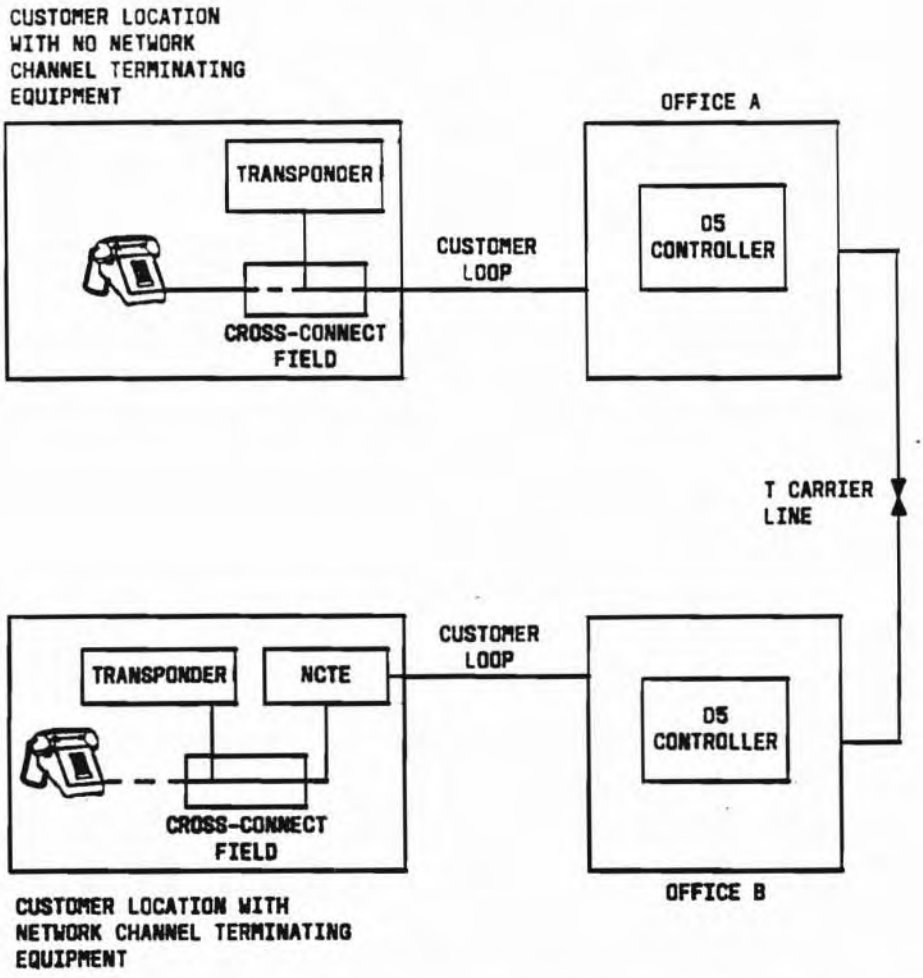

Fig. 2—Circuit Provisioning With Transponder and D5 Controller

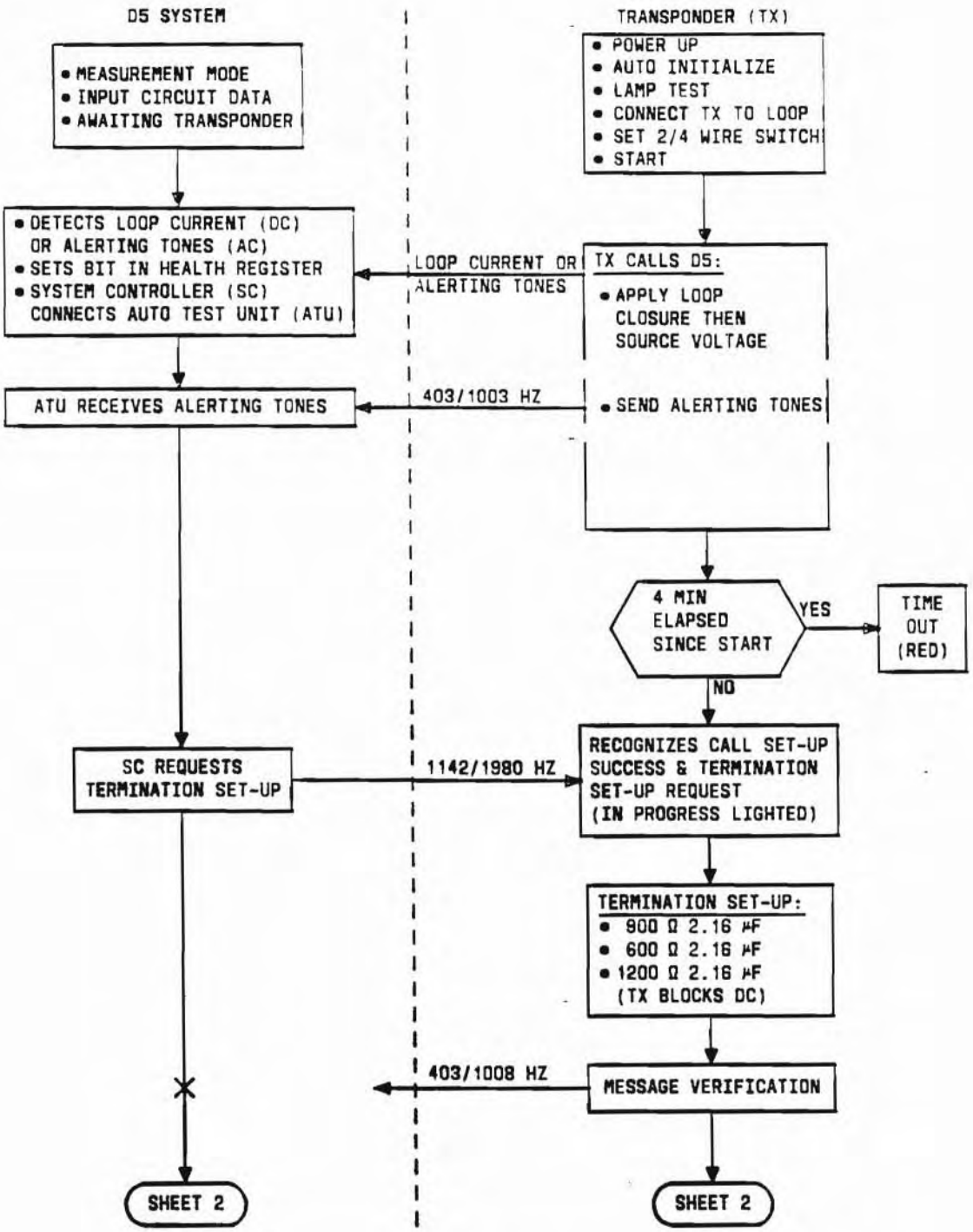

Fig. 3—D5 Controller/Transponder Interaction (Sheet 1 of 3)

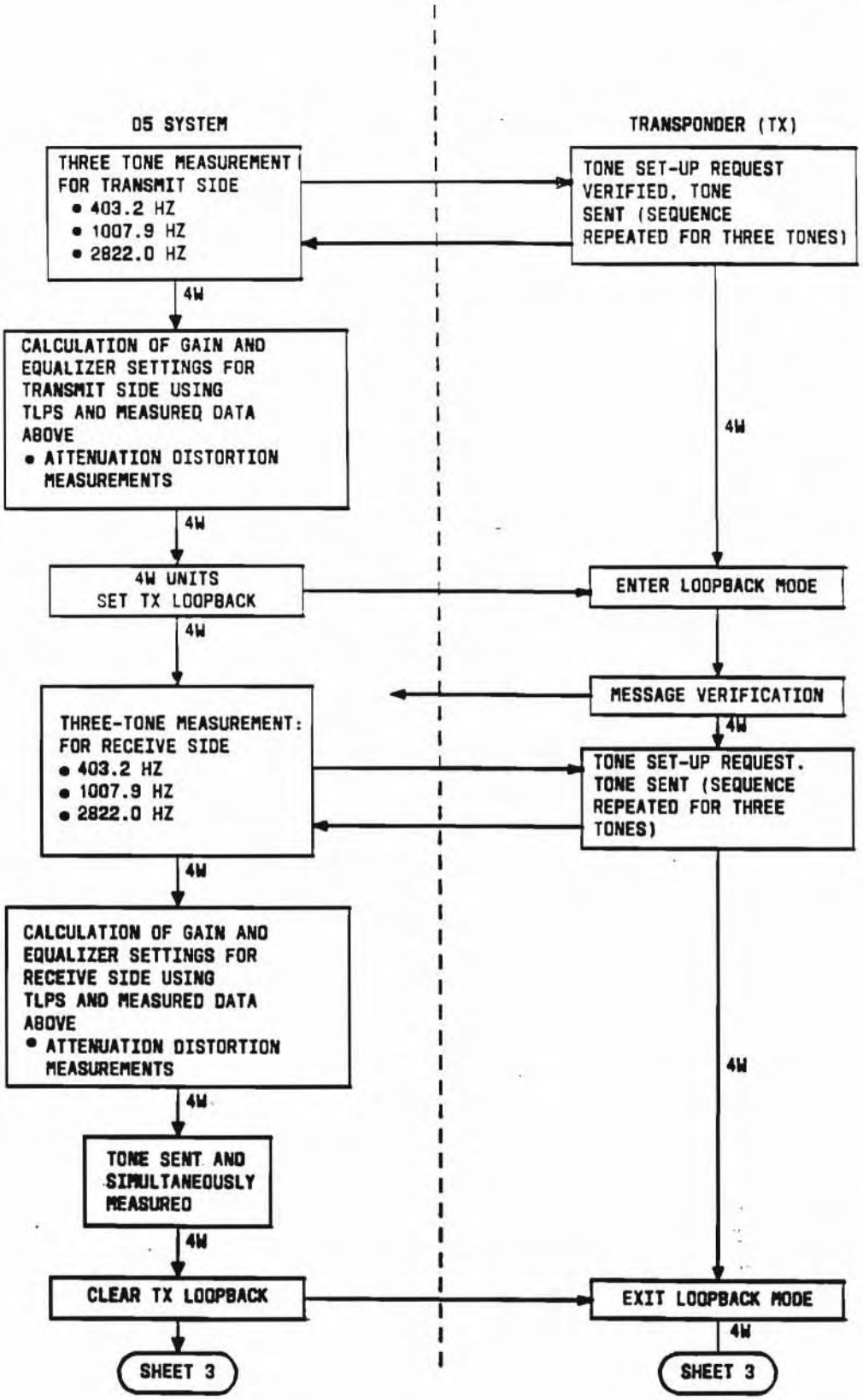

Fig. 3—D5 Controller/Transponder Interaction (Sheet 2 of 3)

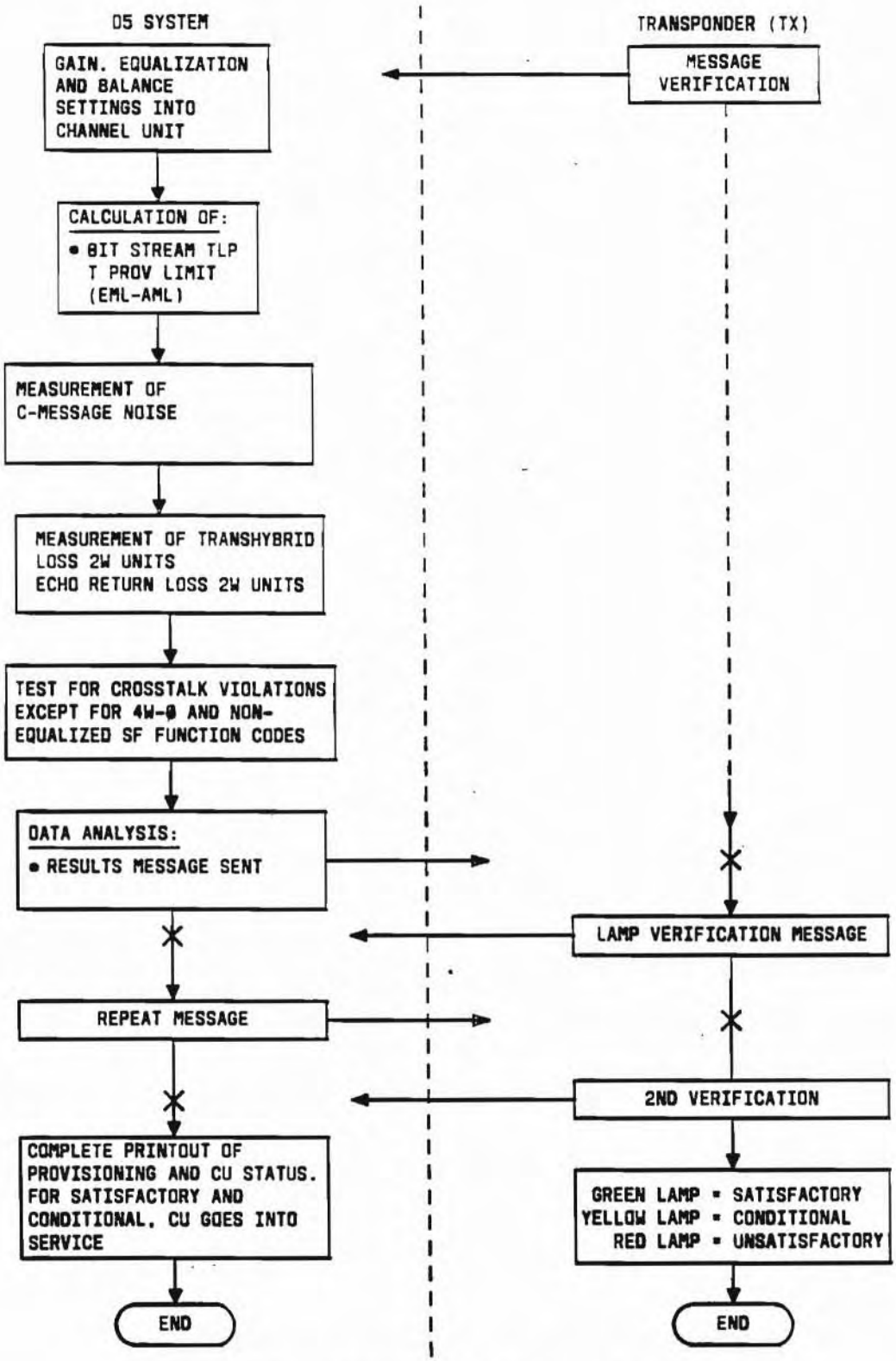

Fig. 3—D5 Controller/Transponder Interaction (Sheet 3 of 3)