OVER-THE-HORIZON RADIO SYSTEM
ITTL 12A-1 OVER-THE-HORIZON RADIO SYSTEM
NUS 3298 RECEIVER
NUS 3360 LOCAL OSCILLATOR
TEST AND MAINTENANCE

This section contains the test and maintenance procedures for the NUS 3360 local oscillator. The tests of the NUS 3360 local oscillator are arranged in a sequence for minimum duplication of effort and should be performed in this order. When only a crystal or electron tube replacement is made and the equipment is known to be in good condition, it should be sufficient to perform only the alignment and frequency measurement tests.

The tests and adjustments described in this section require the system receivers to be operated in dual diversity with the receiver under test removed from service.

CHART **PAGE**

APPARATUS:

1—KS-15750-L1 Tube Tester

2—486A Jacks

1—Microwave Power Meter, Hewlett-Packard 430C

1—Thermistor Mount, Hewlett-Packard 477B

1—RF Attenuator, 10 dB, Microlab AE10N

1—Electronic Frequency Counter, Hewlett-Packard 5245L with Frequency Converter 5254B

1—Volt-Ohm-Milliammeter, KS-14510

1—Pomona Test Socket, 9 pin, type 1449

CHART 1

ELECTRON TUBE TESTS

Refer to Section 100-636-101 for instructions concerning the operation of the electron tube tests and for the tube tester chart.

Self-bias conditions are to be used where a choice of conditions is given on the tester chart. The tube tester self-bias resistor decade should be set to zero if fixed-bias conditions must be used.

STEP	PROCEDURE
1	Test electron tubes V1, V2, and V3 for transconductance, leakage, and evidence of gas. *Note:* The transconductance and cathode activity test requirements differ from those on the tube tester chart and are listed in Table A.
2	Test tube V4, Eimac type 3CX100A5, by measurement of power output as described in Chart 2, Alignment and Performance Tests.
3	Replace tubes failing any tests. Replacement of V1 must be followed by oscillator stage adjustments and frequency measurement described in Charts 2 and 3 of this section. Replacement of V2, V3, or V4 must be followed by the alignment and performance tests described in Chart 2.

TABLE A

ELECTRON TUBE TEST REQUIREMENTS

TUBE TYPE	REQUIREMENTS	
	MINIMUM INDICATED TRANSCONDUCTANCE	CATHODE ACTIVITY LIMIT
12AT7	3,100	15%
404A	9,400	15%

CHART 2

ALIGNMENT AND PERFORMANCE TESTS

The NUS 3360 local oscillator must be realigned following any change in crystal, electron tubes, or components. In order to maintain the required output power, subsequent alignment may be necessary to compensate for changes in characteristics of electron tubes.

CHART 2 (Cont)

The tuning controls on the local oscillator should operate without sticking or binding and meter indications should respond smoothly to the adjustment of controls. Erratic meter indications observed when adjusting the cavity controls indicate internal trouble in the cavities. Generally, this type of trouble can be corrected by cleaning and adjustment of cavity components or replacement of worn parts. Section 410-402-503 describes procedures for maintenance of similar microwave cavities.

It is prerequisite that the receiver power requirements in Section 403-413-501 be met.

STEP	PROCEDURE

Note: Each dual-diversity receiver is equipped with two NUS 3358 receiver control panels. In the performance of this test, functions of the upper control panel are used for the left local oscillator and those of the lower control panel are associated with the right local oscillator. Receiver control panel switch operations and meter readings should be made on the panel associated with the local oscillator under test.

1 On the local oscillator, operate the POWER control fully counterclockwise.

2 Remove the coaxial cables from the OUT jacks on both IF main amplifiers in the receiver under test. Terminate both cables using 486A jacks. Arrange the cables in a manner which prevents transposition.

3 On the receiver control panel associated with the local oscillator under test, operate the metering switch to TST B.

4 Using the appropriate left or right test cord in the receiver, perform the alignment adjustments outlined in Table B.

Note: Test results are indicated on the receiver control panel meter.

TABLE B

LOCAL OSCILLATOR ALIGNMENT PROCEDURE

TEST CORD POSITION	CONTROL DESIGNATION	OBJECTIVE
TP2B	L1	Approximately 80% of maximum meter indication on the least critical of two meter response slopes
TP3B	C16	Maximum meter indication
TP4B	C18	Maximum meter indication
TB5B	C21	Maximum meter indication

CHART 2 (Cont)

STEP	PROCEDURE
5	Replace the test cord probe in its storage jack.
6	On the receiver control panel, operate the metering switch to CONVR CR 1.
7	On the local oscillator, adjust the POWER control slowly clockwise until a control panel meter deflection is perceptible. ***Note:*** If no indication of output power is obtainable, proceed with Step 10.
8	On the control panel, operate the metering switch alternately to CR1 and CR2. Place the switch at the position of greater value meter indication.
9	Adjust the oscillator CAVITY TUNE and LOOP ADJ controls for a maximum meter indication while limiting the power output to half-scale meter deflection by operation of the oscillator POWER control. ***Note:*** Obtainment of half-scale meter deflection is indication of satisfactory local oscillator power output. The angular position of the POWER control in respect to its fully clockwise position is a measure of reserve power available. If it is desired to improve this reserve, or, if the requirement is met, make the oscillator power adjustment described in Step 21.
10	On the local oscillator, adjust the POWER control fully counterclockwise and adjust the CAVITY TUNE control to the micrometer setting for the receiver frequency. This number can be obtained from Fig. 1.
11	Set up test equipment as shown in Fig. 2.
12	Set controls on 430C power meter as follows:

CONTROL	POSITION
BIAS CURRENT	OFF
POWER	ON
COEF	NEG
RES	200
POWER RANGE	1 MW
ZERO SET COARSE	Maximum counterclockwise
ZERO SET FINE	Midrange

13	On the 430C power meter, rotate the BIAS CURRENT switch clockwise, one step at a time, until a positive power meter indication is obtained.
14	Adjust the ZERO SET COARSE control to obtain a power meter indication of 0 milliwatts.
15	On the local oscillator, adjust the POWER control fully clockwise.

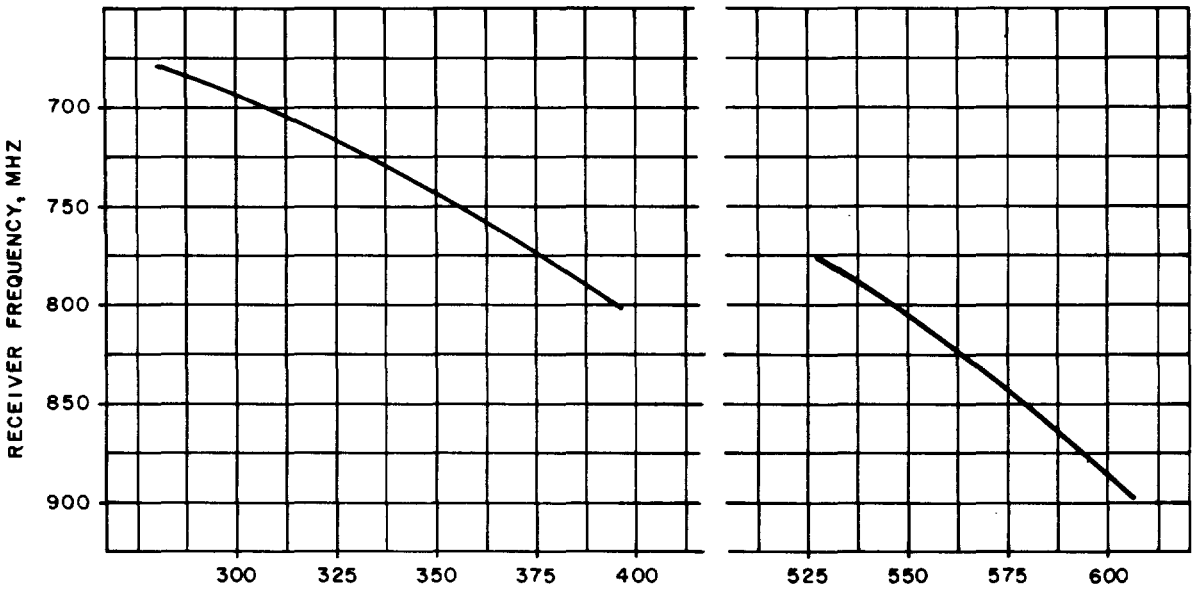

Fig. 1—Output Cavity—Tuning Control Setting

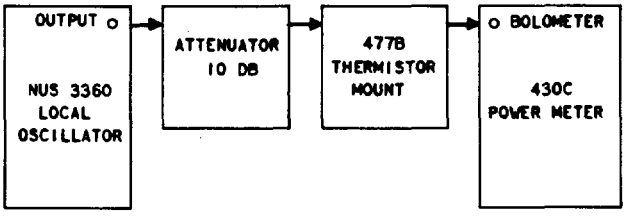

Fig. 2—Local Oscillator Output Power Measurement—Test Setup Diagram

CHART 2 (Cont)

STEP	PROCEDURE
16	Adjust the CAVITY TUNE and LOOP ADJ controls for a maximum power meter indication. ***Requirement:*** The power meter indication should be 0.6 milliwatts or more. ***Note 1:*** This represents a power output of 6 milliwatts or more, reduced by the 10 dB attenuator used at the thermistor mount. ***Note 2:*** If the requirement is met, proceed to Step 18; if the requirement is not met, perform Step 17.

CHART 2 (Cont)

STEP	PROCEDURE
17	Replace tube V4 and adjust C21, the CAVITY TUNE, and LOOP ADJ controls for a maximum power meter indication.
18	On the local oscillator, adjust the POWER control fully counterclockwise.
19	Reconnect the cable normally used at the oscillator OUTPUT jack J2.
20	On the local oscillator, adjust the POWER control to obtain a receiver control panel meter indication of 1.0 on the lower meter scale.
21	On the receiver control panel, operate the metering switch alternately to CR1 and CR2 while observing the meter. Make the minor adjustment necessary on the oscillator POWER control to obtain an average meter indication of 1.0. ***Requirement:*** The difference between the crystal currents indicated on the control panel meter should not exceed 0.25 milliamperes. ***Note:*** An unbalance exceeding the requirement is indication of a defective mixer crystal in the receiver mixer-IF preamplifier.
22	Perform the local oscillator frequency measurement test described in Chart 3 of this section.

CHART 3

LOCAL OSCILLATOR FREQUENCY MEASUREMENT AND ADJUSTMENT

Each local oscillator operates at an output frequency which differs from the received signal frequency by 70 MHz. This frequency is designated "oscillator frequency" and should be posted on the receiver.

It is essential that both local oscillators within a receiver be adjusted to close agreement in frequency in order to be in the range of automatic phase control. The adjustments of the oscillators to meet the requirements of these instructions will result in a proper receiver phase-lock condition.

CHART 3 (Cont)

STEP	PROCEDURE

1 On the electronic counter, make the following control adjustments:

CONTROL	POSITION
SAMPLE RATE	Midrange
SIGNAL UNIT	AC—PLUG IN
TIME BASE	1 ms
STORAGE	OFF
FUNCTION	FREQUENCY

2 Make the test connection shown in Fig. 3. Connect to the E13 coupler located at the ***upper*** local oscillator OUTPUT jack.

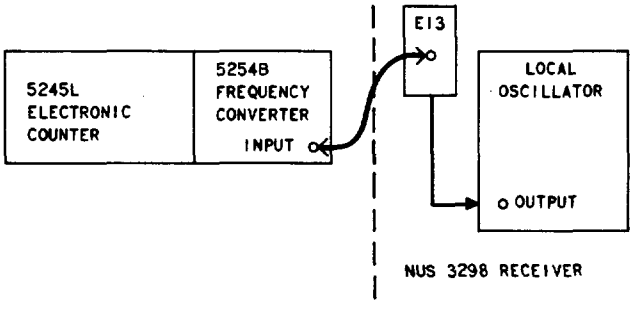

Fig. 3—Local Oscillator Frequency Measurement—Test Setup Diagram

3 Verify that the coaxial cables normally connected to the OUT jacks on both IF main amplifiers have been disconnected and terminated in 486A jacks.

4 On the electronic counter frequency converter, adjust the dial to the first multiple of .05 GHz below the oscillator frequency. Make a minor adjustment of the dial to obtain a maximum frequency converter meter indication.

5 Compute the oscillator frequency in kHz by adding the counter display to the product of the converter dial number and 1,000,000 .

Requirement: The measured oscillator frequency is within 5 kHz of the posted oscillator frequency.

Note: If the requirement is not met, adjust control L1 on the local oscillator to obtain a counter indication equal to the posted oscillator frequency.

CHART 3 (Cont)

STEP	PROCEDURE
6	Remove the test equipment connection from the upper E13 coupler and connect to the lower E13 coupler.
7	Measure and if necessary adjust the frequency of the lower local oscillator by repeating Step 5.
8	Dismantle the test setup and reconnect the cables normally used at the OUT jacks of the IF main amplifiers.

CHART 4

VOLTAGE AND RESISTANCE MEASUREMENTS

This chart includes voltage and resistance values that are useful as reference in trouble locating tests on the NUS 3360 local oscillator.

STEP	PROCEDURE
	Test Point Measurements
1	On the receiver control panel associated with the local oscillator under test, operate the metering switch to TST B. Using the appropriate left or right test cord in the receiver, measure the voltages at the oscillator test points listed in Table C. If measurements are made in the order given, trouble usually will be located in the stage associated with the first test point producing an abnormal meter indication.
	Voltage Measurements
	Note: The use of test adapters or test leads affects the operation of the local oscillator to the extent that some test meter indications obtained in this manner would be of little significance. Useful measurements are listed in Table D.
2	On the receiver alarm and power distribution panel, operate the HIGH VOLTAGE switch to the OFF position.
3	Remove the tube from the stage under test. Insert the tube in a test adapter and insert the adapter in the tube socket.
4	Operate the HIGH VOLTAGE switch to the ON position.
5	Make the voltage measurements at test adapter as listed in Table D.
	Note: Facing the equipment, the test terminals are numbered in counterclockwise order.

TABLE C

TEST POINT MEASUREMENTS

TEST POINT	CIRCUIT MEASURED	TYPICAL METER INDICATION (see Note)
TP1B	V1A cathode	0.65
TP2B	V1B cathode	0.60
TP3B	V2 cathode	1.2
TP4B	V3 cathode	0.5
TP5B	V4 cathode	1.2

Note: Actual voltage is double the value of the lower scale meter indication.

TABLE D

TUBE SOCKET VOLTAGE MEASUREMENTS

TUBE SOCKET	TUBE SOCKET TERMINAL				
	1	4	6	8	9
	NORMAL VOLTAGE				
V1	105		105		−6.0
V2		2.2	145	145	−6.0
V3		1.0	200	200	−6.0

CHART 4 (Cont)

STEP	PROCEDURE
6	With care, measure the voltage at the plate radiator of tube V4. ***Requirement:*** Approximately 160 volts.
	Resistance Measurements
7	Disconnect the power plug from jack J3 on the local oscillator.

CHART 4 (Cont)

STEP	PROCEDURE
8	Remove tubes as required to make resistance measurements between tube socket terminals and ground. Table E lists nominal resistance values as measured from the tube socket terminals to chassis ground. *Note:* Facing the equipment, socket terminals are numbered in counterclockwise order.

TABLE E

TUBE SOCKET TERMINAL RESISTANCE VALUES

TUBE SOCKET	TUBE SOCKET TERMINAL								
	1	2	3	4	5	6	7	8	9
	OHMS								
V1	68.5K	100K	470	24	0	68.5K	inf	470	inf
V2	100K	0	0	330	0	inf	0	inf	28
V3	100K	0	0	330	0	inf	0	inf	28
V4	Plate radiator to ground measures infinity.								

9	Dismantle the test setup; replace the tubes; reconnect the cables and equipment to normal.