N3 CARRIER TELEPHONE SYSTEM
TERMINAL EQUIPMENT
MAINTENANCE CONSIDERATIONS

CONTENTS PAGE

1. GENERAL

1.01 This section describes the testing considerations involved in maintaining an N3 carrier terminal. Similar information for the N3 carrier-frequency supply is covered in 362-901-500.

1.02 This section is revised to make additions to Tables A and B (shaded areas) and to include new information. Arrows indicate additions in the section. This reissue does not affect Equipment Test Lists

2. TESTING CONSIDERATIONS

A. Test Requirements

2.01 In most cases, the test requirements specified in the associated Plant Series maintenance sections are given in actual scale readings on a specified meter. Any corrections necessitated by the use of a meter calibrated for a circuit impedance other than that being measured have been included in the requirements. For this reason, meters other than those specified should not be used unless it is certain that equivalent results can be obtained.

2.02 In some instances, a correction must be applied to level measurements because of a deviation in repeater (or group amplifier) input or output impedance. Where such correction must be applied, attention is called to it in the appropriate section.

2.03 In some tests, requirements are expressed in dBm. A test-tone level expressed in dBm means that the power of the test tone at the circuit point concerned is so many decibels greater or less than a reference power of 1 milliwatt (0 dBm). For example, a signal level expressed as −20 dBm is a power 20 dB less than 1 milliwatt. Similarly, a signal level 20 dB greater than 1 milliwatt is expressed as +20 dBm.

2.04 If a requirement is given as a meter reading in dB (decibels) and not dBm (decibels with respect to 1 milliwatt), it is an indication that the requirement is simply a relative reading on the meter and does not specify an actual amount of power.

B. Precautions

2.05 ***Switching Group and Power Units from Service:*** Except for cases of complete circuit failure, group units are removed from service for

maintenance and alternate units are inserted with the N3 switching set without removing the system from service. It is important to remember that when an N3 carrier group unit is switched from service, a change of levels will result (1 dB for about 7 milliseconds) which may affect any telegraph, telephoto, or other data circuits that have been assigned to the system. For this reason, a group unit should be switched only when requirements listed in the sections have been met or in cases of emergency. A group unit should not be switched from service before the office responsible for the system has been notified. The N3 plug-in power supply unit can be switched with the same switching set used for group units.

2.06 ***Terminating High-Frequency Lines:*** When an N3 carrier system is lined up initially, the transmitted individual channel carrier measurements are made with the transmitting group unit output terminated in 125 ohms (by means of a span pad of 10 dB or greater loss in the line terminating unit) before the repeaters in the system have been activated. At no time should an N carrier high-frequency line be left unterminated (transmitted carriers removed) for an extended period of time unless the repeaters in the system have been deactivated. The N carrier repeaters will regulate to top gain if the individual channel carriers are not present on the line. As a result, crosstalk or noise may be induced into other carrier systems in the cable. This is of particular importance when N carrier systems are working in K carrier cables.

C. Test Jack Color Scheme

2.07 The following color scheme has been standardized for all N3 plug-in units using the KS-14523 and KS-19427 pin jacks, respectively.

JACK COLOR	USE
White	Miscellaneous and Output
Red	130 Volts
Black	Ground
Brown	Transistor Base
Green	Input or Transistor Emitter
Orange	—21 or —48 Volts
Blue	Transistor Collector

3. PLUG-IN UNITS

A. Placement of Plug-In Units

3.01 Align the plug-in unit with the cast guides at the module position in the N3 bay. Slide the unit into the position until contact is made; then manipulate the unit to ensure that the 20-pin connector and jack assembly properly correspond. Cautiously, push the unit forward to complete connection. If difficulty arises, check for a damaged pin connector which must be replaced.

3.02 Plug-in units are locked into place by a latch. Care should be taken to ensure that the latch locks in place when a unit is inserted into the terminal mounting. When a unit is to be removed, the latch must be pulled down to release the unit before it is pulled out.

3.03 Stampings on the front of the mounting shelves indicate the positions of the various plug-in units.

3.04 ▶Initial installation of plug-in units dependent upon the common carrier supply is followed by removal of shorting straps and dummy load resistors. These options are used to terminate the carrier supply in partially equipped bays and for initial tests. Section 362-915-501 lists the terminal pairs at the output of the J99300E secondary distribution panel which contains these options. The new secondary distribution shelf (ED-3C172-30) does not contain shorting straps and dummy load resistors; these options are provided in the primary distribution panel. If an N3 terminal is taken out of service for an extended period of time and the plug-in units removed, the corresponding shorting straps and dummy load resistors should be replaced.

3.05 When an N carrier schedule A and B program terminal (J99333) is used in conjunction with an N3 terminal, four or five N3 message channels must be disabled to provide sufficient bandwidth for program channels. Also, tests may indicate the need to omit one or more N3 channels because of interference with pilot frequencies in K carrier systems operating in the same cable. To disable N3 channels, disconnect and tape the appropriate leads from the secondary carrier regulator terminal strip and place 135Ω resistors across these output terminals (option BB or B on SD-97188-01).

3.06 J99300AR, L1 channel-modem load units should occupy vacant channel modem positions in partially equipped N3 bays to maintain the impedance at the 12-channel combining multiple. Removal of several modem units substantially increases the impedance and voltage at the combining multiple which hinders line amplitude equalization. One resistor in the load unit replacing the channel filter of the modem unit connects to this multiple to restore the normal condition. The other two resistors of the load unit replace the modulator and demodulator circuits of the modem units. Removal of a single modem unit for maintenance is permissible and does not require the use of the modem load unit.◀

3.07 An alarm link unit (ED-97245-50 Group 1) is used in the alarm unit position when a channel group is unequipped or when the alarm and restoral unit is removed for maintenance.

B. Spare Plug-In Units

3.08 Spare plug-in units are required for proper maintenance of the N3 terminal. Table A is a list of spare plug-in units recommended for maintenance of N3 terminals. Use the appropriate column to determine the number of spare units required.

3.09 ▶To minimize deterioration of electrolytic capacitors in the spare J87245A −21 volt power supply, the spare unit should be rotated from stock and placed in service on a periodic basis (about 6 months). The operational power supply removed from service should then be stocked as the spare power supply.◀

4. TEST EQUIPMENT

A. Requirements

4.01 The test equipment listed in Table B is required for maintenance of terminals. The quantity of test equipment required is indicated by the number corresponding to the appropriate equipment and number of channel groups.

4.02 Test equipment listed in this section also includes equipment required to test and maintain the primary and secondary carrier-frequency supply.

4.03 The test equipment should be periodically calibrated in accordance with the sections covering their use.

4.04 Special consideration should be given to periodically calibrating the KS-15538, L4 carrier-frequency voltmeter (CFVM), using an external standard as described in Section 103-400-104. Lists 4, 5, and 5A meters should be given an operational calibration, using the internal injection oscillator, at frequent intervals while making tests.

4.05 The use of KS-14510, List 8 test probes with the KS-14510, List 1 or 5 volt-ohm-milliammeter (VOM) is recommended to prevent accidental shorting of the test point potential to chassis ground. Older KS-14510, List 2 test probes are vulnerable to this difficulty, particularly if the plastic tips are worn and chipped. Other features of the List 8 test probes are the diameter, which is more closely controlled, and the shorter length to minimize the possibility of breakage. Other cords, listed in this section, for pin jack measurements on the faceplates of N3 terminal units, are insulated against accidental shorting to chassis ground. The W2FP cord is used to replace the W2DW cord for making pin jack measurements with the Hewlett-Packard 400-type vacuum-tube voltmeter (VTVM).

B. N3 Terminal Test Stand

4.06 The J99300AW terminal test stand is provided for testing alarm, compandor, and modem units after they are removed from the junction mounting. The test stand is used during lineup to obtain access to test points in the alarm unit. The test points on the faceplates of the compandor and modem units permit normal maintenance measurements to be made without removing the units from the terminal mounting. However, test jacks are available on the test stand to permit troubleshooting tests to be performed on the alarm, compandor, and modem units. To use the test stand, remove the unit (compandor or modem) from the terminal mounting, and place it in the proper position in the test stand. Plug the appropriate connector assembly, P1 or P2, associated with the test stand into the jack from which the unit was removed. When an alarm unit is inserted in a test stand, the only connection to the terminal required is for dc power.

TABLE A

SPARE PLUG-IN UNITS FOR N3 TERMINALS

UNIT	NUMBER OF TERMINALS				NOTE
	1-49	50-99	100-299	300-599	
Transmitting Group	1	1	1	1	1
Receiving Group	1	1	1	1	1
J87245A Power Supply	1	1	1	1	–
J99300AA Compandor	4	4	4	4	–
J99300AD Channel Group Modem	2	2	2	2	2
J99300AS Frequency Correction	2	2	2	2	2
J99300AK Alarm and Restoral	1	1	1	1	–
J99300AT Line Terminating	1	1	1	1	–
J99300AP Combining and Switching	1	1	1	1	–
J99272AT Restoral Oscillator	1	1	1	1	–
ED-97245-( ), Group 1 Alarm Link	2	2	2	2	3
J99300AY, List 1 Channel Modem	1	1	1	1	–
654-Type Filters	12	12	12	12	4
J99300CA, List 1 Double Channel Regulator	1	1	1	1	–
659-Type Filters	6	6	6	6	5
Slope Equalizer	4	4	4	4	6
Span Pad	4	4	4	4	6

Notes:

1. The same type as used in the terminal.
2. One each of both types used in the terminal.
3. An alarm link unit is used to stop alarm indications caused by removal of the alarm and restoral unit.
4. One each of 654AA, AB, AC, AD, AE, AF, AG, AH, AJ, AK, AL, and AM.
5. One each of 659A, B, C, D, E, and F.
6. Two each of all types used in the terminal.

TABLE B

TYPE AND QUANTITY OF TEST EQUIPMENT RECOMMENDED FOR MAINTENANCE OF N3 TERMINALS

CODE NO.	EQUIPMENT	NUMBER OF CHANNEL GROUPS (12 CHANNELS)							
		1 to 24	25 to 49	50 to 99	100 to 199	200 to 299	300 to 399	400 to 499	500 to 599
ED-90595-70, G2	Table-Type Wagon	1	2	3	4	5	5	5	6
J94021A, or J94023A	Transmission Measuring Set or Centralized Transmission Measuring System	1	1	2	2	3	3	3	4
J87245A	N3 Power Supply (Note 1)	1	1	1	1	2	2	2	3
J94002J	Repeater Test Set	1	2	3	4	5	5	5	6
J94003 A,B, or C	Noise Measuring Set	1	1	1	1	2	2	2	3
J94006( )	Impulse Counter	1	1	1	1	2	2	2	3
J99300AF or AG	Transmitting Group Unit (Note 2)	1	1	1	1	2	2	2	3
J99300AH or AJ	Receiving Group Unit (Note 2)	1	1	1	1	2	2	2	3
J99300AU	N3 Switching Set	1	1	1	1	2	2	2	3
J99300AW	N3 Terminal Test Stand	1	1	2	2	3	3	3	4
KS-14510 List 1 or 5	Volt-Ohm-Milliammeter equipped with List 8 Test Probes	1	2	3	4	5	5	5	6
KS-19750, L2	N Line Deviation Test Set (used to check group equalizers)	1	1	1	1	1	1	1	1
KS-15538 List 4, List 5, or List 5A	Carrier-Frequency Voltmeter	1	1	1	2	2	2	2	3
KS-19353 or HP 200CD	Oscillator	1	1	1	1	1	1	1	1
HP 400L or H	Hewlett-Packard Vacuum-Tube Voltmeter	1	2	3	4	5	5	5	6
HP 5233A or HP 5532A	Hewlett-Packard Electronic Frequency Counter (Note 3)	1	1	2	2	3	3	3	4
HP 10110A	Hewlett-Packard Adapter (BNC to Banana-Plug Connector) (Note 3)	1	1	2	2	3	3	3	4

TABLE B (Cont)

CODE NO.	EQUIPMENT	NUMBER OF CHANNEL GROUPS (12 CHANNELS)							
		1 to 24	25 to 49	50 to 99	100 to 199	200 to 299	300 to 399	400 to 499	500 to 599
HP AC60A or HP 11004A	Hewlett-Packard Line Matching Transformer (used with VTVM and Frequency Counter)	1	1	1	2	2	2	2	3
49F (or 38F, MD)	10-dB Span Pads	1	1	2	2	2	3	3	3
165C (or 258C, MD)	Dummy Plugs (used with N3 test stand)	2	2	4	4	6	6	6	8
262B	600-Ohm Plugs	2	4	6	8	10	10	10	12
377A to G	Slope Equalizers (Note 4) (1 per group unit)	2	2	2	2	4	4	4	6
1W13A	Cords equipped with P36A918 Cord Tips (used with 2J and Switching Set)	2	2	2	2	4	4	4	6
3P6	Cords (used with TMS)	2	4	6	8	10	10	10	12
3P17	Cords (used with TMS)	2	4	6	8	10	10	10	12
P2DR	Cords (used with N3 Switching Set and VTVM)	1	1	2	2	3	3	3	4
P3AW	Cords (used with combining and switching unit and VTVM)	1	1	2	2	3	3	3	4
P5K (6 inches)	Cords (used with 2J test set)	1	2	3	4	5	5	5	6
P5K (12 feet)	Cords (used with CFVM)	1	1	2	2	2	2	2	2
W1AP	Cords (used with terminal test stand)	1	1	2	2	3	3	3	4
W2DW	Cords (used with VTVM)	1	2	3	4	5	5	5	6
W2FP	Cords (used with VTVM)	1	2	3	4	5	5	5	6
W2EB	Cords (used with 200CD osc.)	1	1	2	2	3	3	3	4
W1BC	Cords (used as shorting straps)	1	1	2	2	3	3	3	4
W1BB	Cords (used for Alarm + Restoral Unit)	1	1	2	2	3	3	3	4
P47R812	Tool, (removal tool for combining and switching unit plugs)	1	1	2	2	2	3	3	3

TABLE B (Cont)

CODE NO.	EQUIPMENT	NUMBER OF CHANNEL GROUPS (12 CHANNELS)							
		1 to 24	25 to 49	50 to 99	100 to 199	200 to 299	300 to 399	400 to 499	500 to 599
265C	Tool, (contact burnisher)	1	1	1	1	2	2	2	2
266C	Tool, (steel music wire)	1	1	1	1	2	2	2	2
52K	Telephone headset	1	2	3	4	5	5	5	6
145A	Resistor, 600 ohms, equipped with KS-19531 List 2 pin plugs	1	1	2	2	3	3	3	4
238A	Resistors, 300 ohms (Note 3)	1	1	2	2	3	3	3	4
238A	Resistors, 600 ohms	1	1	2	2	3	3	3	4
238A	Resistor, 1200 ohms	1	1	2	2	3	3	3	4
BA99300K102	Variable Resistor, 0-1000 Ohms	1	1	2	2	3	3	3	4
542D	3-μF Mylar Insulation Capacitor (200V), or equivalent, equipped with KS-19531, L1 probes, Lead length shall not exceed 6 inches	1	1	2	2	3	3	3	4

Notes:

1. A spare N3 power supply is used as a testing aid in conjunction with the N3 switching set.
2. One of each type of group unit used in the office is required per switching set and should be wired for switching set use.
3. Used for carrier frequency supply maintenance.
4. Each spare group unit should have the proper slope equalizer installed per circuit layout card.

5. ASSOCIATED FORMS

5.01 When the N line deviation test set is not available, form E-4558-7 can be used to compute slope, bulge, cubic and quartic distortions provided that all the line carriers (2 through 13) are present. If some of the line carriers are missing, form E-4558-6 can be used to determine slope distortion only. Refer to Section 362-400-510 for an explanation of these forms and sample calculations.

5.02 The following forms, Fig. 1 through 4, are used for bay and system designations.

SHELF NO._____

E SIG POS	E SIG UNIT	TERM	CHAN	CIRCUIT
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

E-4894 (1-65)

Fig. 1—Form E4894—E Signaling Information

TERMINAL _____

SYSTEM–

E-4895 (1-65)

Fig. 2—Form E4895—N3 Terminal System Information

TERMINAL _____	
POS	OPTION
LINE TERM	PADS IN_____ OUT_____
ALM & RSTL 1	
ALM & RSTL 2	
CGI F CORR	
CGI MOD	
__GRP RCVR	NET_____ ADJ_____
REG CH 1-2	
REG CH 3-4	
REG CH 5-6	
REG CH 7-8	
REG CH 9-10	
REG CH 11-12	E-4897 (7-64)

Fig. 3—Form E4897—Option Information

TERM CHAN. NO.	CG UNIT CODE J99300	CG CIRCUIT NUMBER
		E-5140 (1-65)

Fig. 4—Form E5140—Channel Information