

**TYPE N1 AND ON CARRIER REPEATERS — REPEATERED HIGH-FREQUENCY LINE
REPEATER TESTS
304-KHZ OSCILLATOR FREQUENCY MEASUREMENTS**

The purpose of this section is to provide test instructions to measure the frequency of the individual 304-kHz carrier oscillators in N1, ON, and N1A repeaters used for ON carrier systems.

These measurements are not required for routine maintenance. They are required for trouble locating purposes.

The N1 and N1A low-high (LH) and high-low (HL) line repeaters and ON terminal repeaters each contain a 304-kHz oscillator which is used to modulate incoming frequencies from low group to high group and vice versa. When these repeaters are used for ON carrier systems, the cumulative deviation of the repeater oscillators can cause the received line carrier frequency to be on the edge of the passband of the pick-off filter in the twin channel units. As a result, the line frequency variations which occur during the daily temperature cycle, cause the received carrier frequency signal to vary over a steep portion of the attenuation curve of the pick-off filter. This, in turn, causes wide variations in transmission level over the 24-hour period. The performance of N3 carrier systems is generally not degraded because of the line frequency correction feature of these systems. Also, N1 and N2 systems are generally not degraded because the bandpass filter characteristic is wide enough for both sidebands with the carrier located in the center. The frequency deviation requirements in this section are applied to three classes of repeaters:

- (a) N1 electron tube repeaters not modified for improved frequency deviation limits (see Table A).
- (b) N1A transistorized repeaters not modified for improved frequency deviation limits (see Table B).
- (c) N1 and N1A repeaters modified for improved frequency deviation limits. These repeaters are originally manufactured or modified at repair centers for the frequency deviation improvement (see Table C).

Oscillators need not be removed from service for this measurement.

APPARATUS:

- 1 — Hewlett-Packard Model 5232A or 5532A Electronic Counter or Equivalent
- 1 — Hewlett-Packard Adapter 10110A (BNC Connector to Banana Plug) or Equivalent
- 1 — W2DW Cord
- 1 — Pomona Electronics 2BC-60 Cord (Two Banana Plugs) or Equivalent
- 1 — N1A Repeater In-Service Adapter and Adapter Cord (May be made up locally as shown in Fig. 1)
- 1 — Cinch-Jones Type TR5-5015B Tube Shield or Equivalent (Modified as described in note below)

Note: The TR5-5015B tube shield is used as a coupling device to measure the frequency of the 304-kHz oscillator of N1 or ON repeaters. The TR5-5015B shield can fit tightly over the tube without touching the shield base on the tube socket; however, it is necessary to modify the shield by cutting approximately one-half inch off the bottom. The anodized surface at the top of the shield should be scraped to provide a good electrical contact for an alligator clip. Alternatively, a coupling device may be improvised by removing the normally-present SOS-3 tube shield from oscillator tube V40 and insulating the shield base on the tube socket with plastic tape or paper before reapplying the tube shield. Ensure that the tube shield does not cut through the insulation, since the shield must not be grounded. A simple substitute for either tube shield type is several turns of wire solder wrapped tightly around oscillator tube V40.

Caution: Be sure to remove insulating material after test is complete.

A. Check of N1 or ON Repeater 304-KHZ Oscillator Frequency

STEP	PROCEDURE
1	<p>Note: The 304-kHz carrier oscillator frequency for the N1 and ON repeaters can be measured by connecting the frequency counter leads between a tight fitting tube shield placed on the oscillator vacuum tube and ground.</p> <p>Remove the carrier oscillator tube shield from V40 of either the ON or N1 repeater. Establish test connections as described in the above note and Fig. 2.</p> <p>Note 1: The tube shield acts as a coupling device for the oscillator circuit and should not be allowed to come in contact with the chassis ground.</p> <p>Note 2: Energize the electronic counter and allow a 30-minute warmup period before performing tests. The electronic counter should be checked for maximum accuracy capabilities in accordance with the specifications of the manufacturer.</p>
2	<p>Use a gate time of one second and measure the oscillator frequency.</p> <p>Requirement: For repeaters listed in Table A from 50° F to 100° F, the frequency should be between 303.984 and 304.021 kHz. For repeaters listed in Table C from 50° F to 100° F, the frequency should be between 303.995 and 304.015 kHz. For temperatures above 100° F and below 50° F, see Fig. 3.</p> <p>Note: Generally the temperature of the crystal may be 15° to 20° higher than the ambient temperature of the area in which the tube type oscillator subassemblies are located. This may be used as a guide; however, a better estimate of the crystal temperature should be used if available.</p>
3	<p>If the requirement of Step 2 is not met, replace the repeater. Repeat the frequency measurement in Steps 1 and 2.</p> <p>Note: To avoid changing the equalized line characteristic, it may be desirable to replace only the oscillator subassembly of the repeater.</p>

B. Check of N1A Repeater 304-KHZ Oscillator Frequency

STEP	PROCEDURE
1	<p>Note: In the N1A repeater, bypass capacitor C46 in the emitter of the 304-kHz oscillator second amplifier is small enough so that a measurable 304-kHz oscillator voltage exists across this capacitor. It is possible to obtain a sample of this voltage by connecting the adapter unit (shown in Fig. 1) between contacts JC3 and JC5 of the test jack located on the front of the repeater. In making this test, the voltage is measured ungrounded. A grounded measurement may introduce stray components from various line carriers into the counter and make the frequency measurements inaccurate. It is also necessary that this test circuit be provided to eliminate any dc continuity between these points in order to avoid disturbing the bias conditions.</p> <p>Insert the adapter plug (shown in Fig. 1) into the repeater jack on the front of the repeater and establish the test connections as shown in Fig. 4.</p> <p>Note: Energize the electronic counter and allow a 30-minute warmup period before performing tests.</p>
2	<p>Use a gate time of one second and measure the oscillator frequency.</p> <p>Requirement: For repeaters listed in Table B from 50° F to 100° F, the frequency should be between 303.975 and 304.013 kHz. For repeaters listed in Table C from 50° F to 100° F, the frequency should be between 303.995 and 304.015 kHz. For temperatures above 100° F or below 50° F, see Fig. 3.</p> <p>Note: Generally, the temperature of the crystal may be approximately 10 degrees higher than the ambient temperature of the area in which the transistorized oscillator subassemblies are located. This may be used as a guide; however, a better estimate of the crystal temperature should be used if available.</p>
3	<p>If the requirement of Step 2 is not met, replace the repeater. Repeat the frequency measurement in Steps 1 and 2.</p> <p>Note: To avoid changing the equalized line characteristic, it may be desirable to replace only the oscillator subassembly of the repeater.</p>

TABLE A
CLASS I UNMODIFIED VACUUM
TUBE TYPE REPEATER

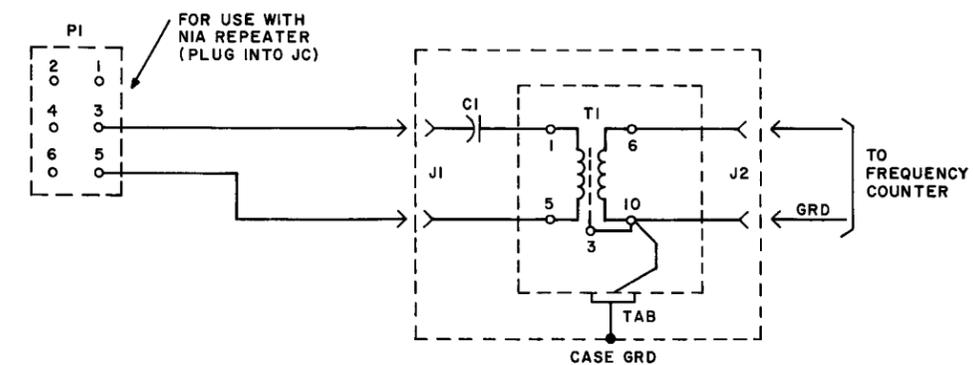
N1 REPEATERS
J98703L-1 L1 J98703LA-1 L1 and L2 J98703M-1 L1 J98703MA-1 L1
ON REPEATERS
J98706C-1 L1 J98706D-1 L1 J98706E-1 L1 J98706F-1 L1 J98706CA-1 L1, L2, and L4 J98706DA-1 L1, L2, and L4 J98706EA-1 L1 and L2 J98706FA-1 L1 and L2
OSCILLATOR SUBASSEMBLIES
ED-95073-30 G1 ED-95073-31 G1

TABLE B
CLASS II UNMODIFIED TRANSISTORIZED
REPEATERS

N1A REPEATERS
J98703LB-1 L1, L2, and L4 J98703MB-1 L1, L3, and L4
OSCILLATOR SUBASSEMBLIES
ED-95126-30 G1 ED-97226-30 G1, G2, and G3

TABLE C
CLASS III REPEATER IN WHICH
304-KHZ OSCILLATOR HAS BEEN MODIFIED FOR
IMPROVED FREQUENCY DEVIATION

N1 REPEATERS (REPAIRED UNITS)
J98703L-1 L2 J98703M-1 L2 J98703LA-1 L4 J98703MA-1 L2
N1 REPEATERS (NEW UNITS)
J98703LA-1 L5 J98703MA-1 L3
N1A REPEATERS (REPAIRED UNITS)
J98703LB-1 L6 and L7 J98703MB-1 L6, L7, and L8
N1A REPEATERS (NEW UNITS)
J98703LB-1 L8 J98703MB-1 L9 and L10
ON REPEATERS (REPAIRED UNITS)
J98706C-1 L4 J98706D-1 L4 J98706E-1 L3 J98706F-1 L3 J98706CA-1 L6 J98706DA-1 L6 J98706EA-1 L4 J98706FA-1 L4
ON REPEATERS (NEW UNITS)
J98706CA-1 L7 J98706DA-1 L7 J98706EA-1 L5 J98706FA-1 L5
OSCILLATOR SUBASSEMBLIES (REPAIRED UNITS)
ED-95073-30 G2 ED-95073-31 G2
OSCILLATOR SUBASSEMBLIES (NEW UNITS)
ED-95073-31 G3 ED-97229-30 G3 ED-97227-30 G3 ED-97228-30 G3 ED-97226-30 G8, G9, and G10



PART	DESCRIPTION
C1	CAPACITOR, 0.01 UF, 200 VDC (SUITABLE TYPE 542S).
J1, J2	JACK, PAIR, BANANA (5-WAY BINDING POSTS SPACED 3/4 INCH).
PI	PLUG, JONES P306CCT
T1	TRANSFORMER, 2591BP (500 TO 20,000 OHMS) BUD CU2101A MINIBOX OR EQUIVALENT.

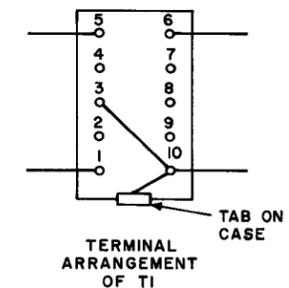


Fig. 1 — 304-KHZ Oscillator Frequency Measurement Adapter Unit for N1A Carrier Repeaters, Schematic

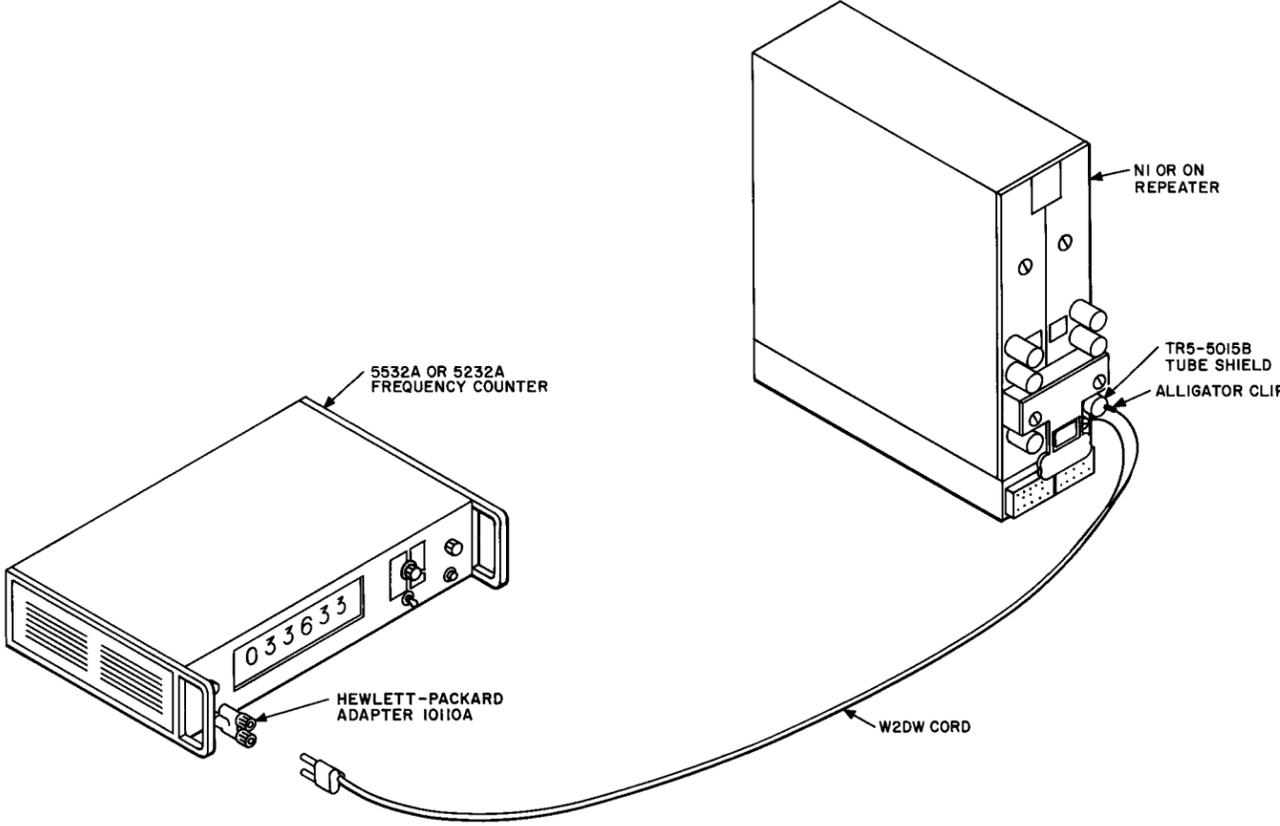


Fig. 2 — 304-KHZ Oscillator Frequency Measurement for N1 or ON Carrier Repeaters

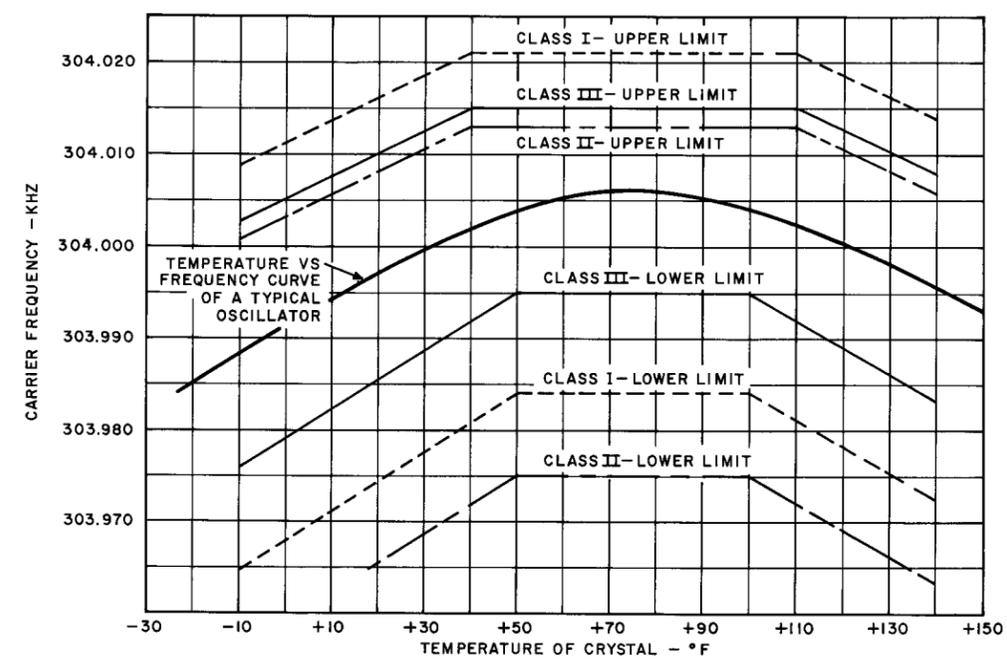


Fig. 3 — N1 and N1A Repeaters, Frequency Deviation Limits Versus Temperatures

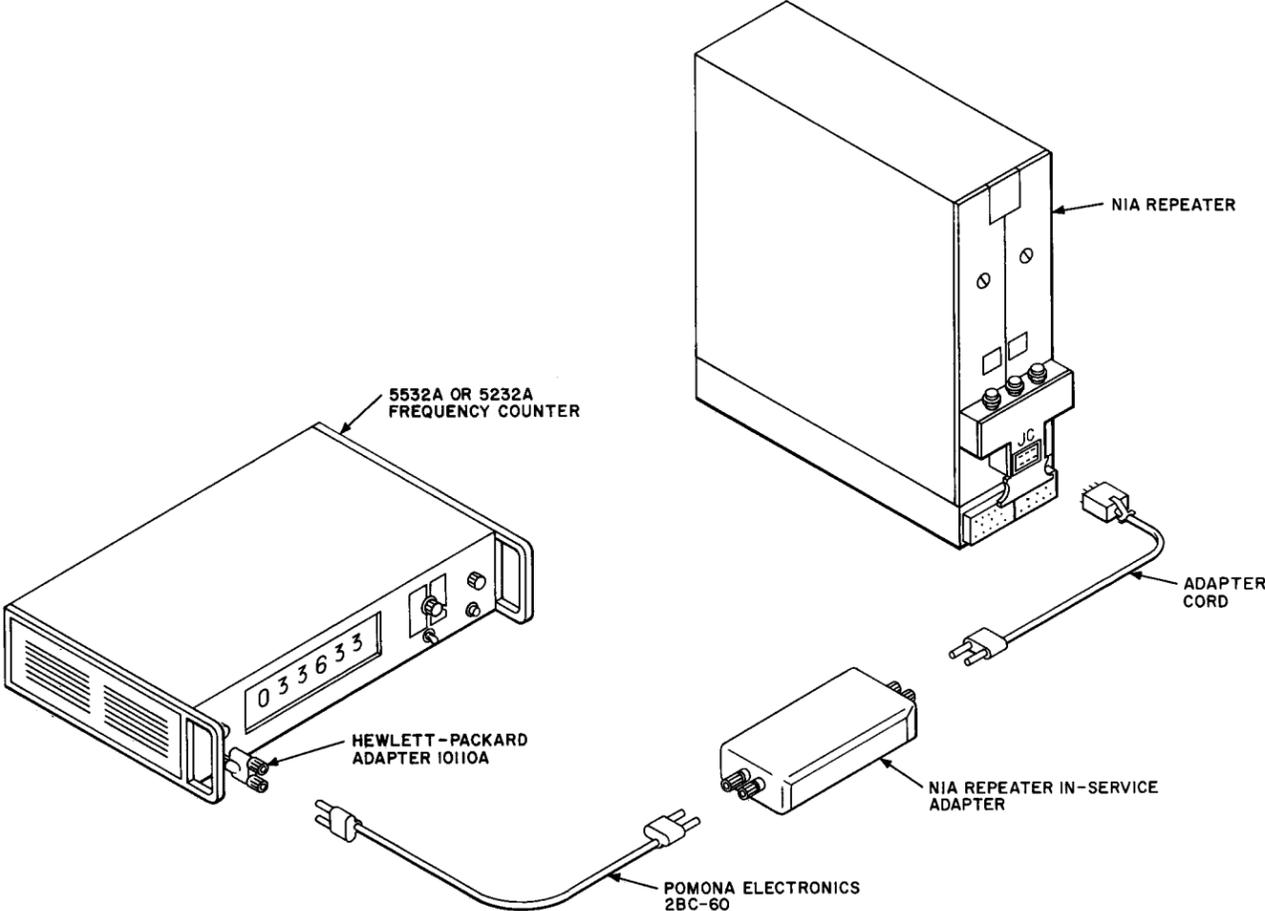


Fig. 4 — 304-KHZ Oscillator Frequency Measurement for NIA Carrier Repeaters