

KSE ALPHABETIC 1961 2007

REVISIONS

APP

HQ-145X TEST PROCEDURE

APPROVED 3-11-63

THE FOLLOWING IS THE COMPLETE TEST PROCEDURE FOR THE HQ-145XA RECEIVER:

- I VOLTAGE MEASUREMENTS
- II RESISTANCE MEASUREMENTS
- III IF ALIGNMENT
- IV RF ALIGNMENT
- V DIAL CALIBRATION
- VI PERFORMANCE MEASUREMENTS
- VII AURAL TEST FOR PERFORMANCE

RECOMMENDED PRODUCTION TESTS TO BE PERFORMED ON EACH RECEIVER:

- III COMPLETE IF ALIGNMENT
- IV COMPLETE RF ALIGNMENT
- V DIAL CALIBRATION
- Via AM SENSITIVITY AT ONE FREQUENCY IN EACH BAND
- b CW SENSITIVITY AT 4.5 mc
- c POWER SENSITIVITY AT 4.5 mc
- d AVG MEASUREMENT AT 4.5 mc
- VII AURAL TEST

I VOLTAGE MEASUREMENTS

TUBE SOCKET VOLTAGES ARE MEASURED FROM TUBE SOCKET PINS TO CHASSIS WITH A VACUUM TUBE VOLTMETER. CONDITIONS AND NORMAL VALUES ARE SHOWN IN TABLE 1 OF SHEET

II RESISTANCE MEASUREMENTS

TUBE SOCKET PIN TO CHASSIS RESISTANCE MEASUREMENTS ARE MADE WITH A VACUUM TUBE VOLT-OHMETER. CONDITIONS AND NORMAL VALUES ARE SHOWN IN TABLE 2 ON SHEET

III IF ALIGNMENT (USE ALIGNMENT TOOLS, GENERAL CEMENT CO. NO. 5097 and NO. 282 OR EQUAL)

A THE IF ALIGNMENT REQUIRES THE USE OF A SWEEP FREQUENCY SIGNAL GENERATOR AT 455 Kcs FOR ALL 455 Kcs TRANSFORMER WINDINGS.

THE 3035 kcs COILS LOCATED IN TRANSFORMERS T-5 AND T-6 SHALL BE PEAK ALIGNED WITH THE AID OF THE CRYSTAL CONTROLLED 3035 Kcs GENERATOR IN THE USUAL MANNER.

B CONNECT THE OUTPUT CABLE OF THE SWEEP GENERATOR TO THE BUS LEAD OF THE 6BE6 1st MIXER GRID. CONNECT THE OSCILLOSCOPE LEADS ACROSS THE SHIELDED CABLE WHICH CONNECTS THE NOISE LIMITER SWITCH WIRING TO THE VOLUME CONTROL.

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C SET FRONT PANEL CONTROLS AS FOLLOWS:

SLOT FREQUENCY	CLOCKWISE
SLOT DEPTH	CLOCKWISE
FUNCTION SWITCH	RECEIVE
PHASING CONDENSER	CENTER
SELECTIVITY	"0"
ANTENNA COMPENSATION	CENTER
MAIN TUNING	4 Mcs
BAND SWITCH	1.6 - 4.0 Mcs
AVC SWITCH	OFF
NOISE LIMITER	OFF
BANDSPREAD DIAL	MAIN DIAL CALIBRATION POINT
RF GAIN	MAXIMUM
AUDIO GAIN	MINIMUM
BFO	MID-POSITION

D ROUGHLY ALIGN ALL 455 Kcs WINDINGS WITH THE SELECTIVITY SWITCH IN POSITION "0" (TOP ADJUSTMENTS OF ALL IF CANS PLUS BOTTOM BUGS OF T9, T10 and T11). TURN SELECTIVITY SWITCH TO POSITION "1" AND ADJUST T8 (CRYSTAL FREQUENCY). TURN SELECTIVITY SWITCH TO POSITION "0" AND ADJUST PHASING OF SWEEP GENERATOR SO THAT BOTH TRACES COINCIDE. TURN TO POSITION "0" AND PEAK ALIGN ALL COILS SO THAT THE TRACES COINCIDE BOTH IN AMPLITUDE AND PHASE. RECHECK CURVE ON SCOPE IN POSITION "4" AND POSITION "0" and "1". THE PROPER ALIGNMENT OCCURS WHEN THE AMPLITUDE AND PHASE OF BOTH TRACES COINCIDE ON ALL POSITIONS AND THE PHASING CAPACITOR IS SET AT ITS MID-POSITION. SEE TABLE 3.

E TURN SLOT FREQUENCY TO 4.0 AND THE SLOT DEPTH TO MID-POSITION. ADJUST STOP FILTER COIL SO THE HOLD IN THE I-CURVE (SELECTIVITY POSITION "0") IS EXACTLY IN THE MIDDLE OF THE PICTURE WITH SYMMETRICAL TRACES. RETURN BOTH CONTROLS TO NOMINAL POSITIONS. SEE FIGURE 1A.

F TURN FUNCTION SWITCH TO CW. LOOSEN THE SET SCREWS LOCATED ON THE STOP COLLAR OF THE BFO SHAFT. TIGHTEN THE NUT (WITH LOCKWASHER) PASTENING THE THREADED CORE TO THE BFO SHAFT. TURN SHAFT UNTIL ZERO BEAT IS OBTAINED. SEE FIGURE 1B FOR THE ZERO BEAT PATTERN.

LOOSEN KNOB SET SCREW; ADJUST ARROW ON KNOB TO MID-POSITION, AND TIGHTEN THE SET SCREW. ADJUST STOP COLLAR POSITION AND TIGHTEN ITS SET SCREWS.

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- G TURN FUNCTION SWITCH TO 10-30 Mcs BAND AND FEED IN A 3035 Kcs SIGNAL ON MIXER GRID. PEAK ALIGN THE BOTTOM CORES OF T5 AND T6.
 - H WITH THE AVC SWITCH "OFF" AND THE SENSITIVITY CONTROL AT MAXIMUM, GROUND THE 1st MIXER GRID; AND ADJUST THE METER ZERO POTENTIOMETER FOR ZERO READING ON THE "S" METER.
- IV RF ALIGNMENT (USE ALIGNMENT TOOL, GENERAL CEMENT CO. NO. 8282 OR EQUAL)
- A ADJUST THE FOUR OSCILLATOR AND THE THREE RF TRIMMER SCREWS TO APPROX. MECHANICAL SETTINGS, DETERMINED FROM A MODEL OF THE RECEIVER WHICH HAS BEEN PREVIOUSLY ALIGNED OR BY PREVIOUS EXPERIENCE IN THE ALIGNMENT OF HQ-145X RECEIVERS.
 - B ALL RF AND ANTENNA SLUG ADJUSTMENTS ARE MADE FROM THE TOP OF THE SHIELD CANS.
 - C CONNECT THE UNMODULATED SIGNAL GENERATOR OUTPUT CABLE TO THE ANTENNA AND GROUND TERMINALS OF THE RECEIVER, WITH ONE A TERMINAL ADJACENT TO THE G TERMINAL JUMPED TOGETHER.
 - D THE CONTROLS ARE SET THE SAME AS FOR IF ALIGNMENT UNDER IIC, THE SENSITIVITY CONTROL SHOULD BE ADJUSTED AS REQUIRED TO OBTAIN A SUFFICIENT TUBE VOLTAGE READING AND TO PREVENT OVERLOADING.
 - E THE OSCILLATOR ADJUSTMENT IS MADE FIRST. THE RF IS ADJUSTED NEXT TO OBTAIN MAXIMUM AMPLITUDE. THE ANTENNA SLUGS ARE ADJUSTED LAST. A CERTAIN AMOUNT OF INTERACTION WILL OCCUR BETWEEN THE OSCILLATOR AND THE RF ADJUSTMENTS, PARTICULARLY ON THE HIGHER FREQUENCY BANDS. FINAL ADJUSTMENT SHOULD BE ACCOMPLISHED BY COMBINED OR ALTERNATE ADJUSTMENT OF THE OSCILLATOR AND RF FOR MAXIMUM AMPLITUDE.
 - F NOTE THAT THE OSCILLATOR FREQUENCY IN THE HQ-145X IS ALWAYS ON THE HIGH SIDE OF THE SIGNAL FREQUENCY. IT IS NECESSARY TO MAKE SURE THAT THE OSCILLATOR FREQUENCY IS NOT ADJUSTED BELOW THE SIGNAL FREQUENCY WHICH WOULD BE AN IMAGE RESPONSE OF THE SIGNAL.
 - G IT WILL BE NECESSARY TO REPEAT LOW AND HIGH END ALIGNMENT ADJUSTMENTS OF EACH BAND SINCE THE ADJUSTMENTS ARE INTERDEPENDENT. THE PROCESS SHOULD BE REPEATED UNTIL MAXIMUM AMPLITUDE OBTAINS AT BOTH ALIGNMENT FREQUENCIES OF EACH BAND.

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V DIAL CALIBRATION

A THE RECEIVER SHOULD BE WARMED UP FOR AT LEAST ONE-HALF HOUR BEFORE FINAL OSCILLATOR FREQUENCY ADJUSTMENTS ARE MADE FOR DIAL CALIBRATION CHECK.

B MAIN DIAL CALIBRATION - USE A CRYSTAL CALIBRATOR HAVING 100 Kc AND 1000 Kc OUTPUT. SET THE ARBITRARY BANDSPREAD DIAL SCALE TO 100. SET THE FUNCTION SWITCH TO CW. SET THE BFO CONTROL TO ZERO (TRIANGULAR INDICE). SET THE SELECTIVITY CONTROL TO "0". SET THE AVC - MAN SWITCH TO AVC. CHECK TO SEE THAT THE FREQUENCIES AT OR NEAR THE ALIGNMENT FREQUENCIES ARE "ON THE LINE." IF NOT, MAKE MINOR NECESSARY ADJUSTMENTS OF THE SLUGS AND TRIMMERS TO MAKE THEM CORRECT. FOR BANDS .54 to 1.6Mc and 1.6 to 4.0 Mc, CHECK EACH 100 Kc CALIBRATION POINT. FOR BANDS 4.0 to 10.0 Mc and 10.0 to 30.0 Mc CHECK EACH 1 Mc CALIBRATION POINT. RECORD DIAL ERRORS TO NEAREST ESTIMATED 1/10 DIAL DIVISION, PLUS OR MINUS FROM THE DIAL CALIBRATION POINT.

C BANDSPREAD DIAL CALIBRATION - SET THE BANDSPREAD DIAL TO THE HIGH FREQUENCY END OF THE 3.5 to 4.0 Mc BAND (4.0 Mc). TUNE IN A 4.0 Mc SIGNAL ON THE MAIN DIAL TO ZERO BEAT. THE MAIN DIAL SHOULD BE SLIGHTLY ABOVE THE 4.0 Mc LINE, AS INDICATED BY THE BAND MARKER. NOW TURN ONLY THE BANDSPREAD DIAL AND CHECK EACH 100 Kc CALIBRATION, RECORDING THE PLUS OR MINUS DEVIATION FROM THE CORRECT DIAL MARKING TO THE NEAREST ESTIMATED 1/10 DIVISION. REPEAT THIS PROCEDURE FOR THE 7.0 to 7.3 Mc BAND, THE 21 to 21.5 Mc BAND AND THE 28 to 30 Mc BAND. NOTE THAT THE BANDSPREAD SCALES ARE CALIBRATED BETWEEN THE ENDS OF THE AMATEUR BANDS, LISTED ABOVE. THIS WAS DONE TO AVOID HAVING BLANK SECTIONS OF DIAL ON SOME SCALES. IT IS NOT NECESSARY TO CHECK THESE PORTIONS OF THE CALIBRATIONS.

NOTE: SEE TEST SPEC K-39312 SHEETS 4 & 5 FOR MORE DETAILED INFORMATION

VI PERFORMANCE MEASUREMENT

- A OPERATION OF CONTROLS
1. CHECK CORRECT SETTING OF ALL CONTROLS.
 2. CHECK SENSITIVITY AND AUDIO GAIN CONTROLS FOR SMOOTHNESS.
 3. CHECK DIAL LIGHTS.
 4. CHECK OPERATION OF DIALS AND DRIVES.
 5. CHECK BAND SWITCH FOR SMOOTHNESS AND DETENT ACTION.
 6. CHECK SETTING OF MAIN AND BANDSPREAD DIALS FOR ALIGNMENT OF INDICES WITH INDICATOR LINES AND CAPACITOR SETTINGS.
 7. CHECK ANTENNA CAPACITOR DRIVE TO SEE THAT ITS CONTROL KNOB IS PROPERLY SET AND THAT CAPACITOR TRAVELS FROM MIN. TO MAX.
 8. CHECK FUNCTION SWITCH FOR PROPER FUNCTIONING AT EACH OF ITS FOUR SETTINGS.

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B. AM SENSITIVITY 30% MODULATION

1. CONNECT THE OUTPUT OF THE SIGNAL GENERATOR THROUGH A SERIES RESISTOR EQUAL TO 100 OHMS MINUS THE SIGNAL GENERATOR OUTPUT IMPEDANCE, TO THE ANTENNA TERMINAL OF THE RECEIVER AND CONNECT THE GROUND OF THE GENERATOR CABLE TO THE OTHER ANTENNA TERMINAL AND THE GROUND TERMINAL JUMPED TOGETHER AT THE RECEIVER.
2. CONNECT AN OUTPUT METER TO THE RECEIVER SPEAKER TERMINALS AND ADJUST THE OUTPUT METER IMPEDANCE TO 3 OHMS.
3. SET THE RECEIVER CONTROLS AS FOLLOWS:
 SENSITIVITY AS REQUIRED
 SELECTIVITY BFO
 OPERATION SWITCH REC
 BANDSPREAD 100 ARBITRARY SCALE
 LIMITER OFF
 MAN-AVC MAN
 AUDIO GAIN MAX
4. TEST FREQUENCIES
 MEASURE AT OR NEAR THE LOW AND HIGH FREQUENCY ENDS AND THE MIDDLE OF EACH OF THE FOUR MAIN FREQUENCY BANDS.
5. SET THE MAIN DIAL AND THE RANGE SELECTOR TO THE DESIRED FREQUENCY AND ADJUST THE SIGNAL GENERATOR FREQUENCY FOR MAXIMUM OUTPUT. ADJUST THE ANTENNA CAPACITOR FOR MAXIMUM OUTPUT. THE SIGNAL GENERATOR OUTPUT SHOULD BE SET FOR APPROXIMATELY 1 to 2 MICROVOLTS FOR BANDS 2, 3 AND 4 AND APPROXIMATELY 1 MICROVOLT FOR BAND 1, THE .54 TO 1.6 Mc BAND.
6. TURN THE GENERATOR MODULATION SWITCH TO OFF AND ADJUST THE SENSITIVITY CONTROL FOR AN OUTPUT OF 20 MILLIWATTS, (NOISE). TURN THE MODULATION BACK ON AND ADJUST THE GENERATOR OUTPUT FOR 20 MILLIWATTS OUTPUT, (SIGNAL PLUS NOISE). IT MAY BE NECESSARY TO REPEAT THE PROCEDURE TO OBTAIN THE REQUIRED 1 TO 1 RATIO WHEN SWITCHING MODULATION OFF AND ON. RECORD THE GENERATOR OUTPUT AS THE AM SENSITIVITY FOR THAT FREQUENCY.
7. REPEAT THE ABOVE PROCEDURE FOR EACH TEST FREQUENCY.

C. IMAGE REJECTION RATIO

1. THE IMAGE REJECTION RATIO IS MEASURED AT THE HIGH FREQUENCY END OF EACH OF THE FOUR MAIN DIAL BANDS.
2. THE PROCEDURE IS SIMILAR TO THAT FOR AM SENSITIVITY. IF AN INTEGRAL VALUE LIKE 1 OR 10 MICROVOLTS IS USED FOR THE RESONANT SIGNAL FREQUENCY INPUT IT SIMPLIFIES OBTAINING THE RATIO VALUE.
3. TUNE IN THE DESIRED FREQUENCY AND TUNE THE ANTENNA CAPACITOR FOR MAXIMUM OUTPUT. ADJUST THE SENSITIVITY CONTROL FOR 20 MILLIWATT OUTPUT. LEAVE THE RECEIVER UNDISTURBED AND ADJUST THE GENERATOR FREQUENCY TO A VALUE EQUAL TO .91 Mc PLUS THE SIGNAL FREQUENCY. INCREASE THE GENERATOR OUTPUT AND TUNE THE GENERATOR FREQUENCY FOR MAXIMUM OUTPUT FROM THE RECEIVER.

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ADJUST THE GENERATOR OUTPUT TO OBTAIN THE ORIGINAL VALUE OF 20 MILLIWATTS OUTPUT. THE RATIO OF THE GENERATOR OUTPUT VOLTAGE TO THAT ORIGINALLY USED AT THE RESONANT FREQUENCY IS THE IMAGE REJECTION RATIO AT THAT FREQUENCY AND IS TO BE SO RECORDED.

D. CW SENSITIVITY

1. FOR CW SENSITIVITY MEASUREMENT, THE CONTROLS ARE SET AS FOR AM SENSITIVITY EXCEPT THAT THE FUNCTION SWITCH IS SET TO CW POSITION.
2. TUNE IN A 4.5 Mc UNMODULATED SIGNAL FOR ZERO BEAT.
3. TURN THE CW PITCH CONTROL APPROXIMATELY 2 INDICES FROM ZERO, THIS WILL PRODUCE AN OUTPUT OF APPROXIMATELY 2 Kc.
4. ADJUST THE ANTENNA CAPACITOR FOR MAXIMUM OUTPUT. THE SIGNAL GENERATOR OUTPUT SHOULD BE APPROXIMATELY .3 MICROVOLTS.

E. AVC OPERATION

1. SET THE CONTROLS AS FOR AM SENSITIVITY EXCEPT THAT THE SENSITIVITY CONTROL IS ADVANCED TO MAXIMUM, THE AVC-MAN SWITCH IS ON AVC AND THE AUDIO GAIN CONTROL IS ADJUSTED AS REQUIRED.
2. TUNE IN A 2 MICROVOLT, MODULATED SIGNAL AT 4.5 MC AND TUNE THE ANTENNA CAPACITOR FOR MAXIMUM OUTPUT.
3. ADJUST THE AUDIO GAIN CONTROL FOR A ZERO DB READING OF THE OUTPUT METER.
4. INCREASE THE GENERATOR OUTPUT TO 100,000 MICROVOLTS AND RECORD THE DB OUTPUT READING FOR THIS RATIO OF SIGNALS.

F. POWER SENSITIVITY

WITH A 30% MODULATED SIGNAL OF 4.5 Mc AND WITH THE CONTROLS SET AS FOR AM SENSITIVITY EXCEPT WITH BOTH AUDIO GAIN AND SENSITIVITY AT MAXIMUM, TUNE FOR MAXIMUM OUTPUT AND ADJUST THE GENERATOR OUTPUT TO OBTAIN 1 WATT OUTPUT, RECORD THIS VALUE OF INPUT.

VII. AFTER TEST FOR PERFORMANCE

- A. CONNECT AN ANTENNA WIRE AND GROUND TO THE RECEIVER INPUT TERMINALS.
- B. CONNECT A SPEAKER TO THE RECEIVER OUTPUT TERMINALS.
- C. CHECK OPERATION ON ALL FREQUENCY BANDS.
- D. CHECK BOTH AM AND CW OPERATION IN ALL CRYSTAL POSITIONS.
- E. CHECK BOTH 3.2 & 500 Kc SPEAKER AND PHONE OPERATION.
- F. CHECK OPERATION OF ALL CONTROLS.
- G. CHECK APPEARANCE AND THAT LICENSE NOTICE, SERIAL NO. AND TUBE LOCATION MARKING IS PROPERLY IN PLACE.

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TABLE 1. TUBE SOCKET VOLTAGES
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 CONTROLS SET AS SPECIFIED IN PARAGRAPH III -C EXCEPT ON 10-30 MCS BAND AND AUDIO GAIN AT MAXIMUM. 117V AC Line.-No Signal.

TUBE SOCKET	SOCKET PIN NUMBER								
	1	2	3	4	5	6	7	8	9
V1 RF 6BZ6	0	1.55	0	6.3AC	245	105	0	--	--
V2 1st Mixer 6BE6	-1.6 to -7.5	1.2	0	6.3AC	13	80	0	--	--
V3 2nd Mixer 6BE6	-3.1	0	0	6.3AC	18	77	-.66	--	--
V4 IP Ampl. 6BA6	0	0	0	6.3AC	25	98	2.35	--	--
V5 IP Ampl. 6BA6	0	0	0	6.3AC	30	100	2.65	--	--
V6 DET.-NL 6AL5	-2.0	3.2	0	6.3AC	2	0	-2.0	--	--
V7 Audio-BFO 12AX7	190	-205	675	6.3AC	3AC	168	-283	0	0
V8 PWR. Ampl. 6AQ5	0	15	0	6.3AC	25	245	0	--	--
V9 HF Osc. 6C4	100	--	6.3AC	1	1	-2.5 to -3.7	0	--	--
V10 Volt.Reg. OB2	105	--	--	1	25	--	0	--	--

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TABLE 2.

TUBE SOCKET RESISTANCES

CONDITIONS SAME AS IN THE TABLE 1. - TUBE SOCKET RESISTANCES, FROM TEST POINT TO CHASSIS.

TUBE SOCKET	SOCKET PIN NUMBER								
	1	2	3	4	5	6	7	8	9
V1 RF 6BZ6	10K	180	0	--	100K	100K	0	--	--
V2 1st Mixer 6BE6	47K	180	0	--	100K	100K	0	--	--
V3 2nd Mixer 6BE6	22K	0	0	--	100K	100K	100K	--	--
V4 IF Ampl. 6BA6	470K	0	0	--	100K	100K	180	--	--
V5 IF Ampl. 6BA6	0	0	0	--	100K	100K	300	--	--
V6 DET.-NL 6AL5	120K	190K	0	--	0	0	120K	--	--
V7 Audio-BFO 12AX7	600K	47	2.2K	--	100K	100K	47K	200	0
V8 FWR Ampl. 6AQ5	500K	430	0	--	100K	100K	500K	--	--
V9 HF Osc. 6C4	100K	--	--	--	100K	100K	0	--	--
V10 Volt Reg. 0B2	100K	--	--	--	100K	--	0	--	--

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TABLE 4. RF AND HF OSC ALIGNMENT CHART - HQ-145X RECEIVER

NOTE: THE TRIMMER ADJUSTMENTS SHOULD BE THE FINAL ADJUSTMENT FOR EACH BAND.

THERE IS NO RF AMPLIFIER ADJUSTMENT FOR THE .54 - 1.6 mc BAND.

THE LOWER SLUG ADJUSTMENTS OF THE RF AND HF OSC COILS SHOULD BE MADE BEFORE THE TOP SLUGS, AT THE FINAL STEPS OF ALIGNMENT, TO AVOID MOVEMENT OF THE TOP SLUGS.

ADJ SLUG AT .6 Mc WITH ANT CAPACITOR NEAR MAX CAPACITY

ADJ SLUG AT 1.65 Mc WITH ANT CAPACITOR NEAR MID CAPACITY

ADJ SLUG AT 4 Mc WITH ANT CAPACITOR NEAR MID CAPACITY

ADJ SLUG AT 10 Mc WITH ANT CAPACITOR NEAR MID CAPACITY

TOP SLUG ADJ AT 1.65 Mc FOR MINIMUM AMPLITUDE

TOP SLUG ADJ AT 4 Mc

BOTTOM SLUG ADJ AT 1.65 Mc FOR MAXIMUM AMPLITUDE

BOTTOM SLUG ADJ AT 10 Mc

TOP SLUG ADJ AT .6 Mc

TOP SLUG ADJ AT 4 Mc

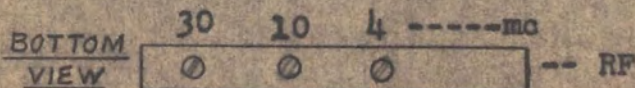
BOTTOM SLUG ADJ AT 1.65 Mc

BOTTOM SLUG ADJ AT 10 Mc

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SLUGS - TOP - FRONT

REAR



ADJ. ON TOP ONLY

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TABLE 3. TYPICAL SWEEP GENERATOR ALIGNMENT CURVES



SELECTIVITY ON "0" III F



SELECTIVITY ON "1" III E

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SELECTIVITY ON "1/2"

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SELECTIVITY ON "1/4" BFO ON ZERO BEAT

SELECTIVITY ON "0" SLOT FREQ. ON "0"

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CRYSTAL CONTROL MEASUREMENT

SENSITIVITY CHECK

1. Switch to "XTAL" position and check power sensitivity at approximately 4.5 MCS. on BAND 3. The figure obtained should be approximately that measured on "VFC" (2-3 uv for 1 watt).

NOTE: If a 5 MCS. crystal is used the check frequency will be 4.545 MC.

OPERATIONAL CHECK

Each band should be checked for proper crystal control operation. From .54 to 10 MCS. (BANDS 1, 2 and 3) the crystal frequency should be 455 KCS. ABOVE the input signal. On the 10-30 MCS. range (BAND 4) the crystal frequency should be 3.035 MCS. BELOW the input signal. This band may also be checked with the oscillator operating ABOVE the input signal if proper crystals are available. Crystals to be used should be of the CR-18/U type for use in a fundamental mode circuit of 32 mm² capacity.

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	APPROVED				
	<i>[Signature]</i>				

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Sheet 11 of 11

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