PERFORMANCE REQUIREMENTS
TYPE TE-A1 RADIO AMPLIFIER
GENERAL EQUIPMENT REQUIREMENTS
RADIO SYSTEMS

1. GENERAL

1.01 This section covers the performance requirements which TE-A1 Radio Amplifiers installed by the Western Electric Company shall meet before turnover to the Telephone Company. It is expected that the tests will be made by the Telephone Company.

1.02 It is expected that these tests will ordinarily be made under conditions of complete installation in a TE system.

1.03 Reference shall be made to Section 800-630-180 covering General Requirements and Definitions for additional information necessary for the proper application of the requirements. Reference should be made to Section R10.284 covering maintenance methods for identification of tuning adjustments.

1.04 ***Test Equipment***

The requirements are based on the use of the following test equipment and tools or equivalent:

1—J64071A—71A Frequency Power Meter

1—Model 260 Voltohmmeter—Simpson Electric, or Weston Model 779 Voltohmmeter

1—Wave guide Spacer ED-63543-90, Group 33

1—Tube Wrench P-257207

1—Tuning Wrench P-257211

1—Tuning Wrench to fit 1/4 inch Allen head screw.

(Allen "Handi-Hex" Key—1/8" diameter, Catalog No. 607)

1—Screwdriver to fit No. 6 Phillips head screw. (Stanley screwdriver size No. 1, 3-inch blade)

1—R2262 open end wrench

1—Cabinet screwdriver with 3/16" blade

2. REQUIREMENTS

2.01 ***Preliminary Check:*** Before starting test, a check shall be made that all the vacuum tubes and relays are installed in their sockets and that the ground is connected.

A. AC Power Tests

2.02 ***115 Volt Circuits:*** Close the 115V AC circuit breaker S51. Turn the PLATE SUPPLY switch S52 to OFF.

Requirements: The 115V SUPPLY lamp LP51 shall light; relay K55 shall operate causing AIR SUPPLY lamp LP52 to light; an ohmmeter circuit connected to terminals 1 and 2 of TS53 shall be opened. The air gauge shall register between 4.5 and 13 inches of water. A small amount of air should be escaping from the three small holes on the right-hand side of each amplifier cavity. To determine whether air is flowing in the cavities, wet the fingers and hold them in front of the three air vent holes. It should be possible to feel air exhausting through these holes.

2.03 ***Safety Switch:*** Remove the cover plate of the Power Supply and Control Panel, thus opening the safety switch S55.

Requirements: The 115V SUPPLY lamp LP51 shall be extinguished and all other indications of power shall stop. The ohmmeter circuit through terminals 1 and 2 of TS53

shall close with a maximum resistance of 2 ohms.

2.04 ***Filament Voltage:*** Close the 115V AC circuit breaker S51 and turn the PLATE SUPPLY switch S52 to OFF. Remove the cover on the rear of the cavity amplifier assembly thus exposing the terminals of the multi-circuit jack through which power is supplied to the amplifier tube. To remove the cover it is necessary to remove the multi-circuit plug. Replace the multi-circuit plug and measure the a-c voltage between terminals 1 and 2 of the jack.

Caution: Unless PLATE SUPPLY switch is OFF dangerous voltage is thus exposed. Care should be exercised to avoid harm to personnel or to equipment. After this test is completed remount the cover on the rear of the cavity amplifier assembly.

Requirement: The voltage measured at the plug of each amplifier should be 6.3 $\pm$.5 volts.

2.05 ***Time Delay Relay Circuit:*** Open the 115V AC circuit breaker S51 and replace the cover plate of the Power Supply and Control Panel. After a period of at least five minutes, close the 115V AC circuit breaker S51 and turn the PLATE SUPPLY switch to ON.

Requirement: After a time delay of between 40 and 80 seconds the relay K53 shall operate. When this occurs, relay K54 shall operate and remain operated. A voltage reading shall be obtained on the panel meter with the METER TRANSFER switch in the RECT V position.

B. Resistance Measurements

2.06 ***Preliminary Adjustments:*** Open the 115 volt AC circuit breaker. Turn PLATE SUPPLY switch S52 to ON. Turn METER TRANSFER switch to RECT V. Set PLT CUR key to center position PLT CUR. Set the bias controls ADJUST BIAS AMP 1 and ADJUST BIAS AMP 2 to the maximum counterclockwise positions.

2.07 ***Plate Circuit:*** Measure the resistance between terminal 4 of TS51 and panel ground. Also measure resistance between terminal 4 of TS52 and panel ground.

Requirement: The resistance measured in each test shall be between 3750 and 5050 ohms.

2.08 ***Bias Circuit:*** Measure the resistance between terminal 1 of the ADJUST BIAS AMP 1 (R63) control to panel ground.

Requirement: The resistance measured shall be between 154 and 208 ohms.

2.09 ***Relay Circuit:*** Measure the resistance between terminal 3 of TS51 and ground. Also measure the resistance between terminal 3 of TS52 and panel ground.

Requirement: The resistance measured in each test shall be less than 2 ohms.

C. DC Power Tests

2.10 ***Rectifier Voltage:*** Close the 115V AC circuit breaker S51 and turn the PLATE SUPPLY switch S52 to ON. After the time delay relay K53 operates, adjust the voltage of the J86218A-1 Regulated Tube Rectifier to 250 volts as measured by the panel meter M51.

2.11 ***Bias Adjustments:*** Adjust the bias controls, ADJUST BIAS AMP 1 and ADJUST BIAS AMP 2 for plate currents of 30 ma for each amplifier.

Requirement: Rotating the bias controls shall change the plate currents and it shall be possible to obtain 30 ma plate current on each tube.

2.12 ***Plate Voltage:*** Remove the cover on the rear of the cavity amplifier assembly thus exposing the terminals of the multi-circuit jack through which power is supplied to the amplifier tube. To remove the cover it is necessary to remove the multi-circuit plug. Replace the plug and measure the d-c voltage between terminals 4 and 1 of the jack. After replacing the plug sufficient time should be allowed for the time delay relay to operate.

Caution: Dangerous voltage is thus exposed. Care should be exercised to avoid harm to personnel or to equipment. After this test is completed remount the cover on the rear of the cavity amplifier assembly.

Requirement: The voltage should measure between 175 and 225 volts.

D. Transmission Tests

2.13 ***Alignment of Amplifier on Desired Frequency***

(a) During tuneup, disable the office alarm circuit. Turn on the driving transmitter and adjust its frequency in accordance with the R series of Bell System Practices applicable. The frequency should be set to the assigned mid-band frequency.

(b) At the wave guide assembly, turn the RF switch S1 to give transmission into the DUMMY LOAD AT2. Set the CALIBRATED ATTENUATOR AT1 to give a loss of about 10 db. Remove the OUTPUT FILTER and insert the wave guide spacer in its place.

(c) At the control panel, close the 115V AC circuit breaker S51 and turn the PLATE SUPPLY switch S52 to ON. Set the METER TRANSFER switch to RECT V and after the time delay relay K53 closes, adjust the regulated rectifier if necessary to give 250 volts.

(d) Adjust the bias controls, ADJUST BIAS AMP 1 and ADJUST BIAS AMP 2 for plate currents of 30 ma for each amplifier. Allow approximately 20 minutes for the amplifier to warm up.

(e) Remove the CRYSTAL MOUNT from the TRANSDUCER MT1, and connect the cord of the 71A Frequency Power Meter to the TRANSDUCER.

(f) Operate the METER TRANSFER switch to the AMP 1 position and the PLT CUR key to − or + BIAS to obtain a reading on the meter.

(g) Adjust the AMP 1 INPUT APERTURE TUNING until a maximum change in bias in the negative bias direction is obtained. If necessary, the attenuation of the CALIBRATED ATTENUATOR may be reduced in order to more easily find the approximate setting for the AMP 1 INPUT APERTURE TUNING. The BIAS should not exceed 2 volts. However, the final adjustment of the AMP 1 INPUT APERTURE TUNING should be made with at least 10 db in the CALIBRATED ATTENUATOR.

(h) Tune the AMP 1 PLATE TUNING and the AMP 2 INPUT APERTURE TUNING for maximum change in amplifier 2 grid bias in the negative direction. This may be read with the METER TRANSFER switch in the AMP 2 position.

(i) Tune the AMP 2 PLATE TUNING for maximum power output, observed on the 71A Frequency Power Meter.

(j) Adjust each of the following controls for maximum power output. Readjust the CALIBRATED ATTENUATOR for an output of 27 dbm, if necessary, after each adjustment.

(1) AMP 1 PLATE TUNING

(2) AMP 1 OUTPUT COUPLING

(3) INTERSTAGE TUNER

(4) AMP 2 INPUT APERTURE TUNING

(5) AMP 2 PLATE TUNING

(6) AMP 2 OUTPUT COUPLING

Note: To obtain the power output in dbm the reading of the 71A Power Meter should be added to the attenuation of the 71A Power Meter cord in db and the attenuation of the directional coupler in db. The attenuation of the directional coupler should be derived for the frequency in use from the calibration which is stamped on the directional coupler.

(k) Remove the 71A Power Meter cord from the TRANSDUCER and reinsert the CRYSTAL MOUNT. Adjust the CAL RF OUTPUT potentiometer for a meter reading of 37 on the 50 ma scale with the METER TRANSFER switch set to the RF OUTPUT position. This reading of 37 then corresponds to 27 dbm power output and should be used in making the remaining tuning adjustments.

(l) Read the setting of the CALIBRATED ATTENUATOR and if it is not at least 10 db, increase the attenuation to 10 db.

(m) Adjust the screws in the INPUT TUNER and the AMP 1 INPUT APERTURE TUNING for maximum power output.

(n) Readjust the CALIBRATED ATTENUATOR for a reading of 37 on the RF OUTPUT meter.

(o) Check the transmitter frequency and readjust if necessary.

(p) Adjust the bias controls for 30 ma plate current on each amplifier.

(q) Carefully adjust the AMP 2 PLATE TUNING and AMP 2 OUTPUT COUPLING controls for maximum power output.

(r) Remove the wave guide spacer and reinsert the OUTPUT FILTER. For frequencies below 3950 mc install the filter with the black dots matched at the CAVITY AMP 2. For frequencies above 3950 mc the white dots should be matched.

Caution: During this operation, the plate voltage should be turned off. A voltage of 200 volts is otherwise exposed on the coupling probe in the cavity output.

(s) Adjust the tuning of the OUTPUT FILTER for maximum power output. Do not readjust the AMP 2 PLATE TUNING and AMP 2 OUTPUT COUPLING controls.

(t) Reset the CALIBRATED ATTENUATOR for a reading of 37 on the RF OUTPUT meter. This represents 27 dbm output and the alignment is complete.

2.14 ***Transmitter Power Output:*** With the 71A Frequency Power Meter measure the power output of the TE transmitter. Instructions for measuring the power output of the transmitter may be found in the R series Bell System Practice for the type transmitter used.

2.15 ***Amplifier Gain:*** The amplifier gain may be computed as the amplifier output in dbm, minus the transmitter output in dbm, plus the db attenuation in the CALIBRATED ATTENUATOR.

Requirement: The gain of the amplifier when tested at 4170 megacycles shall be greater than 8 db for an output of 27 dbm. The same measurement made at 3890 megacycles should yield a gain of at least 10 db for an output of 27 dbm. At other frequencies the minimum gain requirement may be found by interpolating between 8 db and 10 db.

2.16 ***Band Width***

(a) Line up the amplifier on the desired center frequency in the manner described in 2.13.

(b) With the 71A Frequency Power Meter measure the power output of the TE-A1 amplifier.

(c) Measure the power output of the TE transmitter.

(d) The gain of the amplifier at lineup frequency should now be computed as the amplifier output in dbm minus the transmitter output in dbm plus the db attenuation in the CALIBRATED ATTENUATOR.

(e) Without altering the amplifier tuning, set the transmitter frequency 15 megacycles above the lineup frequency.

(f) Readjust the CALIBRATED ATTENUATOR if necessary, to make the difference between the transmitter output in dbm and the attenuation of the CALIBRATED ATTENUATOR in db the same as in step (d). This maintains the same input to the amplifier.

(g) Compute the gain as in step (d).

(h) Set the oscillator frequency 15 megacycles below the lineup frequency.

(i) Readjust the CALIBRATED ATTENUATOR if necessary, to make the difference between the transmitter output in dbm and the attenuation of the CALIBRATED ATTENUATOR in db the same as in step (d).

(j) Compute the gain as in step (d).

Requirement: For any line-up frequency from 3890 to 4170 megacycles, the gain measured at frequencies 15 megacycles above and below the line-up frequency shall not

differ more than 3 db from the line-up frequency gain.

2.17 ***RF Alarm Circuit***

(a) Line up the amplifier on the desired frequency in the manner described in 2.13.

(b) The RF OUTPUT meter should be calibrated to give a meter reading of 37 for 27 dbm output as described in 2.13(k).

(c) With the CALIBRATED ATTENUATOR vary the RF OUTPUT and note the indications for which the alarm circuit opens and closes. If an external alarm crcuit has not been connected use an ohmmeter connected to terminals 3 and 4 of TS-53 as an indicator. When the measured resistance is less than 20 ohms the alarm circuit is considered to be closed and when the resistance is greater than 20 ohms the alarm circuit is considered to be open. Do not use a buzzer for this indication.

Requirement: (1) The alarm circuit shall open for readings greater than 35 on the RF OUTPUT meter. (2) The alarm circuit shall close for readings less than 15 on the RF OUTPUT meter.

3. TEST REPORTS AND RECORDS

3.01 The required record of these tests shall be entered on the proper form.