

TYPE N2 CARRIER TELEPHONE SYSTEM
TERMINAL EQUIPMENT
MAINTENANCE CONSIDERATIONS

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1. GENERAL	
1.01 This section describes the testing considerations involved in maintaining an N2 carrier terminal.	
1.02 This section is reissued to show current test equipment requirements and to make other miscellaneous changes. Since this is a general revision, change arrows are not used. This reissue does not affect the Equipment Test List.	
2. TESTING CONSIDERATIONS	
A. Test Requirements	
2.01 In most cases the test requirements in related sections are given in actual scale	

readings on a specified meter. Any corrections due to using a meter calibrated for one impedance in a different impedance circuit 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 An exception to 2.01 is when a correction must be applied to level measurements because of a deviation in repeater (or group amplifier) input or output impedances. When such corrections must be applied, attention is called to it in the section.

2.03 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 voltage reading on the meter and does not specify an actual amount of power.

2.04 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.

B. Precautions

2.05 *Switching Units from Service:* Except for cases of complete circuit failure, group units are normally removed from service by one of the switching methods. It is important to remember that when an N2 carrier group unit is switched from service, a change of levels will result which may affect special service or data circuits which have been assigned to the system. For this reason, a group unit should not be switched except in cases of emergency, or when certain requirements listed in the sections have been met. A group unit should not be switched from service before the office responsible for the system has been notified.

2.06 Terminating High-Frequency Lines: When an N2 carrier system is given an initial lineup, 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 regulated N carrier repeaters will operate at top gain if the individual channel carriers are not present on the line. As a result, crosstalk or noise may develop in other carrier systems in the cable. This is of particular importance when N carrier and K carrier systems are working in the same cable.

C. Test Jack Color Scheme

2.07 The following color scheme has been standardized for all N2 terminal test jacks of the KS-14523 (pin jack) type.

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

3. PLUG-IN UNITS

A. Placement of Plug-in Units

3.01 The active components of N2 carrier systems are plug-in units. **Extreme care must be exercised when inserting the plug-in units into carrier terminal mountings to prevent damage to the jack and the hand-operated latch.** Before inserting the units, raise the latch on the faceplate;

then insert the unit. Feel for the proper positioning of the connector plug with its jack assembly; then firmly push the unit home. If more force than this seems to be required, remove the unit and examine the connector and jack assembly for bent or broken parts. After a unit has been inserted in the terminal mounting, the latch should be pushed down. This locks the unit in place and prevents loss of transmission due to a unit moving away from its terminal mounting connector. To remove a plug-in unit from the terminal mounting, the latch must be pulled up, then forward. This acts as a lever to pull the unit loose from its jack.

3.02 Each N2 terminal is shipped with an alarm test connector in the alarm unit jack (J26). This is a 530A plug with pins 19 and 20 strapped together. The connector must be removed before the alarm unit is installed. One of these 530A plugs can be used in testing the N2 switching set by removing the strap and connecting a 135-ohm resistor across pins 17 and 19.

3.03 Slots in the terminal mounting for the plug-in channel assemblies (compandor and modem units) are lettered from "A" to "M" (excluding the letter "I"). In the recommended arrangement, channel 13 occupies the slot labeled "A" and other channels from 2 to 12 are inserted progressively from "B" to "M". The exception will be where channel 1 is used in place of any one of the channels (2 to 13). In this case the channel 1 modem unit at both terminals will be inserted in place of the channel unit it is replacing. Since channel position A is monitored by the carrier group alarm circuit during the system restoral sequence, it is desirable to always use channel 13 in this position (channel 13 has a slightly poorer signal-to-noise ratio than the other channels).

3.04 Schedule C & D program channels are available in channels 3, 4, 5, 6, and 7; therefore, they will normally be placed in channel slots C, D, E, F, and G. If the N2WM-1 wideband modem is used, only channels 3 and 4 may be used for Schedule C & D program service.

3.05 The N2WM-1 wideband modem units are placed in the upper row of channel positions. The lower row of channels will normally be channels 13, 2, 3, 4, 12, and 1 in channel positions A through F, respectively.

B. Spare Plug-in Units

3.06 Spare plug-in units are required for proper maintenance of the N2 terminals. Table A gives a suggested list of spares for various numbers of N2 terminals. At least one spare signal receiver unit, VF amplifier unit, N2WM-1 wideband modem unit, and one C & D program compandor and modem unit should be provided if these are used.

TABLE A

UNIT	NO. OF TERMS.				NOTE
	1-49	50-99	100-299	300-599	
Transmitting group unit	2	3	4	5	1,2
Receiving group unit	2	3	4	5	1,2
Power supply unit	2	3	4	5	
Compandor	3	5	7	9	
Message Modem	3	5	7	9	
Line terminating unit	1	1	1	1	
Alarm unit	1	1	1	1	
Slope equalizer	4	6	8	10	1
Span pad	2	2	4	4	1
Alarm and Restoral Oscillator	1	1	1	1	3
Carrier Group Alarm Signal Receiver Unit	1	1	1	1	

Notes:

1. The same type as used in the terminal.
2. One each, wired for switching set use.
3. For office with packaged bays.

3.07 Spare power supply units should be activated for one hour every twelve months in the N2 switching set to maintain film formation in the electrolytic capacitors. Follow the procedures given in Section 362-802-510 except for the transfer operation.

C. Jack Repairs

3.08 Damaged individual jack terminals may be replaced without replacing the whole jack assembly. The jack assemblies can be made accessible by sliding the terminal mounting shelf out onto an ED-97124-50 maintenance support assembly. Another use of this support assembly is to permit inspection of the jack assembly terminals in case of a trouble condition which can not be remedied by normal routines. Check to see if any terminals have been loosened; this would be evidenced by the loosened terminals projecting out further than the other jack terminals. If a terminal is projecting out of line and the terminal and jack assemblies have not been damaged, push the terminal into place and bend the two terminal extensions (which fit onto the outside of the jack assembly block) in opposing directions. Care should be taken not to overbend the two extensions to avoid loss of freedom of the terminal to float into proper alignment with its mating terminal on the plug.

4. TEST EQUIPMENT**A. Requirements**

4.01 The tests described in related sections require the use of the test equipment listed below. The test equipment should be periodically calibrated in accordance with the Bell System Practices covering their use. The quantity of each type listed below is the minimum required per office for proper maintenance of N2 carrier terminals. The first two items (and some of the cords) are used exclusively for N2 carrier maintenance; the other items are also used for O, ON, N1, and N3 carrier maintenance.

4.02 Additional test equipment may be required as additional N2 terminals are installed. A second set of each of the items listed will probably be required after about one hundred terminals have been installed, and a third set will be required after about three hundred terminals have been installed.

1—N2 Switching Set (J99272U)

1—N2 Terminal Test Stand (J99272W or AH)
(see 4.06)

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- 1—KS-14510 Volt-Ohm-Milliammeter (VOM), or equivalent
- 1—KS-15538 Carrier Frequency Voltmeter (CFVM), List 4 or later, or equivalent
- 1—2J Repeater Test Set (J94002J)
- 1—Hewlett-Packard 400-Type Vacuum Tube Voltmeter (VTVM), or equivalent
- 1—3A Noise Measuring Set (NMS) (J94003A)
- 1—Transmission Measuring Set (TMS) (40B, 21A, or equivalent)
- 1—52K Head Telephone Set
- 1—Hewlett-Packard 200CD Oscillator equipped with HP AC-60A or HP 11004A Transformer (or equivalent) (for N2WM-1, only as a source of 30.6 kHz tone)
- 1—6A Impulse Counter (J94006A)
- 1—Hewlett-Packard 11004A or AC-60A Line Matching Transformer (LMT) (for use with 400-type VTVM)
- 1—265C Tool (contact burnisher)
- 1—266C Tool (steel music wire) (for testing fuse alarms)
- 1—38F Span Pad (10 dB) (to terminate the group transmitter)
- 2—364-Type Equalizers (one of each type for use in switching set group units)
- 2—KS-8585, List 9 Plugs (one wired for power alarm test, one for access to test jack pins)
- 2—262B Plugs (600-ohm termination)
- 2—258C Plugs (dummy plugs)
- 2—1W13A Cords equipped with P36A918 Tips (to connect the 2J set to the N2 switching set)
- 1—2W42A Cord (to connect the 200CD oscillator to the data patch panel, N2WM-1 only)
- 1—3P6 Cord (to patch test tone)
- 1—3P17 Cord (for 21A TMS)
- 1—P1M Cord (for temporary strap with pin tips)
- 1—P2DH Cord (to measure carrier power with CFVM or VTVM)
- 1—P4AN Cord, 6-inch version (used with 2J repeater test set to measure transmitting group unit output)
- 1—P4AN Cord, 12-foot version (used with CFVM to measure carrier power)
- 4—W1Y Cords (for temporary straps with alligator clips)
- 1—W2DW Cord, or equivalent (for use with the VTVM)
- 1—W2FP Cord, or equivalent (for use with the VTVM)
- 1—P2DS Cord (for use with 6A impulse counter)
- 1—P3BA Cord (for use with HP 11004A transformer and 400-type VTVM to measure total carrier power)

4.03 The N2 terminals have a minimum of adjustments of transmission levels. Because of this, greater accuracy is required of test instruments for N2 terminals as compared with N1 terminals. It is recommended that the Hewlett-Packard Model 400D or later model VTVM is used.

4.04 Special consideration should be given to periodically calibrating the KS-15538 CFVM, using an external source of power as described in the section covering its use. The CFVM should be given the local calibration, using the internal injection oscillator, at frequent intervals during the time the tests described in related practices are being performed.

4.05 The use of KS-14510, List 8 test leads with the KS-14510, List 1 or 5 VOM is recommended to prevent accidental shorting of the test point potential to chassis ground. Older KS-14510 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 (which minimizes the possibility of breakage). Other cords listed in this section for pin jack measurements on the faceplates of the terminal units are insulated against accidental shorting to chassis ground. The W2FP cord replaces the W2DW cord for making pin jack measurements with the VTVM.

B. N2 Terminal Test Stands

4.06 Two terminal test stands are available for use at the N2 terminals. The J99272W terminal test stand is provided for testing compandor, VF amplifier, modem, and J99272L alarm units. The J99272AH terminal test stand is provided for testing compandor, VF amplifier, modem, restoral oscillator, and J99272AW alarm units. The restoral oscillator and the J99272AW alarm units (used in the N2 packaged terminals) can be tested only in the J99272AH test stand. The J99272L (MD) and J99272BL may be tested in the J99272W test stand. Both test stands have similar circuits for testing the compandor, VF amplifier, and modem units except that a noise test feature and a modem loop-back feature have been added on the J99272AH test stand.

4.07 Normally, it will not be necessary to remove the compandor, VF amplifier, and modem

units from the terminal mounting during lineup unless patch bays or equivalent 4-wire VF jacks are not provided for the N2 channels. The test points on the faceplates of the compandor, VF amplifier, 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 stands to permit troubleshooting tests to be performed on these units. To use the test stand, remove the unit from the terminal mounting and place it in the proper position in the stand. Plug in the appropriate connector assembly associated with the test stand in the jack from which the unit was removed. The appropriate test stand must be used during lineup of the units for adjustment procedures.

5. ASSOCIATED FORMS

5.01 Form E-4965 (Fig. 1) is used for designating the system and channel assignments at the N2 terminal.

5.02 Form E-4962 is used for trouble analysis as covered in Section 362-800-010.

5.03 Form E-5274 (Fig. 1) designates a signaling unit associated with a channel and circuit. One form is required for each signaling shelf.

5.04 Form E-5275 (Fig. 1) designates channel units and channel positions. One form is required for each channel unit shelf.

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N 2 CARRIER TERMINAL	
SYSTEM _____	
TRANS. PR. _____	REC. PR. _____
CH 13	
CH 2	
CH 3	
CH 4	
CH 5	
CH 6	
CH 7	
CH 8	
CH 9	
CH 10	
CH 11	
CH 12	
CH 1	
PRINTED IN U.S.A. E-4965 (11-63)	

SHELF NO.				CIRCUIT
E SIG	U N I T	T E R M	C H P O S	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				E-5274

FORM - E-5274

TERMINAL		
C H P O S	UNIT CODE J99272	CIRCUIT
		E-5275

FORM - E-5275

Fig. 1—N2 Terminal Designations