NO. 569-2548-000

COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA - DALLAS DIVISION

PRODUCTION TEST SPECIFICATION

FOR

820D-1 AM BROADCAST TRANSMITTER

PART NUMBER 522-3391-000

APPROVED BY

PROJECT ENGINEER		DATE
ENGINEERING GROUP HEAD		DATE 6 Feb 68
QUALITY ASSURANCE		DATE 16 Feb 68
QUALITY CONTROL		DATE 3/12/68

DCN CONTROL

CUST. DWG. 074-5343-300

2168397

SYM	REV.NO	DATE	SH.REV	APPD	SYM	REV.NO	DATE	SH.REV	APPD
	0	4-29 1968		MB					

REVISION DATA

CODE IDENT NO. 13499

569-2548-000

SHEET 1 OF 43

D-207 (REV. 6-63)

1.0 SCOPE

These production test requirements apply to the Collins Type Number 820D-1 AM Broadcast Transmitter, Part No. 522-3391-000. (Test of Type 310W-1 Exciter should be made separately, using referenced test specification.)

2.0 REFERENCE INFORMATION

2.1 Specifications

820D-1 Equipment Specification, Part No. 568-1999-000
310W-1 Production Test Specification, Part No. 569-7242-000

2.2 Publications

820D-1 Instruction Manual, Part No. 523-0559-937
310W-1 Instruction Manual, Part No. 523-0556833-001438
FCC Type Acceptance Application 820D-1

2.3 Drawings

Schematic Diagram, Part No. 771-9021-000
Outline and Installation Drawing, Part No. 771-9064-000

2.4 Photographs

See 820D-1 Instruction Book for photographs

3.0 TEST EQUIPMENT

The following equipment or their equivalent are required to perform the tests.

	Item	Manufacturer	Qty.
1.	RF Load 50+j0 2.5 kW	Bird Water Cooled	1
2.	RF Signal Generator	GR 1338H or HP 606A	1
3.	RF Impedance Bridge	GR 606A or 916AL	1
4.	RF Detector	Collins 51-S	1
5.	Multimeter	Triplett Model 630N/A	1
6.	Audio Signal Generator	HP 206A	1
7.	Distortion and Noise Analyzer	HP 334A	1
8.	Modulation Monitor	GR 1931B or Metron 506B	1
9.	DC Power Supply	Electro Lab Model EFB	1
10.	VTVM	HP 412A or 425A	1
11.	Digital Voltmeter	HP 3430	1
12.	Remote Control Test Card	Collins (771-9265-001)	1
13.	Oscilloscope	Tektronic 545	1
14.	3350 ohm Resistor ±1% (Noninductive)	Composition	1

4.0 TEST CONDITIONS

Unless otherwise specified, all tests will be performed under the following conditions:

4.1 Power Supply

208/230/240 volts ±5% 50/60 Hz, single phase

4.2 Ambient Temperature

Normal factory ambient

4.3 Ambient Humidity

Normal factory ambient

4.4 Ambient Atmospheric Pressure

Normal factory ambient

4.5 Shielding and Isolation

None

4.6 Operational Duty Cycle

Continuous

4.7 Warm-Up

5 Minutes

5.0 PRELIMINARY TESTS

Warning!

HIGH VOLTAGE

is used in this equipment.

DEATH ON CONTACT

may result if personnel
fail to observe safety regulations.

When working inside the equipment, be sure that all breakers are open and remove power at wall disconnect. Always short all High Voltage terminals to ground with grounding stick provided.

5.1 Visual Inspection

Ascertain that main power input line is disconnected. Inspect the unit to determine that all materials and workmanship are in accordance with Collins Radio standards and that the unit is constructed with the latest drawings. Inspect equipment for loose components and/or connections. Check carbon block arrestors (E-1, E-2, and E-3) for proper installation. Check arc gap on T-1 for .075 inches. Adjust all door interlocks and door grounding switches for proper operation.

5.2 Ohmmeter Checks

5.2.1 Measure the DC resistance between ground and each of the below listed power supply terminals. A high resistance should exist. Open each of the panels listed in turn to see if the high resistance goes to a short circuit condition. Finally, check each power supply ground return, also listed below for low resistance to ground.

P.S. and Terminal	Panel to be Opened
High Voltage Supply CR1 Pos	lower right front lower left front tube door
PA Screen Supply A14 CR1 Pos	lower right front lower left front tube door
Mod Screen Supply A14 CR2 Pos	lower right front lower left front tube door

P.S. and Terminal	Panels to be Opened
Bias Supply A13 CR1 Neg	None
28 Volt Supply A12 CR1-2	None
Ground Return	
Ground Return CR2 Neg	
Ground Return A14 CR1 Neg	
Ground Return A14 CR2 Neg	
Ground Return A13 CR1 Pos	
Ground Return A12 CR4-2	

5.2.2 Electrolytic Capacitor Ground

Check the negative terminals of electrolytic capacitor C-30; A14 C3, 4; A14 C5, 6; A12 C2, and the positive end of A13 C2 to ground for a low resistance value. For this test all panel grounding switches must be open.

5.2.3 AC Line

Remove loads from TB8-1 and TB9-1. Closing all circuit breakers, check each side of the 208/230/240 line to ground with the following relays operated manually. (K1, K2, K2 and K5, K2 and K6). Reinstall leads on TB8-1 and TB9-1.

5.2.4 Filaments

Inspect PA and Mod filaments for correct wiring. Check each filament at socket of tube for low resistance to ground.

5.3 Equipment Interconnections

5.3.1 Phantom Load Connection

Connect phantom load and RF ammeter to transmitter output.

5.3.2 Extended Control Panel Connection

Be certain all 53 connections to A1TB1 and TB1 are properly made.

5.3.3 Power Supply Transformer Taps

Check eac'ı power supply to see that the correct transformer primary taps are connected for existing line voltage (208/230/240).

TABLE IA
TRANSFORMER CONNECTIONS

Transformer	Line Voltage		
	208	230	240
28 Volt	A12TB1-1 A12TB1-2	A12TB1-1 A12TB1-3	A12TB1-1 A12TB1-4
Bias	A13TB1-7 A13TB1-6	A13TB1-7 A13TB1-5	A13TB1-7 A13TB1-5
Mod Filament	A15TB2-1 A15TB2-5	A15TB2-1 A15TB2-6	A15TB2-1 A15TB2-7
PA Filament	A15TB2-1 A15TB2-2	A15TB2-1 A15TB2-3	A15TB2-1 A15TB2-4
Screen	A14TB1-3 A14TB1-4	A14TB1-3 A14TB1-5	A14TB1-3 A14TB1-6

TABLE IB
HIGH VOLTAGE
TRANSFORMER CONNECTIONS

Cutback Power	Line Voltage		
	208	230	240
500 Watts	T5-3 T5-5	T5-2 T5-6	T5-1 T5-7
250 Watts	T5-3 T5-8	T5-2 T5-9	T5-1 T5-10
1000 Watts	T5-3 T5-4	T5-2 T5-4	T5-1 T5-4

5.3.4 Frequency Dependent Connections

Check for installation of correct frequency dependent components as indicated in Tables 2 and 3 on sheet 7 and 9, respectively; and Figure 2 on sheet 8.

5.3.5 Grounding

Connect building power line ground to transmitter ground terminal E4.

FIGURE 1
SIMPLIFIED SCHEMATIC
OUTPUT NETWORK

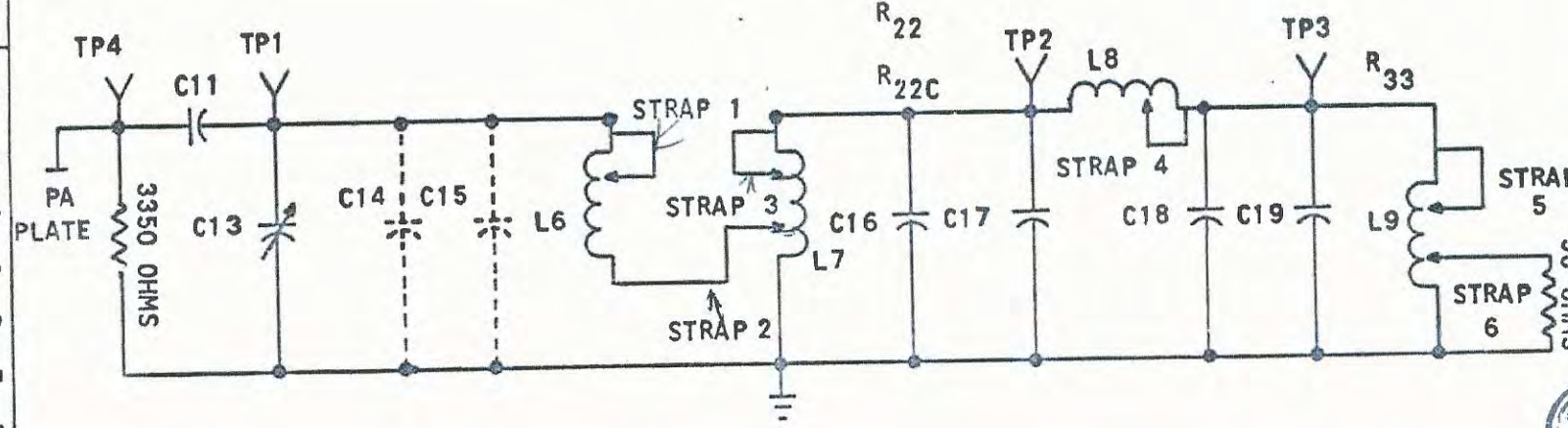


TABLE 2
OUTPUT NETWORK
CAPACITOR VALUES

FREQUENCY	C14	C15	C16	C17	C18	C19
540-700	240 PF	240 PF	3900 PF	3900 PF	3900 PF	3900 PF
710-920	180 PF	NONE	3000 PF	3000 PF	3000 PF	3000 PF
930-1150	180 PF	NONE	2400 PF	2400 PF	2400 PF	2400 PF
1160-1380	NONE	NONE	2000 PF	2000 PF	2000 PF	2000 PF
1390-1600	NONE	NONE	1600 PF	1600 PF	1600 PF	1600 PF

NO. 569-2548-000

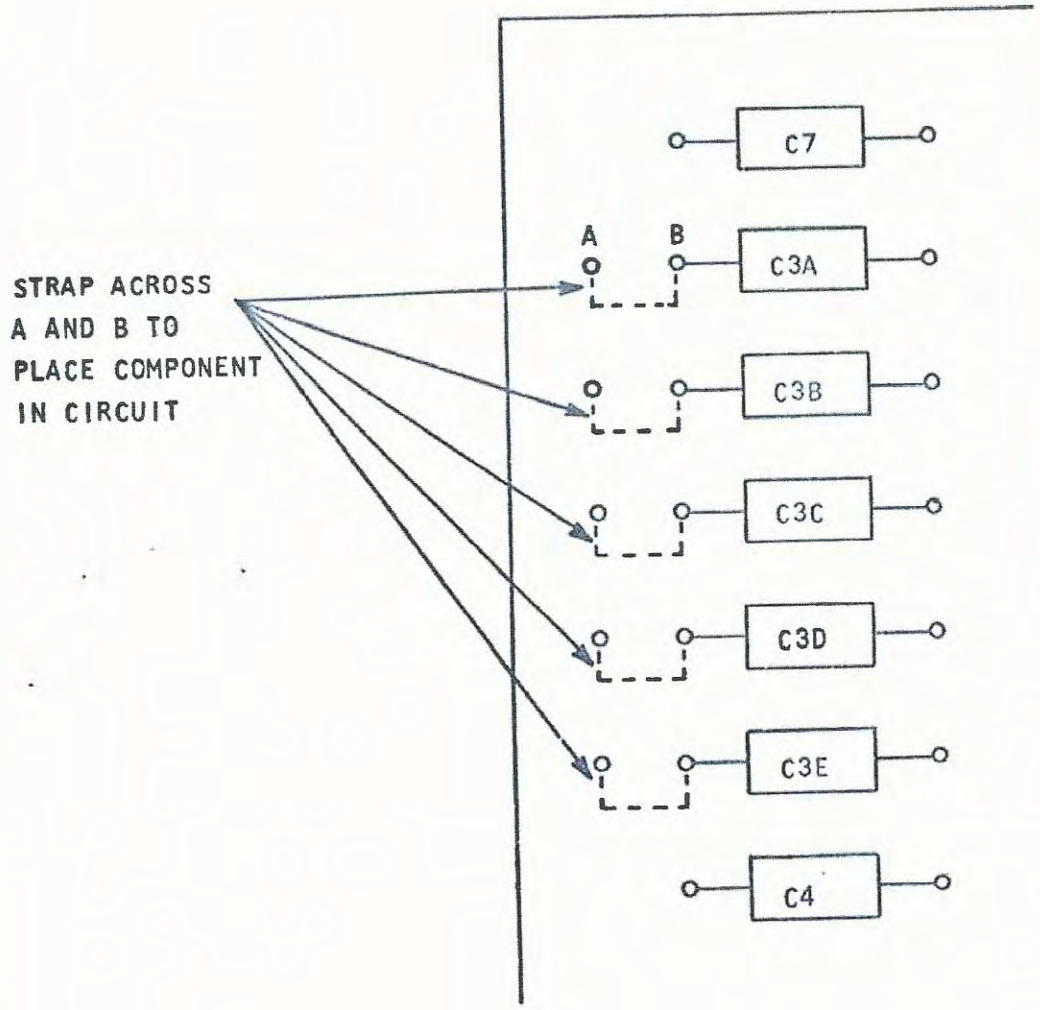


FIGURE 2
RF DRIVER COMPONENT BOARD

TABLE 3

RF DRIVER CAPACITORS

X DENOTES ACTIVE CAPACITORS					
Frequency	C3A	C3B	C3C	C3D	C3E
540-550	X				X
560-580	X	X	X	X	
590-600		X	X	X	
610-625	X		X	X	
635-645			X	X	
655-675	X	X		X	
685-710		X		X	
720-735	X			X	
745-780				X	
790-850		X	X		
860-890	X		X		
900-965			X		
975-1100	X	X			
1110-1225		X			
1260-1420	X				
1430-1600					

5.4 Control Circuit Operation

Open all circuit breakers. Connect external single phase three wire power at TB5-1, 2, and 3 and apply power.

5.4.1 Filament On

Close breaker CB1. FILAMENT OFF and PLATE OFF lamp should illuminate if all interlocks are closed. Meter 28V d-c supply between A12TB1-5 and ground using calibrated Triplett meter. Value read should be between 26 and 30 V d-c. Compare this value with that read on Test Meter, S8, in 28 V Supply position. Difference in readings should be no more than 5%.

Open the tube compartment door and each panel in turn, observing that each extinguished the FILAMENT OFF lamp.

Depress FILAMENT ON button observing that blower and fan operate. After blowers come up to speed FILAMENT ON lamp should illuminate and K2 should operate applying filament power. FILAMENT OFF lamp will extinguish. Manually operate the blower and fan air switches in turn to see that K2 de-energizes after a slight time delay and FILAMENT ON lamp will extinguish and FILAMENT OFF lamp will illuminate.

Check to see that +28 V d-c exist between TB4-1 and TB4-2.

5.4.2 Filament Voltage Adjustment

Meter filament voltage with calibrated Triplett meter. Measure Modulation Filament at E36 and E37; measure PA Filament at E34 and E35. Adjust R15 and R16 so that the Modulation and PA filament voltages are both 9.5 VAC. As an option a sola constant voltage transformer may be obtained to provide a regulated filament voltage. If this option has been chosen, the output of the Sola is a constant 236 volts. Therefore the taps on the filament transformers must be set for 230 volts regardless of the line voltage. Again the filaments must be adjusted as above.

5.4.3 Plate On

Caution: Insure that CB2 is open before performing following. Checking all interlocks to be sure they are closed, depress the LOW POWER ON switch. Observe the FILAMENT OFF and PLATE OFF lamps extinguish and the FILAMENT ON and LOW POWER ON lamps illuminate. Depress FILAMENT OFF switch and observe the LOW POWER ON and FILAMENT ON lamps extinguish. The FILAMENT OFF and PLATE OFF lamps should illuminate.

Depress the HIGH POWER ON switch. Observe the FILAMENT OFF and PLATE OFF lamps extinguish and the FILAMENT ON and HIGH POWER ON lamps illuminate. Depress the FILAMENT OFF switch and observe the HIGH POWER ON and FILAMENT ON lamps extinguish. The FILAMENT OFF and PLATE OFF lamps should illuminate.

5.4.4 Overload Circuits

Set R14 for maximum resistance and with the Electro supply (Test Equipment Item 9) apply 14.5 V d-c, negative polarity between R14-1 and ground. Adjust R14 such that the applied voltage does just energize K3.

5.4.5 Tuning

Ascertain that all frequency dependent components are properly in place on A11, RF Driver.

Check to be sure that CB1 is closed and CB2 is open. Depress the FILAMENT ON switch and observe the FILAMENT ON lamp to illuminate and the FILAMENT OFF lamp to extinguish.

Adjust A11C3, PA GRID TUNING, for a maximum grid current reading on A1M3 with S8 in PA GRID I position. Open L.V. Breaker.

With motor shaft disengaged from capacitor manually turn variable capacitor clockwise to its internal end stop. Back off 2 turns from this point. By use of PA TUNING turn motor clockwise to end stop. Engage shaft to capacitor.

Check to see that mechanical stop on POWER ADJUST motor shaft has the same angular position that the contact on the Variac has.

Close L.V. Breaker. With POWER CONTROL in MANUAL position, hold the POWER ADJUST switch in RAISE position and then in LOWER position while observing motor B4 turn clockwise and then counter clockwise (fig 11).

Hold PA TUNING switch first in RAISE position and then in LOWER position while observing motor B3 turn clockwise and then counter clockwise (fig 12).

Figure 11

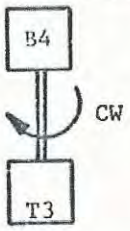
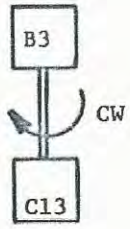


Figure 12



5.4.6 Remote Control (Optional)

Although the Remote Control feature is optional, the operation of the Remote Control should nevertheless be checked. If the option has been selected, the Remote Control cards will previously have been installed and the straps between pins 3 and 4, 5 and 6, 7 and 8, and 9 and 10 of TB3 will have been removed. Check to be sure these straps have been removed. If the Remote Control option has not been selected, remove the previously mentioned straps from TB3 and insert the TEST CARD into the card cage.

It will be necessary in the following procedure to apply 28 V d-c to various terminals of TB2. Either the transmitter 28 V d-c supply (available at TB1-5) or the Electro d-c supply may be used. Install a ground on TB2-11. Open the HIGH POWER circuit breaker and close the LOW POWER breaker. Observe the FILAMENT OFF and PLATE OFF lamps illuminate. Momentarily apply 28 V d-c to TB2-4 and observe the FILAMENT ON lamp illuminate and the FILAMENT OFF lamp to extinguish.

Momentarily apply 28 volts to TB2-6 and observe the FILAMENT ON and LOW POWER ON lamps illuminate. The FILAMENT OFF and PLATE OFF lamps should extinguish.

Momentarily apply 28 volts to TB2-5 and observe the LOW POWER ON lamp extinguish. The PLATE OFF should illuminate.

Momentarily apply 28 volts to TB2-8 and observe the HIGH POWER ON lamp illuminate and the PLATE OFF lamp extinguish.

Momentarily apply 28 volts to TB2-7 and observe HIGH POWER ON lamp extinguish and the PLATE OFF lamp illuminate.

Again, momentarily apply 28 volts to TB2-6 and observe the LOW POWER ON lamp illuminate and the PLATE OFF lamp extinguish.

Again, momentarily apply 28 volts to TB2-8 and observe the HIGH POWER ON lamp illuminate and LOW POWER ON lamp extinguish.

Finally, momentarily apply 28 volts to TB2-3 and observe the HIGH POWER ON and FILAMENT ON lamps to extinguish. Also observe the FILAMENT OFF and PLATE OFF lamps to illuminate.

Apply 28 volts to TB2-9 and to TB2-10 while observing motor B4 turn counter clockwise and then clockwise.

If the Remote Control option was not selected, remove the TEST CARD from the card cage and replace straps removed from TB3.

5.4.7 Output Network Tuning

In order to properly tune the output network, it is necessary to bridge the network at various points in the circuit and to make fine adjustments of the network components to give correct impedance values, once the preliminary adjustments have been made.

Begin by making the preliminary adjustments indicated in figures 1, 3, 4, 5, 6, 7, and 8. Disconnect the strap from C13 to L6 and then bridge from TP1 to ground. Adjust the variable capacitor so as to render ~~321~~ -261 ohms reactance. Reconnect strap C13 to L6.

Place shorting clip lead from TP2 to ground and bridge from TP3 to ground. Varying resistance with Strap 6 and reactance with Strap 5, adjust Strap 5 and Strap 6 for a bridge reading of zero ohms reactance and a resistance R_{33} (see Figure 9).

Move shorting clip lead from TP2 and ground to TP1 and ground. Place bridge from TP2 to ground. Varying resistance with Strap 4 and reactance with Strap 3, adjust Strap 3 and Strap 4 for a bridge reading of zero ohms reactance and a resistance R_{22} (see Figure 10).

NOTE: The following measurement must be made with the front panel in place on the output network.

FIGURE 3
APPROXIMATE SETTINGS
FOR STRAP 1

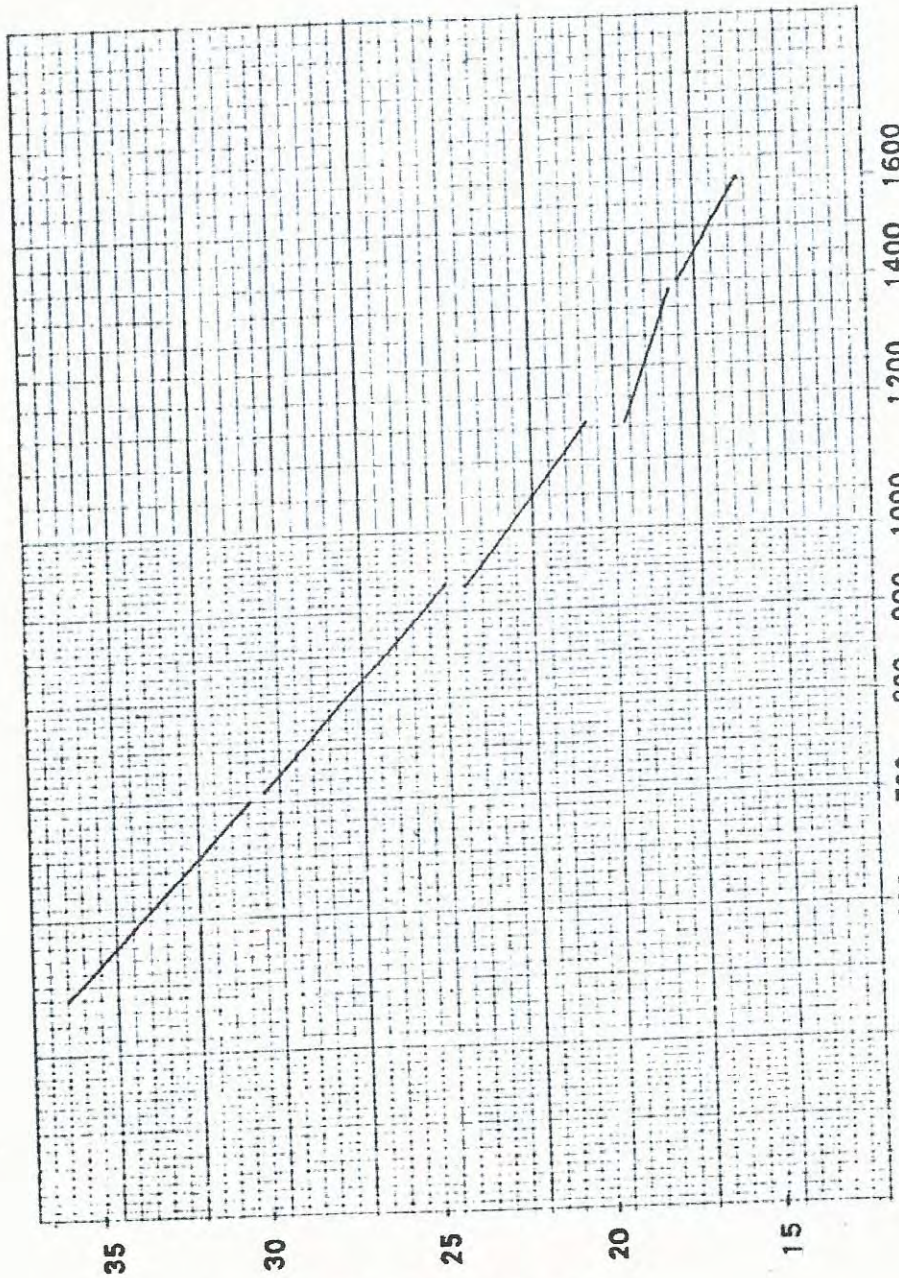
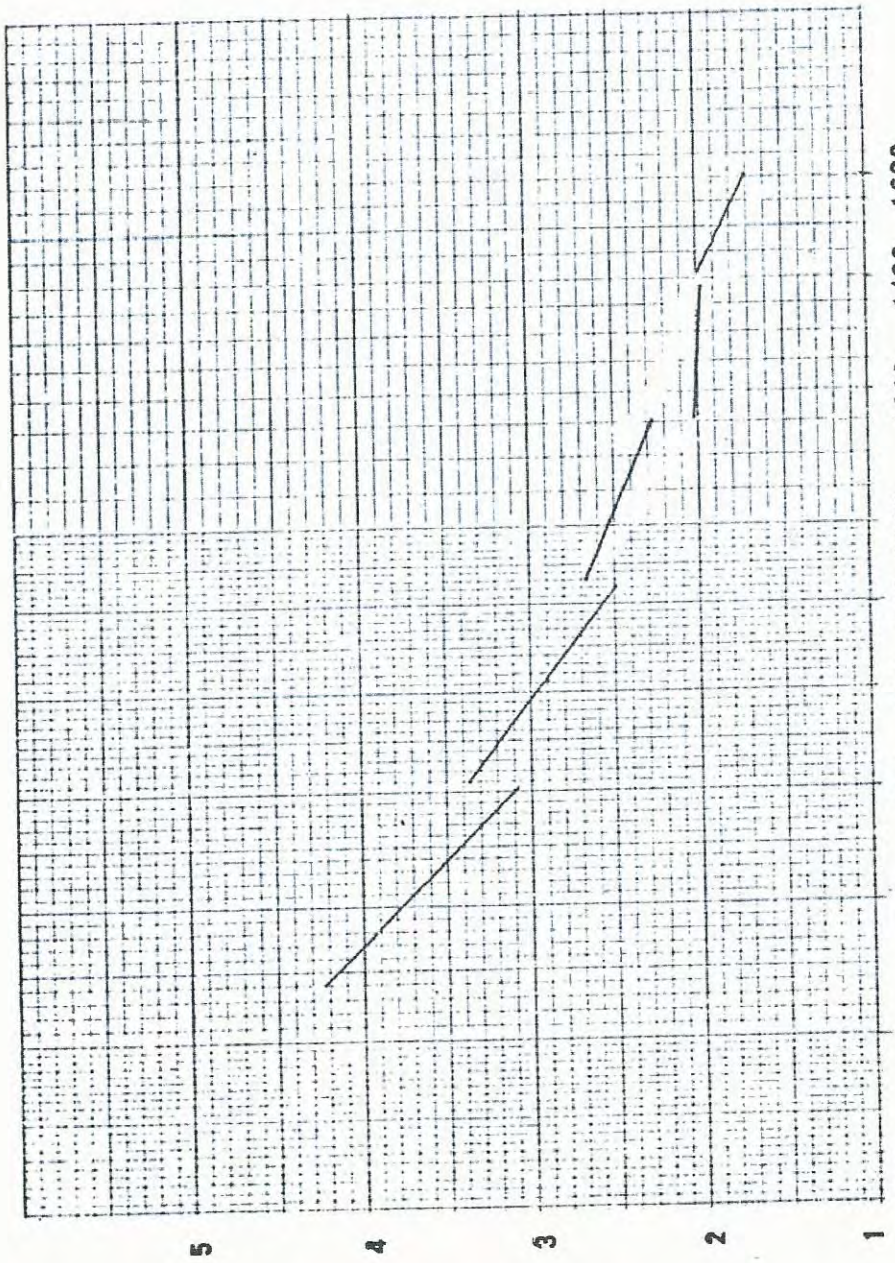


FIGURE 4
APPROXIMATE SETTINGS
FOR STRAP 2



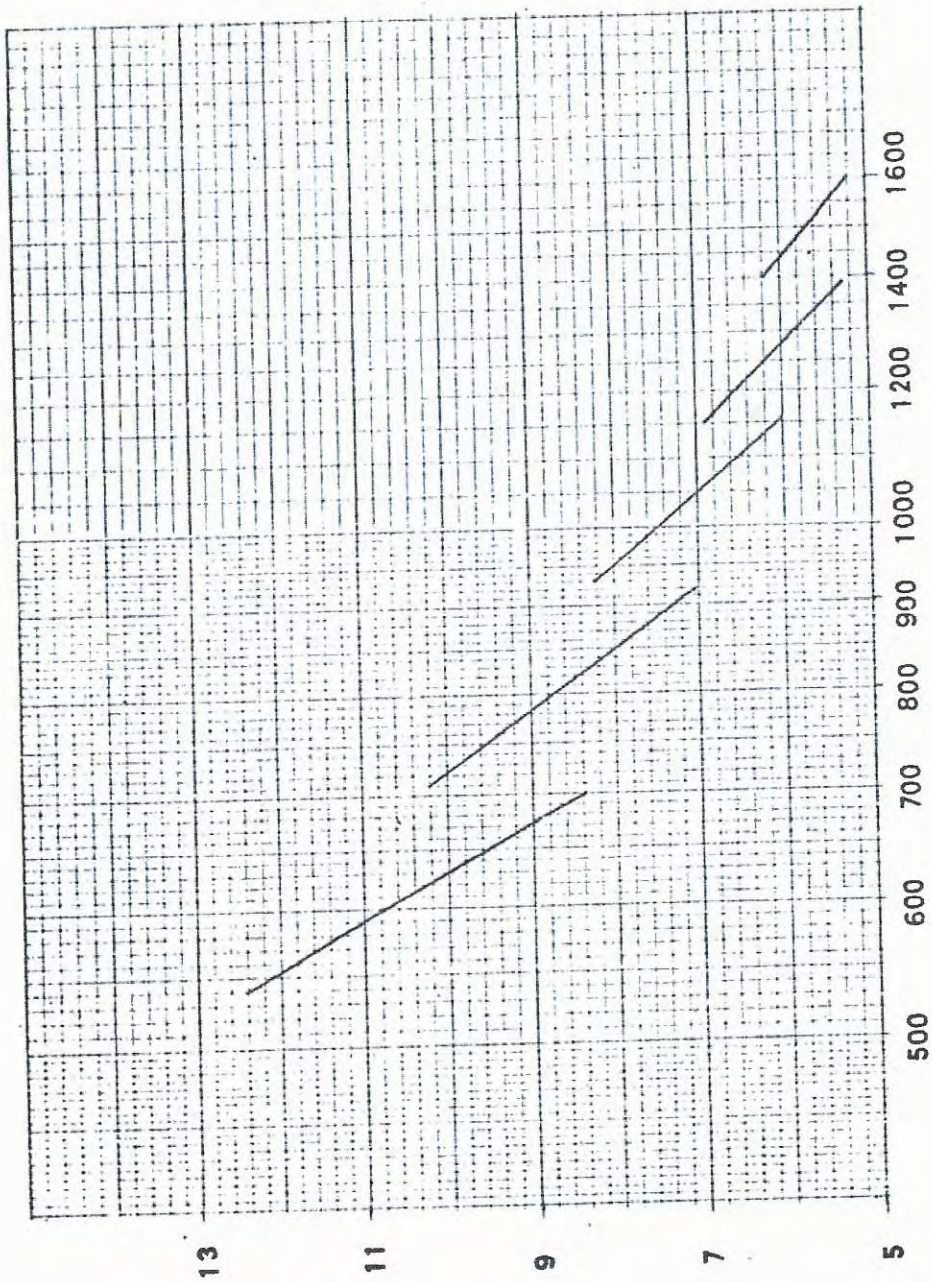


FIGURE 5
APPROXIMATE SETTINGS
FOR STRAP 3

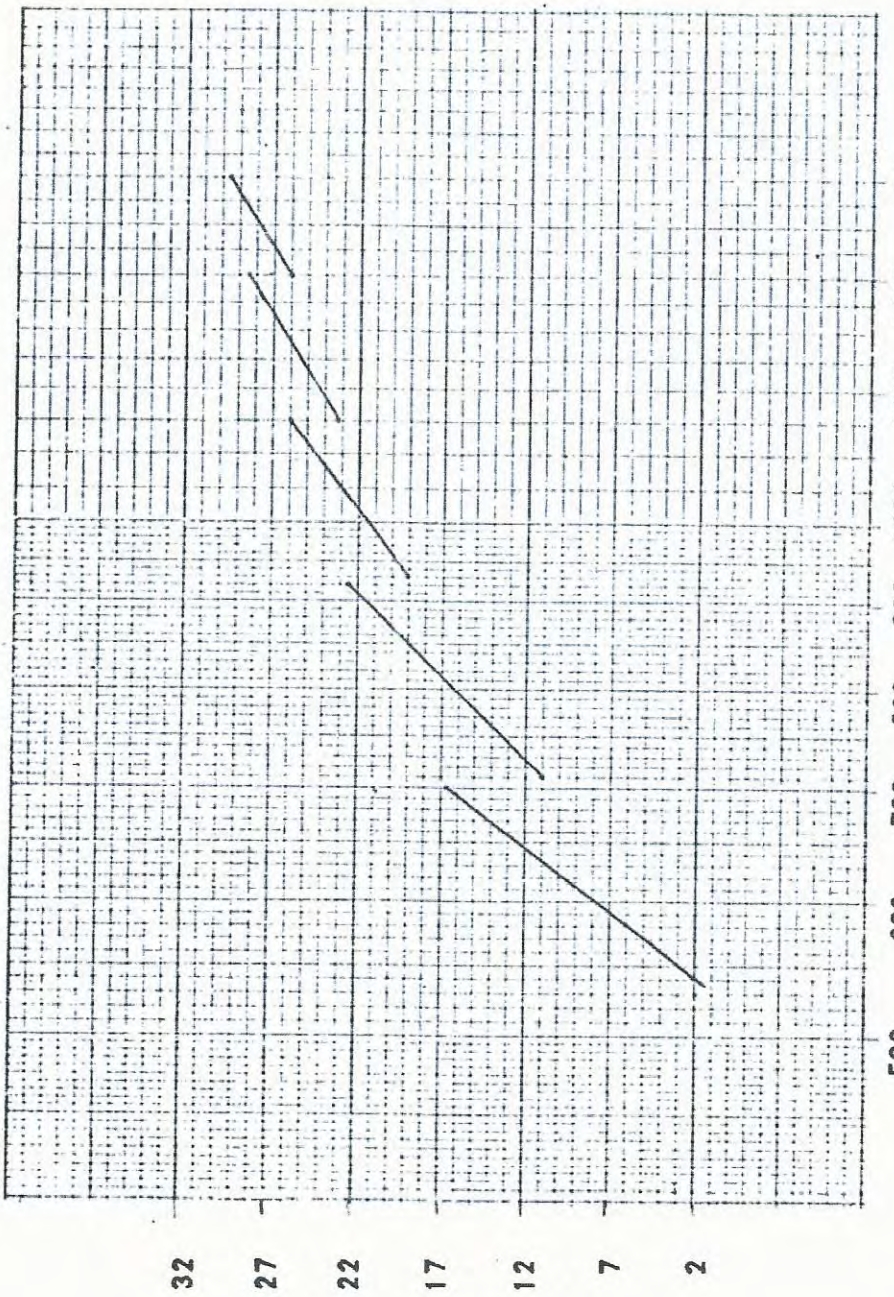
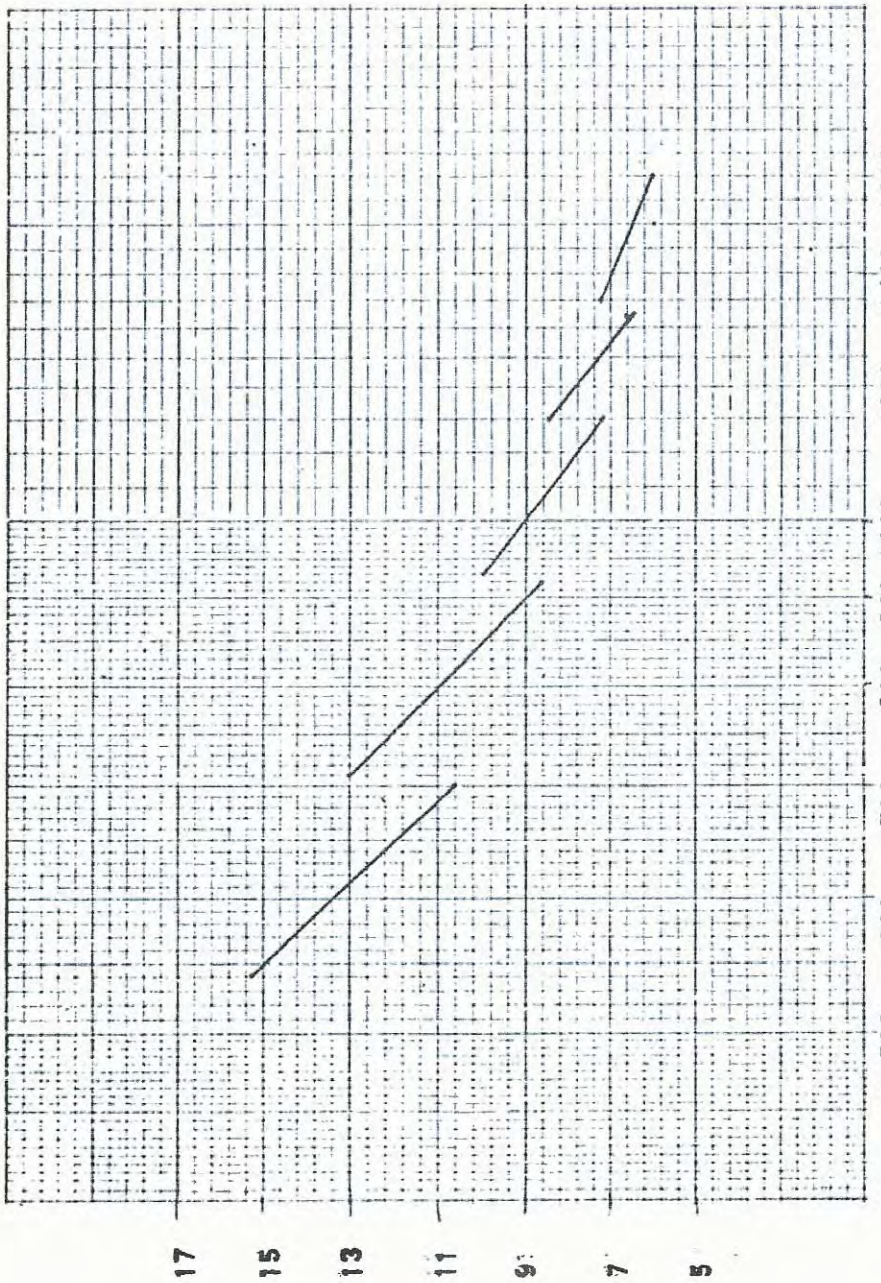


FIGURE 6
APPROXIMATE SETTINGS
FOR STRAP 4

FIGURE 7
APPROXIMATE SETTINGS
FOR STRAP 6



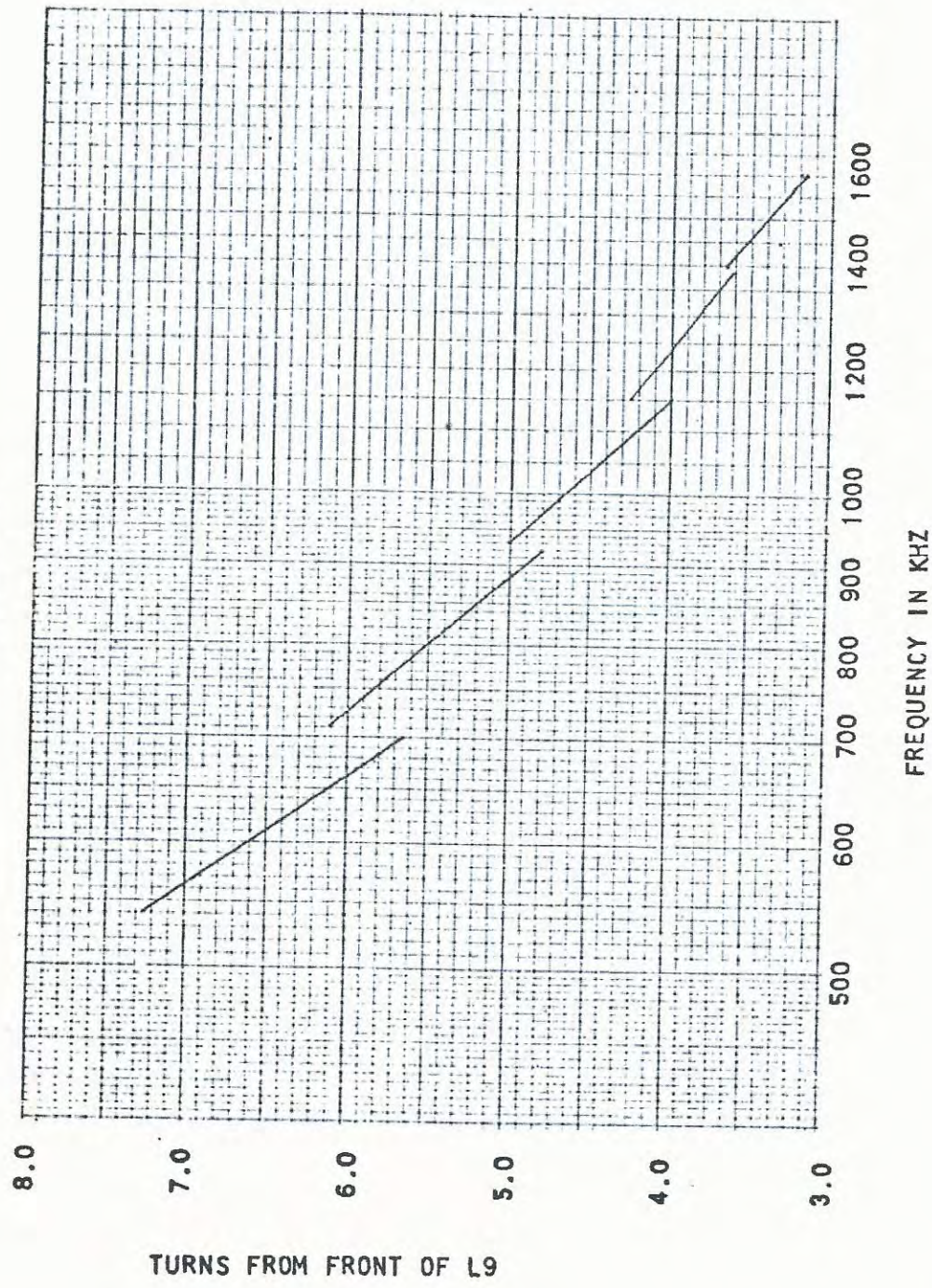


FIGURE 8
APPROXIMATE SETTINGS
FOR STRAP 6

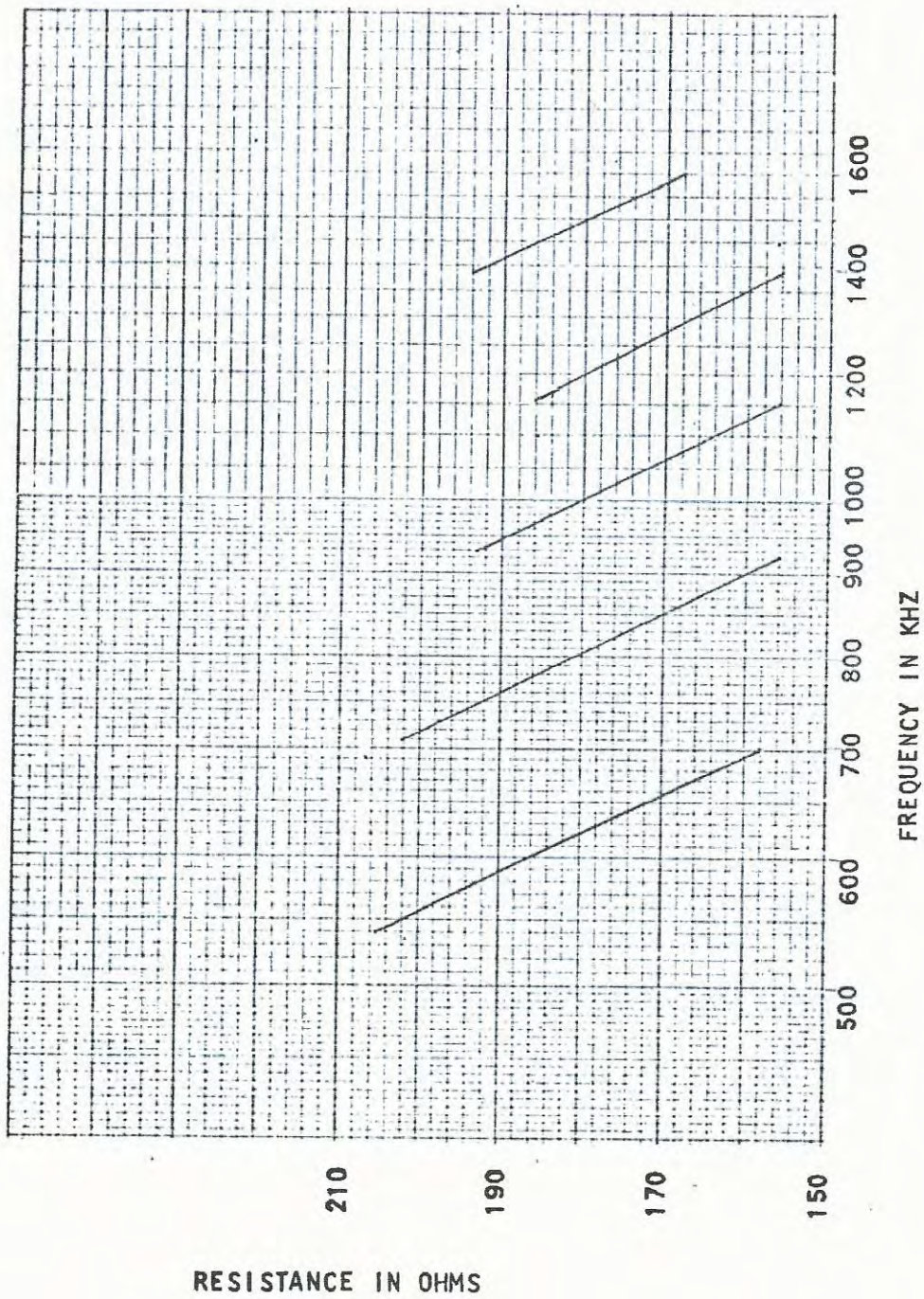


FIGURE 9
R'_{33} VALUES

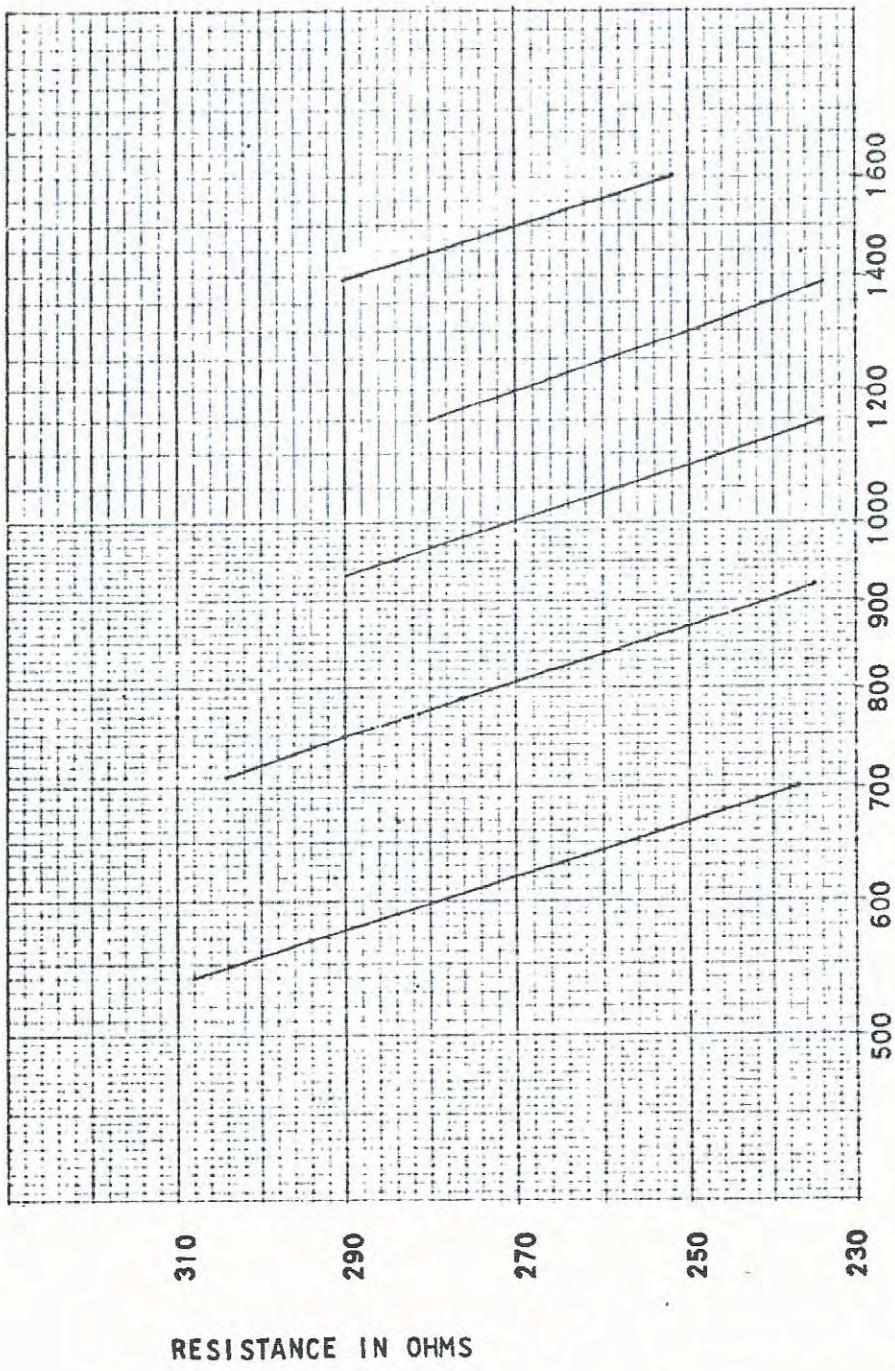


FIGURE 10
R_{22} VALUES
$R_{22} = R_{22C}$

Move shorting clip lead from TP1 to TP3 and ground and install a 3350 ohm resistor from TP4 to ground. Varying resistance with Strap 2 and reactance with Strap 1, adjust Strap 2 and Strap 1 for a bridge reading of zero ohms reactance and a resistance value R_{22c} (see Figure 10).

Remove the 3350 ohm resistor, shorting clip lead, and bridge from the radio.

5.4.8 Power Supplies

NOTE: Caution should be exercised when metering across power supplies with external meter. Open all circuit breakers and momentarily ground points across which meter is to be placed before connecting meter leads.

5.4.8.1 Plate Supply

The plate and screen power supplies should be tested with the PA and modulator tubes removed. Set PA Variac to midscale in manual position. Close both circuit breakers, CB1 and CB2. Depress LOW POWER ON switch and observe the PLATE VOLTAGE meter on the extended control panel. Meter should indicate approximately 2250 volts for the 500 watt cutback version and approximately 1550 volts for the 250 watt cutback version. Depress the HIGH POWER ON switch; the meter should read approximately 3200 volts. Open all breakers.

5.4.8.2 Bias Supply

Check for proper installation of F1, a one ampere fuse located in panel beneath the exciter. Close both breakers and depress FILAMENT ON switch. After blowers and filaments come on, read bias supply voltage on M3 of extended control panel with S8 in bias supply position. Compare with readings taken across supply output (A13TB1-2 to A13TB1-4) using calibrated Triplett. Readings should be within 5%. Reading on Triplett should be approximately -155 volts. /A.

5.4.8.3 Modulator Screen Supply

Connect Triplett meter between A14E3 and A14E1 and set to 1200 V d-c scale. Close both breakers and depress LOW POWER ON switch. TEST METER, M3, with S8 in position MOD SCREEN V and Triplett should read approximately 810 volts. Readings should be within 5%. Depress HIGH POWER ON switch and observe no change in screen voltage readings. Open all breakers. (Determined by drive level.

5.4.8.4 PA Screen Supply

Repeat procedure of 5.4.8.3, except connect Triplett across A14E5 and A14E4. Nominal voltage read should be 680 V d-c.

PA Screen voltage is read on TEST METER, SCREEN V position. Open all circuit breakers. Reconnect PA and modulator tubes removed in 5.4.8.1.

6.0 INITIAL ADJUSTMENTS

6.1 Exciter

Set crystal selector switch to position 1.

6.2 Potentiometer Adjustments

Set MOD 1 and MOD 2 DRIVE potentiometers fully clockwise.
Set MOD 1 and MOD 2 BIAS potentiometers fully counter-clockwise.

7.0 TEST REQUIREMENTS

7.1 Preliminary Tests

As detailed in Section 5.

7.2 Initial Adjustments

As detailed in Section 6.

7.3 RF Turn-On and Tuning

7.3.1 Disconnect feedback at A17-Pins 2 and 4.

7.3.2 Depress LOW POWER ON switch and observe r-f output current begins. (Also note correct plate voltage. Observe too that plate current is not excessive. NMT 360ma/550 watt, 260ma/275 watt)

7.3.3 Tune PA grid by adjusting A11C3 for a maximum grid current. Observe A11C3 is tuned at some point within its adjustment range and not at fully open nor fully closed.

7.3.4 After tuning PA Grid, adjust A11R2 such that approximately 2.5-2.7 amps of collector current exists. Then back off A11R2 until grid current just starts to decrease. At this point, collector current will be 2.3 to 2.5 amperes d-c.

7.4 Modulator Static Adjustment

Depress HIGH POWER ON switch. Adjust MOD 1 BIAS and MOD 2 BIAS potentiometers to set the modulator cathode current at 100 mA per tube.

This is accomplished by adjusting both tubes to as near cut-off as the Bias adjusts will allow. Note static current Io at this point. Then increase Mod 1 until a reading of 100 ma +Io/2 is read on Mod Cathode Current Meter. Then adjust Mod 2 adjust for a 200 ma cathode current reading.

7.5 Power Output

7.5.1 Power Adjust

After insuring that proper line voltage exists, check to be sure that the limit stops on motor B4 allow the adjust Powerstat, T3, to be adjusted through its entire range.

Depress HIGH POWER ON switch. With power control switch, A1S9, in MANUAL position, run POWER ADJUST through its entire range and record output power at each extreme. Then set output power for 1.10 kW.

Depress LOW POWER ON switch and run POWER ADJUST through its entire range and record output power at each extreme. Then, for the 500 W cutback model, set the output power for 550W. (Set the 250 W cutback model for 275 W.)

7.5.2 Servo Power Control

If the servo power control option has been chosen, check line voltage to see that the proper nominal value is present. With control in MANUAL and with proper power output, install the digital voltmeter (Test Equipment, Item No. 11) between A6R30-2 and ground. Close both circuit breakers and depress the LOW POWER ON switch. Set low power adjust pot (A6R28) to give a zero millivolt reading. Remove the voltmeter and record the antenna current. Put POWER CONTROL switch in AUTOMATIC and note no movement in motor B4 and no change in antenna current. Return POWER CONTROL to MANUAL and set antenna current to a lower value than nominal using the manual power adjust. Return POWER CONTROL to AUTOMATIC and observe that line current returns to nominal. Return to MANUAL and reset antenna current higher than nominal. Again note that the current returns to nominal in the AUTOMATIC position.

Repeat above paragraph for the high power condition, adjusting A6R29 for the zero millivolt reading.

7.6 PA Efficiency

Obtain PA input power as the product of plate current and plate voltage. Efficiency should be at least 72% at both high and low power operation.

7.7 Modulation Characteristics

With power at 1.1 kW (carrier cond) note the voltage at J3. It should be approximately 12 V.P.P. when the 334A is connected and peaked. To adjust move Pin 3 on L-15 after removing output network cover. Repeat for the lower power mode, adjusting Pin 4 for an identical output.

NOTE: UNDER NO CIRCUMSTANCES SHOULD THE VOLTAGE AT J3 EXCEED 20V P.P. UNDER CARRIER CONDITIONS

7.9 Heat Run

Operate transmitter over an eight hour period at full power output and with normal program modulation. After 30 minutes of operation, remove power and check all components for signs of overheating.

After eight hours of operation, observe that meter indications are close to those recorded in preceding section. Remove power and again check all components for signs of overheating.

7.10 Tube Serial Numbers

Record serial numbers of tubes V1, V2, V3, and V4.

7.11 Special Changes

Record any special changes made in the transmitter which deviate from standard drawing configuration.

7.12 Test Data Approval

Obtain signature approval of test supervisor or cognizant engineer.

7.7.2.2 Noise Level

Determine noise level with 334A distortion analyzer.

7.7.2.3 Distortion

Determine distortion as in 7.7.1.1 for high power operation, except record values for 25, 50, and 95% modulation.

7.7.2.4 Response

Measure response as in Section 7.7.1.2 at high power operation, except at 25, 50, and 95% modulation.

7.7.2.5 Carrier Shift

At high power operation, determine carrier shift at 95% modulation, 400 Hz.

7.7.2.6 Peak Dissymmetry

Determine peak dissymmetry at high power operation, 1000 Hz, 95% modulation.

7.7.2.7 Low Power Operation

Repeat Sections 7.7.2.1 through 7.7.2.6 at low power operation.

7.8 Meter and Test Point Indications

7.8.1 Full Power Meter Readings

Record meter indications for high power, unmodulated operation. Also record modulator current and output power indications at 1000 Hz, 100% modulation. Note that values are closely within range for normal indications.

7.8.2 Reduced Power Meter Readings

Repeat measurements recorded above, except for low power.

7.8.3 Test Point Voltages

Record voltage levels at indicated test points for full power operation unmodulated. Note agreement with normal indications given in table. Several other voltage indications are given as general troubleshooting information in the tables on pages 41 and 42.

7.7.1 Performance Without Feedback

7.7.1.1 Audio Frequency Distortion

Using the distortion analyzer connected at the modulation monitor r-f input, determine audio distortion over the range 50 Hz - 10 KHz at 50% modulation in high power operation. Set MOD 1 and MOD 2 DRIVE potentiometers by modulating 95% at 7500 Hz and adjusting one of the potentiometers to yield minimum distortion. One of the potentiometers will remain full clockwise.

CAUTION: In this step and in subsequent distortion measurements, the Type 334A distortion analyzer should be driven from the transmitter modulation monitor sample with connection made at the analyzer r-f input. The modulation monitor should be disconnected during these measurements. An oscilloscope may be connected at the analyzer input, but the X10 isolation probe should be employed.

7.7.1.2 Audio Frequency Response

Measure audio frequency response over the range 30 Hz to 10 KHz at 50% modulation for high power operation. This is done by maintaining 50% modulation at all frequencies and observing the variation of input level with frequency. Normalize input levels with reference to 1 KHz. Response should be made holding modulation level constant as indicated on modulation monitor. (Monitor should be removed for distortion and noise tests.)

7.7.1.3 Input Level

Determine audio input level necessary for 100% modulation at 1000 Hz for high power operation.

7.7.1.4 Low Power Operation

Repeat 7.7.1.1, 7.7.1.2, and 7.7.1.3 at low power.

7.7.2 Performance with Feedback

Restore feedback by reconnecting leads at A17 Pins 2 and 4.

7.7.2.1 Input Level

Determine input level necessary for 100% modulation at 1000 Hz for high power operation. Determine and record amount of feedback.

Type _____

Unit S/N _____

Date _____

Technician _____

8.0 TEST DATA FOR COLLINS TYPE 820D-1 AM BROADCAST TRANSMITTER, PART NUMBER 522-3391-00

8.1 Preliminary Tests

8.1.1 Visual Inspection

Complete	_____ Ck
Interlocks and ground switches adjusted	_____ Ck

8.1.2 Ohmmeter Checks

8.1.2.1

ITEM	LIMITS Door Closed	Door Open	
CR1 Pos	NLT 75K ohm	NMT 40 ohm	_____ Ck
A14CR1 Pos	NLT 20K ohm	NMT 175 ohm	_____ Ck
A14CR2 Pos	NLT 80K ohm	NMT 175 ohm	_____ Ck
A13CR1 Neg	NLT 200 ohm	----------	_____ Ck
A12CR1-2	NLT 30 ohm	----------	_____ Ck
CR2 Neg	NLT 20K ohm	----------	_____ Ck
A14CR1 Neg	NMT 20 ohm	----------	_____ Ck
A14CR2 Neg	NMT 2 ohm	----------	_____ Ck
A13CR1 Pos	NMT 20 ohm	----------	_____ Ck
A12CR4-2	NMT 5 ohm	----------	_____ Ck

8.1.2.2 Capacitor Grounds

ITEM	LIMITS	
C30	NMT 20 ohm	_____ Ck
A14C3	NMT 20 ohm	_____ Ck
A14C4	NMT 20 ohm	_____ Ck
A14C5	NMT 5 ohm	_____ Ck
A14C6	NMT 5 ohm	_____ Ck
A12C2	NMT 5 ohm	_____ Ck
A13C2	NMT 20 ohm	_____ Ck

8.1.2.3 AC Line

ITEM	LIMITS	
K1	NLT 5 ohm	_____ Ck
K2, K2 and K5, K2 and K6	NLT 100K ohm, each line to ground	_____ Ck

Type_____

Unit S/N_____

Date_____

Technician_____

8.1.2.4 Filaments

ITEM	LIMITS	
Modulator Filaments	NMT 2 ohms	_____Ck
PA Filaments	NMT 12 ohms	_____Ck

8.1.3 Equipment Interconnections

Complete _____Ck

8.1.4 Control Circuit Operation

Open breakers _____Ck
Apply power _____Ck

8.1.4.1 Filament On

ITEM	LIMITS	MEASURED VALUE	
Close CB1			_____Ck
Proper lamps illuminate			_____Ck
28 vdc supply	26 to 30vdc	____vdc	_____Ck
Test Meter Reading difference	NMT 5%	____%	_____Ck
Door Interlock Function			_____Ck
Filament Properly Energized			_____Ck
Blower and Fan Air Switch Function			_____Ck
Filament Turn-Off Correctly			_____Ck
28vdc between TB4-1 and TB4-2			_____Ck

Type_____

Unit S/N_____

Date_____

Technician_____

8.1.4.2 Filament Voltage Adjustment

Modulator and PA Filaments set at 9.5vac _____Ck

8.1.4.3 Plate On

Low power on function complete and correct _____Ck

Plate and filaments off _____Ck

High power on function complete and correct _____Ck

Filaments off _____Ck

8.1.4.4 Overload Circuit

Set R14 _____Ck

8.1.4.5 Tuning

Frequency dependent components correctly installed _____Ck

Peak PA grid current _____Ck

Power Control switch to manual _____Ck

Power Adjust motor operates correctly; limit stops set _____Ck

PA Tuning motor operates correctly; limit stops set _____Ck

8.1.4.6 Remote Control (Optional)

Open breakers and remove proper straps _____Ck

Close CB1 _____Ck

Blowers and filaments operate _____Ck

Filaments and blowers de-energize _____Ck

Power Adjust motor operates correctly _____Ck

Type_____

Unit S/N_____

Date_____

Technician_____

Reinstall Straps

8.1.5 Output Network Tuning

ITEM	MEASURED VALUE	
Bridge phantom antenna	_____ohms	
Bridge and set C13	_____ohms	
Bridge and set R_{33}	_____ohms	
Bridge and set R_{22}	_____ohms	
Bridge and set R_{22c}	_____j___	
Bridging complete		_____Ck

8.1.6 Power Supplies

8.1.6.1 Plate Supply

ITEM	LIMITS	MEASURED VALUE	
Breakers open, circuit modifications			_____Ck
CB1 and CB2 closed			_____Ck
Low power voltage reading	2250±200vdc (500W cutback) 1550±200vdc (250W cutback)	_____vdc _____vdc	
High power voltage reading	3200±200vdc	_____vdc	
Open all breakers			_____Ck

8.1.6.2 Bias Supply

ITEM	LIMITS	MEASURED VALUE	
Depress FILAMENT ON switch			_____Ck

Type_____

Unit S/N_____

Date_____

Technician_____

ITEMS	LIMITS	MEASURED VALUE
Read bias meter	-155±10V dc	_____vdc
Test meter		_____vdc
Reading difference	±5%	_____%

8.1.6.3 Modulator Screen Supply

ITEM	LIMITS	MEASURED VALUE	
Connect test meter			_____Ck
Close breakers			_____Ck
Low power voltage reading	810±20vdc	_____vdc	
Test Meter Reading		_____vdc	
Difference in readings	±5%	_____vdc	
Open all breakers			_____Ck

8.1.6.4 PA Screen Supply

ITEM	LIMITS	MEASURED VALUE	
Connect test meter			_____Ck
Close breakers			_____Ck
Low power voltage reading	680±20vdc	_____vdc	
Test Meter Reading		_____vdc	
Difference in readings	+5%	_____%	
High power voltage reading	680±20vdc	_____vdc	
Test Meter Reading		_____vdc	

Type _____

Unit S/N _____

Date _____

Technician _____

	ITEM	LIMITS	MEASURED VALUE	
	Difference in readings	±5%	_____%	
	Open breakers			_____Ck
	Circuit connections re-established			_____Ck
8.2	Initial Adjustments			
8.2.1	Exciter			
	Crystal switch set to 1			_____Ck
8.2.2	Potentiometer Adjustments			
	Complete			_____Ck
8.3	RF Turn-On and Tuning			
8.3.1	Feedback disconnected			_____Ck
8.3.2	Low power output, correct metering			_____Ck
8.3.3	PA Grid tuned			_____Ck
	PA Grid current	NLT 75mA	_____mA	
8.3.4	Driver Collector Tuned			
	Driver Collector current	NLT 2.0A	_____A	
	RF Line current (low power)	None	_____A	
8.4	Modulator Static Adjustment			
	Cathode current set			_____Ck

Type_____

Unit S/N_____

Date_____

Technician_____

8.5 Power Output

8.5.1 Power Adjust

ITEM	LIMITS	MEASURED VALUE	
High power output:			
Maximum power (a)	NLT 1.1 Nom	_____kW	
Minimum power (b)	NMT .9 Nom	_____kW	
Power range (a-b)		_____kW	_____Ck
Low power output:			
Maximum power (c)	NLT 1.1 Nom	_____kW	
Minimum power (d)	NMT .9 Nom	_____kW	
Power range (c-d)		_____kW	_____Ck

8.5.2 Servo Power Control

ITEM	LIMITS	MEASURED VALUE	
Connect test meter			_____Ck
Close breakers			_____Ck
Low power ant. I error set to zero		_____Amps	_____Ck
Low power ant. I returning from minus		_____Amps	
Difference in readings	±2%	_____%	
Low power ant. I returning from plus.		_____Amps	
High power ant. I error set to zero		_____Amps	_____Ck

Type _____

Unit S/N _____

Date _____

Technician _____

ITEM	LIMITS	MEASURED VALUE
High power ant. I returning from minus		_____Amps
Difference in readings	±2%	_____%
High power Ant. I returning from plus		_____Amps
Difference in readings	±2%	_____%
Open breakers		_____Ck
Test meter removed		_____Ck

8.6 PA Efficiency

ITEM	HIGH POWER LIMITS	HIGH POWER MEASURED	LOW POWER LIMITS	LOW POWER MEASURED
PA Plate Current	None	_____A	None	_____A
PA Plate Voltage	None	_____kV	None	_____kV
PA Plate Input Power	NMT 1.55kW	_____kW	NMT .75kW (550W cutback)	_____kW
			NMT .375kW (275W Cutback)	_____kW
Transmitter Output Power	1.1kW	_____Ck	550W	_____Ck
			or 275W	_____Ck
PA Efficiency	NLT 72%	_____%	NLT 72%	_____%

8.7 Modulation Characteristics

Type _____

Unit S/N _____

Date _____

Technician _____

8.7.1 Modulation Monitor

	Unit	Reading
Adjust high power voltage at j3	$12V_{pp}$ ±1V	____ V_{pp}
Adjust low power voltage at j3	$12V_{pp}$ ±1V	____ V_{pp}

8.7.2 Performance Without Feedback

8.7.2.1 Audio Frequency Distortion Set to then 3%

Adjust for minimum distortion at 7500 Hz _____ Ck

Freq.(Hz)	50% Mod
50	____ %
100	____ %
400	____ %
1000	____ %
5000	____ %
7500	____ %
10,000	____ %

8.7.2.2 Audio Frequency Response

Freq.(Hz)	50% Mod.
30	____ dB
50	____ dB
100	____ dB
400	____ dB
1000	0 dB
5000	____ dB
7500	____ dB
10,000	____ dB

8.7.2.3 Input Level

	LIMITS	MEASURED
Input in dBm	None	____ dBm

8.7.2.4 Low Power Operation

Type_____

Unit S/N_____

Date_____

Technician_____

8.7.2.4.1 Audio Frequency Distortion

Freq.(Hz)	50% Mod.
50	_____%
100	_____%
400	_____%
1000	_____%
5000	_____%
7500	_____%
10,000	_____%

8.7.2.4.2 Audio Frequency Response

Freq.(Hz)	50% Mod.
30	_____dB
50	_____dB
100	_____dB
400	_____dB
1000	0 dB
5000	_____dB
7500	_____dB
10,000	_____dB

8.7.2.4.3 Input Level

	LIMITS	MEASURED
Input in dBm	None	_____dBm

8.7.3 Performance with Feedback

Feedback reconnected _____Ck

8.7.3.1 Input Level

	LIMITS	MEASURED
Input in dBm	+10±2dBm	_____dBm
Feedback	NLT 8dB	_____dB

8.7.3.2 Noise

ITEM	LIMITS	MEASURED
Noise level	NLT-60dB	_____dB

Type_____

Unit S/N_____

Date_____

Technician_____

8.7.3.3 Distortion

Adjust balance for minimum distortion @ 7500Hz. _____Ck

LIMITS: NMT 3%

Freq.(Hz)	25% Modulation	50% Modulation	95% Modulation
50	_____%	_____%	_____%
100	_____%	_____%	_____%
400	_____%	_____%	_____%
1000	_____%	_____%	_____%
5000	_____%	_____%	_____%
7500	_____%	_____%	_____%
10,000	_____%	_____%	_____%

8.7.3.4 Response

LIMITS: ±1.0 dB, 100 to 7500 Hz
±2.0 dB, 50 to 10,000 Hz

Freq. (Hz)	25% Mod.	50% Mod.	95% Mod.
30	_____dB	_____dB	_____dB
50	_____dB	_____dB	_____dB
100	_____dB	_____dB	_____dB
400	_____dB	_____dB	_____dB
1000	0 dB	0 dB	0 dB
5000	_____dB	_____dB	_____dB
7500	_____dB	_____dB	_____dB
10,000	_____dB	_____dB	_____dB

8.7.3.5 Carrier Shift

ITEM	LIMITS	MEASURED
Carrier shift	NMT 3%	_____%

8.7.3.6 Peak Disymmetry

ITEM	LIMITS	MEASURED
Peak disymmetry with respect to negative peak	NMT 2%	_____%

Type _____

Unit S/N _____

Date _____

Technician _____

8.7.3.7 Low Power Operation

8.7.3.7.1 Input Level

	LIMITS	MEASURED
Input in dBm	+10±2 dBm	_____ dBm
Feedback	NLT 8 dB	_____ dB

8.7.3.7.2 Noise

ITEM	LIMITS	MEASURED
Noise Level	NLT-60dB	_____ dB

8.7.3.7.3 Distortion

LIMITS: NMT 3%

Freq.(Hz)	25% Modulation	50% Modulation	95% Modulation
50	_____ %	_____ %	_____ %
100	_____ %	_____ %	_____ %
400	_____ %	_____ %	_____ %
1000	_____ %	_____ %	_____ %
5000	_____ %	_____ %	_____ %
7500	_____ %	_____ %	_____ %
10,000	_____ %	_____ %	_____ %

8.7.3.7.4 Response

LIMITS: ±1.0 dB, 100 to 7500 Hz
±2.0 dB, 50 to 10,000 Hz

Freq. (Hz)	25% Mod.	50% Mod.	95% Mod.
30	_____ dB	_____ dB	_____ dB
50	_____ dB	_____ dB	_____ dB
100	_____ dB	_____ dB	_____ dB
400	_____ dB	_____ dB	_____ dB
1000	0 dB	0 dB	0 dB
5000	_____ dB	_____ dB	_____ dB
7500	_____ dB	_____ dB	_____ dB
10,000	_____ dB	_____ dB	_____ dB

Type_____

Unit S/N_____

Date_____

Technician_____

8.7.3.7.5 Carrier Shift

ITEM	LIMITS	MEASURED
Carrier shift	NMT 3%	_____%

8.7.3.7.6 Peak Disymmetry

ITEM	LIMITS	MEASURED
Peak disymmetry with respect to negative peak	NMT 2%	_____%

Type_____

Unit S/N_____

Date_____

Technician_____

8.8 Meter and Test Point Indications:

8.8.1 Full Power Meter Readings:

Function	Normal Condition	Meter Reading
RF Line Current *0%	4.64A	
RF Line Current *100%	5.69A	
Plate Current	480ma	
Plate Voltage	3100V	
Driver Collector Current	2.4A	
PA Grid Current	80ma	
PA Screen Current	115ma	
PA Screen Voltage	680	
Bias Supply Voltage	-155	
Mod Cath Current 0%	200ma	
Mod Cath Current 100%	464ma	
Mod Screen Voltage	810	
28V Supply Voltage	27	
Power Output **	1.1kW	
Power Input **	1500W	
Efficiency **	73%	

*At 51 ohms load impedance
**Calculated values

8.8.2.1 **Test Point Voltage Readings*:**

Function	Test Points	Normal Indication		Meter Reading
		Equivalent Current	Test Point Voltage	
Mod Filament Voltage	E36 to E37	--	9.5VAC	
PA Filament Voltage	E34 to E35	--	9.5VAC	
Mod Cath Current (No Mod)	J7 to J6	200ma	.2V	
PA Grid Current	J4 to J5	80ma	.4V	
PA Screen Voltage	C6-1 to Ground		680V	
Driver Collector Current	A11R3-1 to A11R3-2	2.5A	1.25V	
A3Q3 Emitter Current	A3R27 to Ground	7ma	3.6V	
A3Q4 Emitter Current	A3R28 to Ground	7ma	3.6V	

*Recorded at full power, unmodulated

COLLINS

Type
Unit S/N
Date
Technician

NO. 569-2548-000

Type_____

Unit S/N_____

Date_____

Technician_____

8.8.2 Reduced Power Meter Readings:

Function	Normal Condition 550	Normal Condition 275	Meter Reading
RF Line Current * 0%	3.28A	2.32A	
RF Line Current * 100%	4.03A	2.84A	
Plate Current	338ma	235ma	
Plate Voltage	2200V	1550V	
Driver Collector Current	2.5A	2.5 A	
PA Grid Current	80ma	80ma	
PA Screen Current	140ma	150ma	
PA Screen Voltage	690V	690 V	
Bias Supply Voltage	-155V	-155V	
Mod Cath Current 0%	150ma	130ma	
Mod Cath Current 100%	340ma	240ma	
Mod Screen Voltage	810V	800V	
28 V Supply Voltage	27V	27V	
Power Output **	550W	275W	
Power Input **	736W	364W	
Efficiency	74%	75%	

*At 51 ohms load impedance
**Calculated values

Type_____

Unit S/N_____

Date_____

Technician_____

8.9 Heat Run

30 minutes component check _____Ck
Meter readings correspond to previous readings _____Ck
Eight-hour component check _____Ck

8.10 Serial Numbers

ITEM	SERIAL NO.
Vacuum Tubes:	
V1, 5-500A	_____
V2, 5-500A	_____
V3, 5-500A	_____
V4, 5-500A	_____

8.11 Special Changes

The following special changes were required for this transmitter: