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RI-6

Complete Test Report
on Production Model
Serial # 3

[redacted]

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remove from file.

50X1

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R.S. - 6

EVALUATION OF PRODUCTION MODEL #3

50X1

2/19/52

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Contents

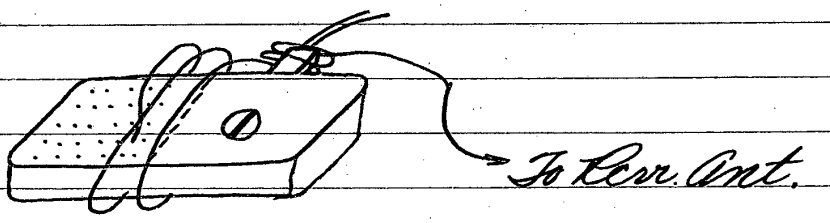
1 - Receiver

1-1 Sensitivity
1-2 Signal to Noise Ratio
1-3 Noise Output

	Raw Noise		10 db Sig/Noise		Input for 5 mw.	
f	BFO off	BFO max	Carrier + mod + noise/noise	BFO max	BFO off	BFO max
(mcs)	AM	CW	AM	CW	AM	CW
3.0	5 μw	1.3 mw	2.3 μv	1.23 μv	5.7 μv	0.58 μv
4.75	10 "	1.6 "	2.2 "	0.94 "	3.9 "	0.37 "
6.5	10 "	2.3 "	2.1 "	1.1 "	3.6 "	0.33 "
6.5	8 "	1.7 "	1.9 "	0.94 "	3.2 "	0.36 "
10.75	10 "	1.0 "	2.3 "	0.75 "	3.8 "	0.40 "
15.0	22 "	1.5 "	2.2 "	1.4 "	2.9 "	0.70 "

1-4 Equivalent Noise Input

Set up: The set is operated from a 6 volt battery inside the screened room on the ground plane. The antenna ground is connected to the ground plane. A 3 foot length of wire is wrapped twice around the jones plug and twice around the power supply, and is used as the receiver antenna.



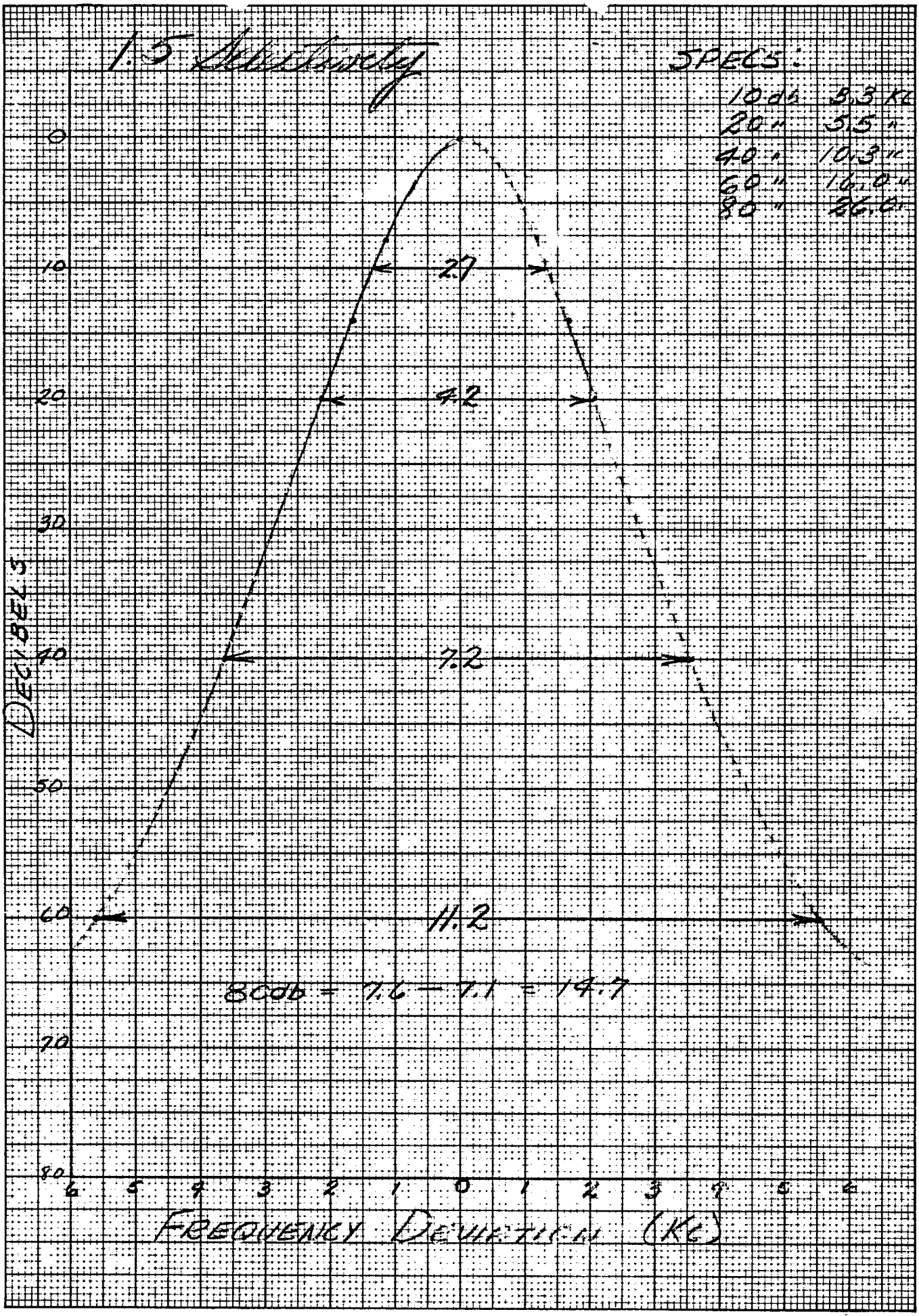
Equivalent input is measured with the same set-up, except that a signal generator modulated 30% at 1000 ~, replaces the antenna wire.

① Equivalent Input, Jones plug not grounded, 10 micro-volts

② Equivalent Input, Jones plug grounded, 1 micro-volt.

1-5 Selectivity

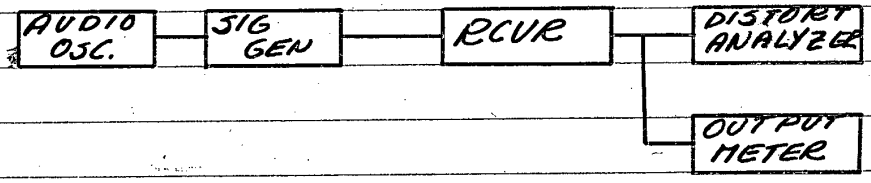
Method of Test: IF frequency to grid of mixer, with BC-221 as standard. Input modulated 400 ~. Output across milliwattmeter. Input increased in db steps and frequency shifted to deliver standard output to wattmeter.



BOOb = 7.6 − 7.1 = 14.7

1-6 Harmonic Distortion

Receiver tuned to 3.4 mcs, gain control set at max. Input from sig gen (mod 30%) varied to provide 5 mw output from receiver. This input averaged about 4 ~~volts~~ microvolts. The BFO was turned off.



f (cps)	FUNDAMENTAL	% DISTORTION 2nd HARMONIC	% DISTORTION 3rd HARMONIC
300	100%	3%	7%
600	100%	1%	2%
1200	100%	1%	0.5%
2400	100%	1%	0.5%

A Study on Cross Modulation Products With Various Means of Measurement.

Method #1:

Two frequencies are chosen so that the sum lies at the high end of the band and the difference lies at the low end of the band. The input from each generator is set at 200,000 ~~u~~ volts, and a resistor whose value is twice that of the receiver input impedance is connected in series with the high side of each generator. The receiver is tuned to the sum or difference frequency and the RF gain controlled backed off until the receiver output is 1.0 mw. The BFO is adjusted for max. One signal generator is turned off and the series resistor in the other one is changed to be the same as the input impedance of the receiver. The sig gen is then tuned to the receiver frequency and ~~the~~ its output adjusted to deliver one mw from the receiver without changing the gain control as previously set. The ~~mw~~ microvolt setting of the sig gen is then divided into 200,000 to calculate db. The procedure is repeated for each band.

Ratios on Set #3:

Frequencies:	Ratios:
1.9 mcs	LELB — 88.4 db
4.9 mcs	HELB — 85.66 db
4.25 mcs	LEHB — 87.12 db
10.75 mcs	HEHB — 81.4 db.

Method #2: This procedure is the same as for method #1, except that when one signal generator is shut off, the resistors are not changed, or disconnected.

Frequencies:	Ratios:	
1.9	LELB	81.95 db
4.9	HELB	81.95 db
4.25	LEHB	80.4 db
10.75	HEHB	76.26 db

Method #3:

This procedure is the same as for method #1 except that the receiver gain is left at max, and the input is decreased simultaneously on each generator until the output is 5 mw. (Noise runs about 1.5 mw). The ratio is calculated from (input/2) over input from one signal to deliver 5 mw.

Frequencies:	Ratios:	
1.9	LELB	106 db
4.9	HELB	103.8 db
4.25	LEHB	105.1 db
10.75	HEHB	100 db.

LELB - Low End of Low Band
HELB - High End of Low Band

Method #4:

The procedure is the same as in method #2, except that the difference frequency lies at the low end of the low band and the sum frequency lies at the high end of the high band.

Frequencies:	Ratios:
4.0	LEHB - 86 db
7.0	HEHB - 80.8 db

1-8 Image Rejection

Conditions: BFO - off, 30% modulation
400~ for 2 mw output.

LB	3.0 mcs	63 db
	6.5 mcs	46.75 "
HB	6.5 mcs	52.4 "
	15 mcs	33.4 "

1-9 I.F. Rejection

Conditions: BFO off. 30% modulation
400 ~ for 2 mw output.

Low Band	3.0 mcs	86.54 db
High Band	6.5 mcs	110.1 db.

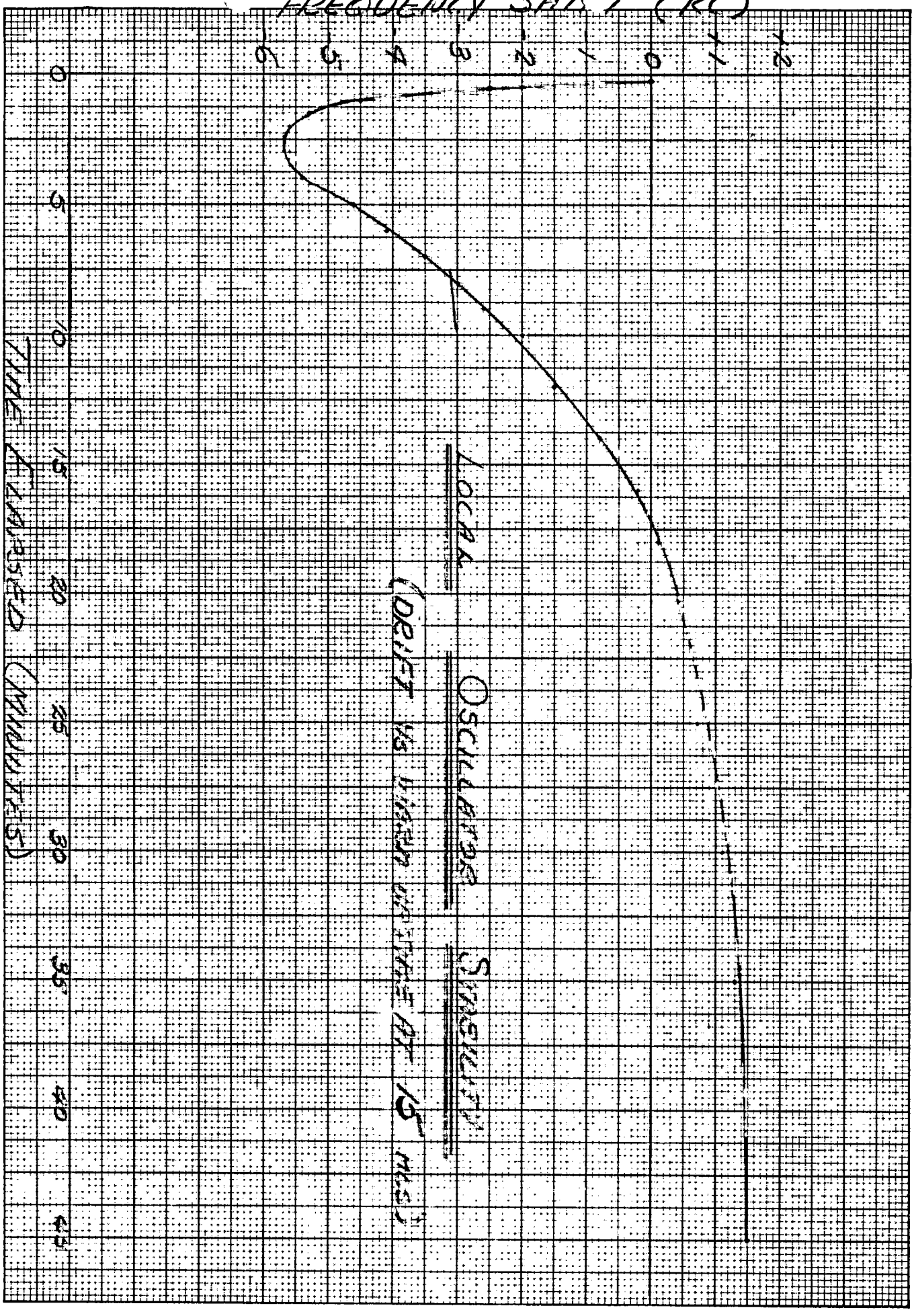
1-10 Resettability

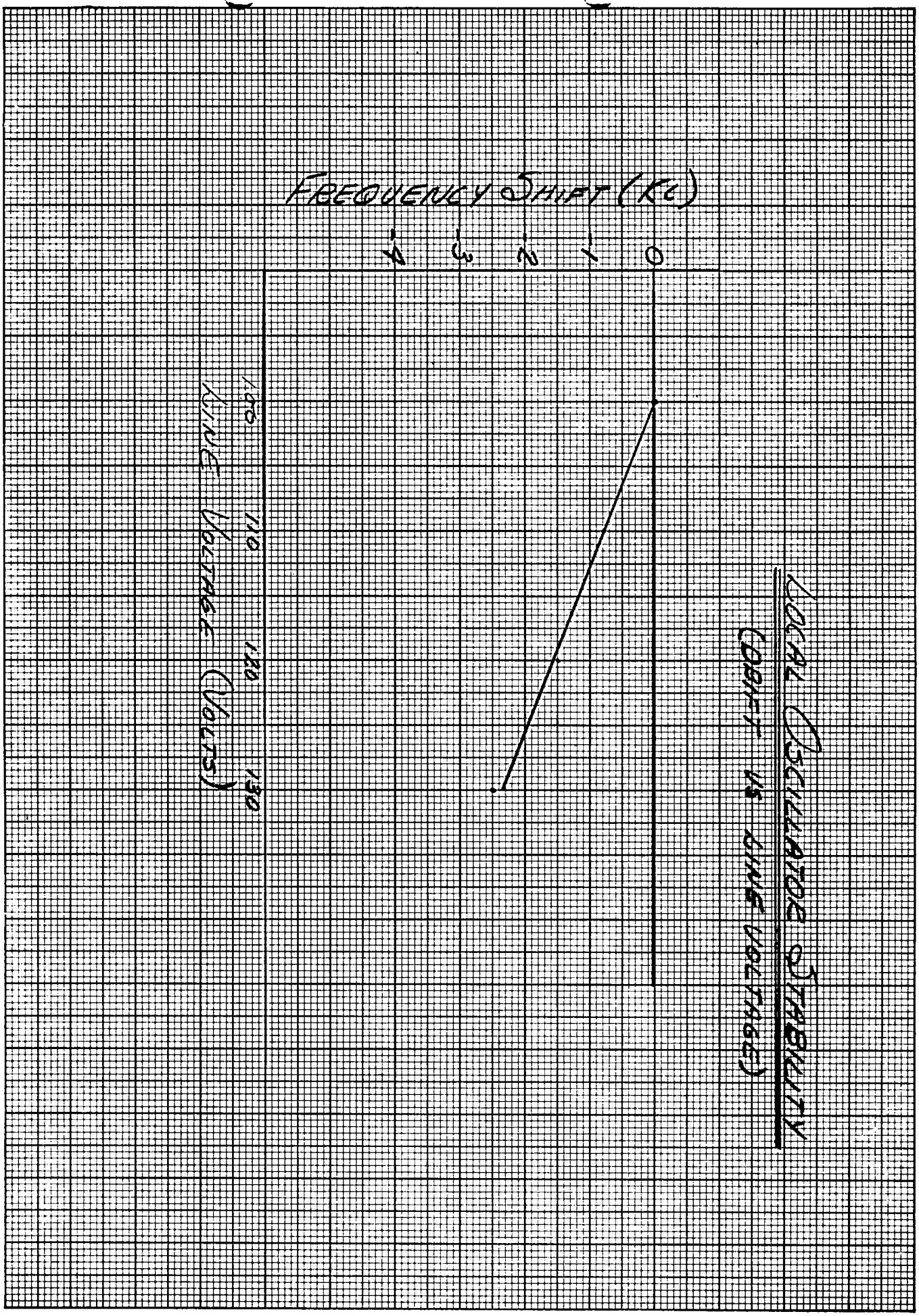
Approach	Freq		diff
CW	6684608	>	522
CCW	6685130	>	696
CW	6684434	>	946
CCW	6685380	>	250
CW	6685130		

Resettability — 0.009%

1-11 Local Oscillator Stability

1.- Warm up - see curve
2.- Line Voltage - see curve
3.- Hand capacity shift - 200 cycles
4.- Deformation of case - 200 cycles
5.- Jarring 500 cycles to 2 Kc.





1-12 Calibration Oscillator Accuracy

Frequency	after 15 secs	500000 ~
"	" 30 secs	500017 ~
"	" 1 min	500019 ~

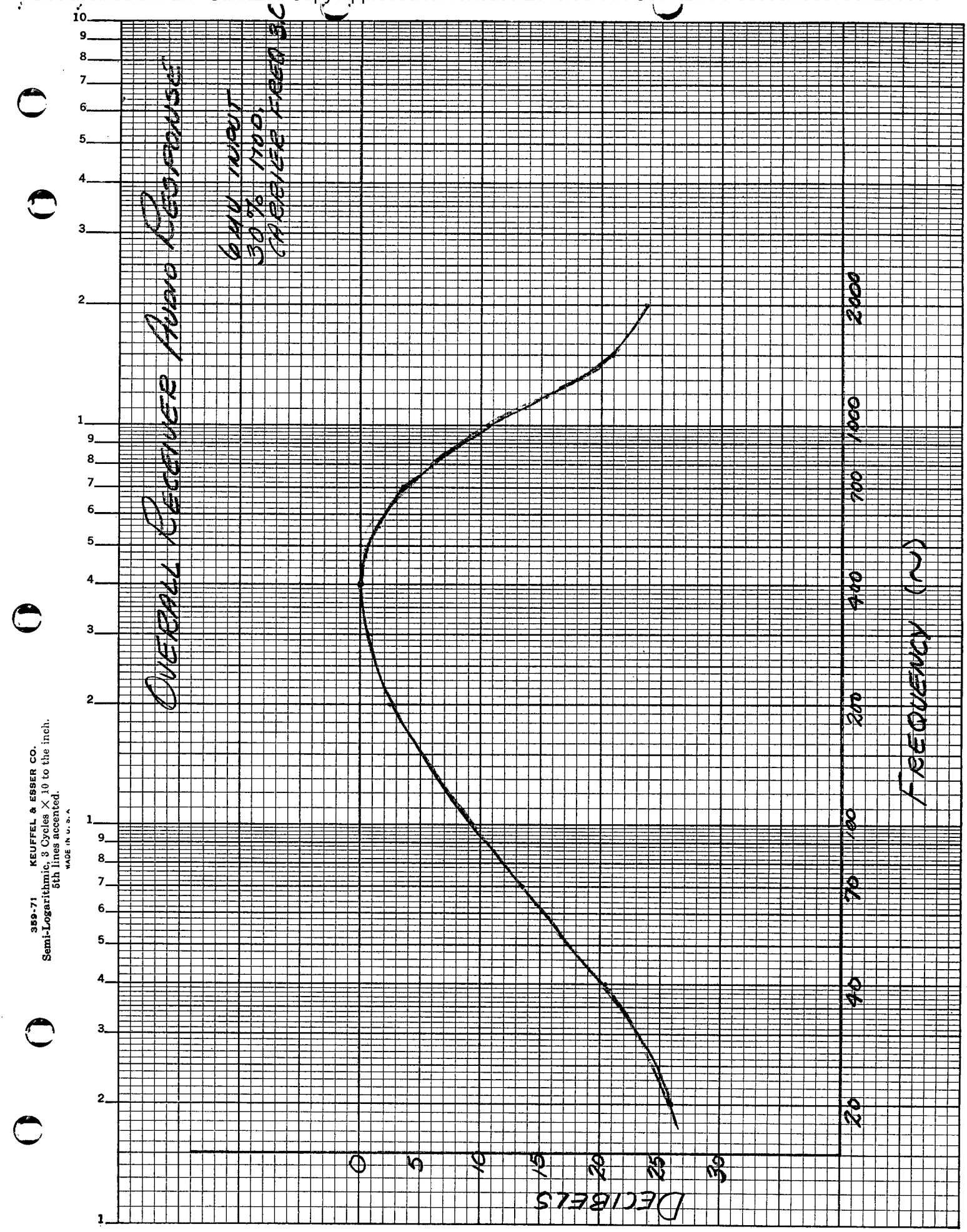
1-13 Local Oscillator Pulling

At 14.9 mcs, reducing gain from max to min pulls the Oscillator 500 cycles

Increasing input from 2μv to 200,000 μv pulls the oscillator 400 cycles

1-14 Audio Response

Method of test: 6μv input, 30% mod
400 ~. Carrier freq
3.0 mcs.



STANDARD FORM NO. 64

50X1

Office Memorandum • UNITED STATES GOVERNMENT

TO : [redacted]

DATE: 10 Feb 1954

FROM : [redacted]

SUBJECT: [redacted]

Thanks, very much, for the use of these.

[redacted]

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1-15 Receiver Calibration

Method:

1. Set fiduciary to center of "ball"
2. Rotate dial to set frequency under hairline.
3. Tune sig gen till sig is heard with receiver.
4. Measure freq with Collins 51-J-2.

DIAL SETTING	TRUE FREQ.	DEVIATION KC.	% DEVIATION
3.0	3.009	9	0.3
4.8	4.800	0	0.0
6.8	6.828	28	0.41
6.5	6.513	13	0.2
10.4	10.388	12	0.115
15.0	15.052	52	0.35

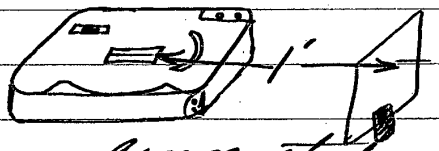
1-16 Beat Frequency Oscillator Operation

When received the BFO range was 456.25 to 496.65 kc. IF center frequency was 454.6 kc.

The BFO shifts from day to day. Has to be recentered each morning. Adjustment screw now protrudes through the bottom of the case.

1-17 Recuvu Radiation

According to Jan I 225
Orientation ?



No antenna connected

I Local Oscillator (AC operation)

f	Fundamental	2nd harmonic	3rd harmonic
3.0	9000 uV/m	140 uV/m	40 uV/m
4.8	7400 "	120 "	40 "
6.8	3000 "	90 "	40 "
6.5	30,000 "	90 "	35 "
10.4	10,000 "	170 "	———
15.0	14,000 "	———	———

II Calibration Oscillator

f	Fundamental	2nd	3rd	4th	
500 kc	4000 uV/m	1000	260	100	

III BFO

f	Fund	2nd	3rd
BFO	1000 uV/m	———	———

1-17 Receiver Radiation

Co-ax interconnection between receiver and Stoddart, with impedance match at Stoddart.

I Local Oscillator

f	FUND.	2nd	3rd
3.0	1700 uv	200 uv	30 uv
4.8	10 000 "	25 "	16 "
6.8	1800 "	400 "	225 "
6.5	9000 "	140 "	70 "
10.4	10,000 "	250 "	—
15.0	30,000 "	—	—

II Calibrating Oscillator

f	Fund	2nd	3rd	4th	
500 kc	250 uv	200 uv	140 uv	90 uv	

III BFO

f	Fund	2nd	3rd
BFO	—	—	—

1-18 Crystal Operation of Rcvr.

Procedure:

① Insert crystal and tune receiver 500 kc below operating frequency of crystal.

AM ② Modulate 30%, 1000 ~ and adjust rcvr for max output, tracking along with sig gen. Adjust for 5 mw output at rcvr gain max.

CW ③ Same procedure as for AM, except that modulation is removed from carrier, and BFO is adjusted for max.

OPERATING FREQ OF CRYSTAL	f SIG GEN	AM SENSITIVITY FOR 5 mw OUTPUT	CW SENSITIVITY FOR 5 mw OUTPUT
4.0 I	3.5	4.5 uv	0.65 uv
8.0 II	7.5	4.5 "	0.70 "
12.0 III	11.5	10.5 "	2.4 "

2 - Transmitter

- 2-1 Power Output Matrix
- 2-2 Effecency
- 2-3 Crystal Current
- NO 2-4 Crystal Input Capacity
- 2-5 Harmonic Radiation
- 2-6 Keying Characteristics

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Power Output

f	73 Ω			146 Ω			240 Ω			600 Ω			1000 Ω		
	120 AC	6.3 (5.9 AT C.T.)	6.0 (5.6 AT CT)	120 AC.	6.3 (5.9 AT CT)	6.0 (5.6 AT CT)	120 AC	6.3 (5.9 AT CT)	6.0 (5.6 AT CT)	120 AC	6.3 (5.9 AT C.T.)	6.0 (5.6 AT CT)	120 AC	6.3 (5.9 AT C.T.)	6.0 (5.6 AT C.T.)
3	8.0	7.75	6.95	9.2	8.8	7.8	10	9.6	8.3	9.7	9.1	8.3	10.0	9.1	8.6
6 II	10	10	8.9	12.2	11.8	10.2	12.7	12.0	10.8	12.0	11.3	10.6	11.2	11.2	10.3
5.5	10.1	10		12.2	11.8		12.6	12.5		11.2	12.0		11.2	11.3	
11 III	7.5	8.5		8.0	9.5		8.8	9.5		8.3	9.3		8.3	9.0	
7 LB	9.7	11.2	9.8	12.2	12.2	11.2	12.7	13.0	11.6	12.0	12.6	11.2	11.0	12.0	10.3
7 NB	6.8	6.3	5.5	7.2	7.0	6.1	7.8	7.5	6.5	7.4	7.9	7.1	6.7	7.0	6.4
14 II	9.3	9.0	7.8	10.0	9.5	8.8	10.0	10.0	9.0	9.3	9.5	8.8	8.1	9.5	8.3
15 II	9.3	8.75		10.0	9.5		9.8	9.8		9.3	9.7		8.4	9.0	
8 III	2.8	2.8	2.3	3.3	3.3	2.8	3.5	3.3	2.9	3.6	2.6	3.0	2.9	2.5	1.9
9 III	5.6	4.2	2.6	7.3	4.7	3.0	6.6	5.4	3.2	6.0	4.9	3.3	5.3	4.4	3.4

2-2 Efficiency

f	KEY UP			KEY DOWN				
	E_P	I_P	P_P	$E_{P(v)}$	$I_{P(mA)}$	$P_{P(w)}$	$P_{o(w)}$	%EFF
3.0	360v	25ma	9w	397	53.5	21.2	10.5	50%
14 II	"	"	"	387	57	22.1	10.1	45.7"
9 III	"	"	"	375	57	21.2	3.2	15 "
8 IIII	"	"	"	385	60	23.1	3.46	15

1.- 6.0 volt operation
2.- 240Ω antenna load
3.- Readings taken with transmitter case removed.

2-3 Crystal Current

Crystal current is 7ma as measured with Heston Meter, (0-50 ma).

2-4 Crystal Input Capacity

Test freq - 5.5 mcs
Ant Z - 400 Ω
Measured with Galvin CES-1

C = 24 pf

2-5 Harmonic Radiation

Xmtr Freq	Stoddart f	FI μv/m	%
5.0	5.0	50,000	
5.0	10.0	2000	4.0
5.0	15.0	200	0.4
10.0 II	10.0	45000	
10.0 II	20.0	70	0.156
10.0 II	5.0	40	0.089

Measured with Stoddart NM-20-A using mast antenna at 6'.

2-6 Keying Characteristics

Max Rate with Relay – 30 wpm.
Max Rate without Relay
(Jack completely in) 100 wpm.
Definite "chirping" noticed.
Waveshape looks good with
sloping leading & trailing edges.

3 - General Considerations

3-1 Defects in Set When Received
3-2 Temperature Rise
3-3 Power Consumption
3-4 Power Supply Voltage Measurements
3-5 Battery Charging Rate
3-6 A-C Operation & Conducted Interference
3-7 Battery Operation - Radiated Hash

3-1 Defects in Production Model

Receiver:

1.- Failed to operate for initial hook-up. Trouble traced to a shorted wire. A green wire running from the 3rd IF can to the second detector was punched between the receiver cover and the casting on which the BFO control is mounted. The casting pierced the insulation.

2.- No BFO stop.

3.- Extremely difficult to read the dial. Too much tint on window.

4.- BFO range 456.25 — 496.65 KC. No zero beat.

Transmitter:

1.- Arcing occurred between the transmitter case cover and the high voltage lugs on the terminal strip to which the transmitter cable is terminated.

2.- Poor solder dressing on the pins of the connector plug. One wire not soldered at all!

Adapter Unit:

1 - Poor solder dressing on pins.

3-2 Temperature Rise

Transmit Operation, Key Up.
Line Voltage 120 VAC.

One Houre Elapsed: Ambient 76°F

UNIT	TEMP (°F)	TEMP RISE (°F)	TEMP RISE (°C)
RR	100	24	13.3
RP	120	44	24.4
RT	125	49	27.2
RA	150	74	41.1

Time Elapsed: 4hrs. Ambient 76°F

UNIT	TEMP (°F)	TEMP RISE (°F)	TEMP RISE (°C)
RR	100	24	13.3
RP	130	54	30.0
RT	135	59	32.8
RA	160	84	46.7

3-3 Power Consumption

	Function	Voltage	Current	Power	P.F
DC					
	Receive	6.3 v	11.2 A	70.5 w	—
	Transmit (KO)	6.3 v	11.2 A	70.5 "	—
	Transmit (KO)	6.3 v	10.6 A	66.7 "	—
120 VAC 60 ~	Receive	120 v	.59	63 w	.89
	Transmit (KO)	120 "	.59	63 w	.89
	Transmit (KO)	120 "	.56	60 w	.895
400 cycle operation	Transmit (KO)	105 v	.535	56 w	unity
		(Voltage selector switch on 120 v position)			

3-4 Power Supply Voltage Measurements

A.C. Operation

6X4 Peak to Peak Voltage Loaded (Scope)	2430 Vpp
" " " " " (meter)	2145 Vpp
" " " " Not Loaded (Scope)	2770 Vpp.
" " " " " (meter)	2330 Vpp.
B+ using filter section as load	590 V.O.C.
Full load voltage at Xmtr, (KU)	390 V.O.C
Voltage for Receiver	390 V.O.C.
Max peak-inverse voltage	1076 volts
Normal " " "	876 volts

6.3 Volt Operation

Peak to peak, no load	3500 volts
" " " loaded	2100 volts
B+ using filter section as load	615 volts
Full load voltage at Transmitter	380 "
Voltage for receiver	380 "
Max peak inverse voltage	1140 volts
Normal peak " "	905 volts

3.5 Battery Charging Rate

3 amperes to a full charged storage battery

3-6 A-C. Operation Conducted Interference

Measurements taken in accordance with Jan I 225.

f (recv.)	uV on ac line
3.0	9
4.8	17
6.8	10
6.5	—
10.4	—
15.0	—

3-7. Battery Operation - Radiated Hash

f	Radiated Field (uV/m)	Conducted Noise on cables (peak)
150 KC	19,000 uV/m	270KC > 1 volt
400 KC	800 "	1750 uV
700 KC	200 "	600 "
1 mc	80 "	350 "
2 mc	in noise	75 "
4 mc		50 "
7 mc		80 "
10 mc		80 "
20 mc		30 "

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