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371

RS-6A

PROTOTYPE ACCEPTABILITY REPORT

UNITS #8 + #9

(cont of alignment)

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12/10/53

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I. INTRODUCTION

Two prototype models of the RS-6A Radio Set were submitted, in October to the Analysis and Appraisal Unit of the Research and Development Branch Laboratory of Commar Engineering. Appropriate tests were conducted to determine their acceptability.

II. SUMMARY

The RS-6A is an extended range version (4.5 to 22.0 Mc/s) of the RS-6.

The test results indicate that in general the RS-6A Prototypes meet the requirements of Specification No. 50-A-1006-A. Individual sections of this specification covering the RR-6A and RT-6A are compared to these results in the conclusion of this report. The standard test conditions listed in Section 4.6.1, were followed.

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RS-6A

PROTOTYPE ACCEPTABILITY REPORT

UNITS #8 & #9

12/10/53

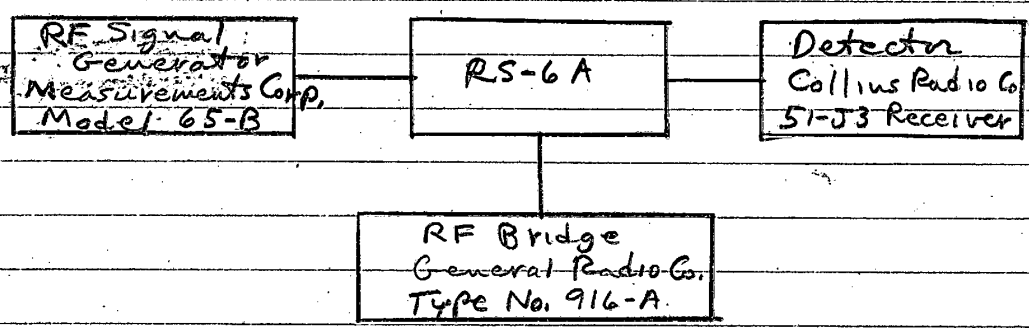
11. RECEIVER TESTS

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1.1. ANTENNA INPUT IMPEDANCE

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Set Up:-



Method of Test:

As per Specification 50-A-1006-A, Sections 4.6.9.3, 4.6.9.1, 4.6.9.2.

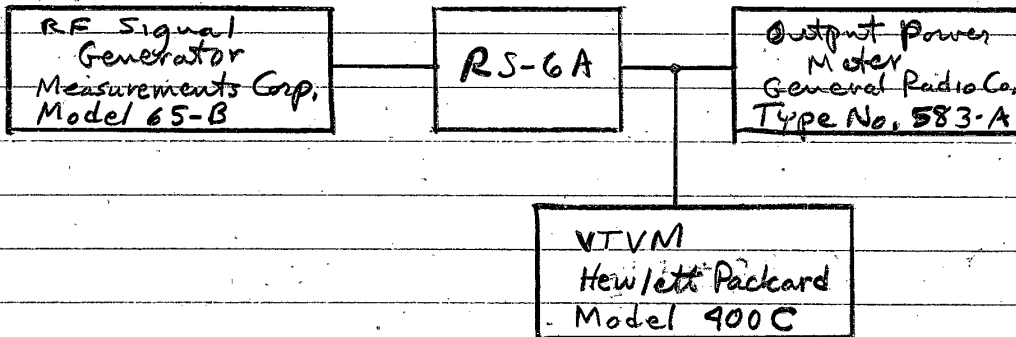
Test Results:

Frequency (Mc/s)	Antenna Impedance (Ohms)
4.5	246
7.0	379
10.0	490
10.0	266
16.0	349
22.0	219

The above test was conducted on Unit #8 and the results meet specifications.

1.2. SENSITIVITY

Set Up:



Method of Test:

As per Specification 50-A-1006-A, Sections
 4.6.2., 4.6.2.1., 4.6.2.2., 4.6.2.2.1., 4.6.2.2.2.,
 4.6.3., 4.6.3.1., 4.6.3.2., 4.6.3.2.1., 4.6.3.2.2.,
 4.6.4., 4.6.4.1., 4.6.4.2.

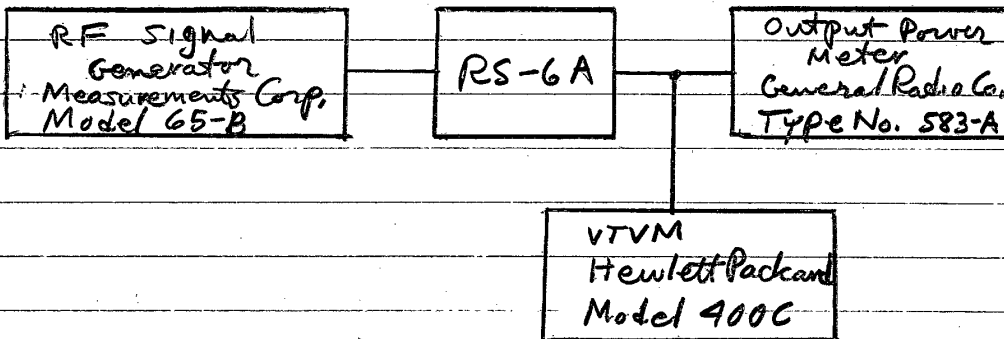
Test Results:

Frequency (Mc/s)	Raw Noise (Milliwatts)		10 db SN (Microvolts)		Raw Sensitivity (MicroVolts)	
	AM	CW	AM	CW	AM	CW
<u>Prototype # 8</u>						
4.5	0.0011	0.25	0.72	0.83	7.5	1.2
7.0	0.0003	0.09	1.05	0.81	10.6	2.9
10.0	0.0009	0.20	0.65	0.87	6.1	1.6
10.0	0.0008	0.23	0.80	1.20	7.9	2.1
16.0	0.0005	0.12	0.58	0.90	4.8	2.1
22.0	0.0056	0.56	0.57	1.09	2.6	3.0
<u>Prototype # 9</u>						
7.0	0.0016	0.36	0.70	1.00	5.5	1.4
16.0	0.0009	0.20	0.53	0.83	3.8	1.4

Except for excessive Raw Noise (CW) the results of the above test are satisfactory.

1.3. BREAK-IN SENSITIVITY

Set Up:



Method of Test:

No specifications given

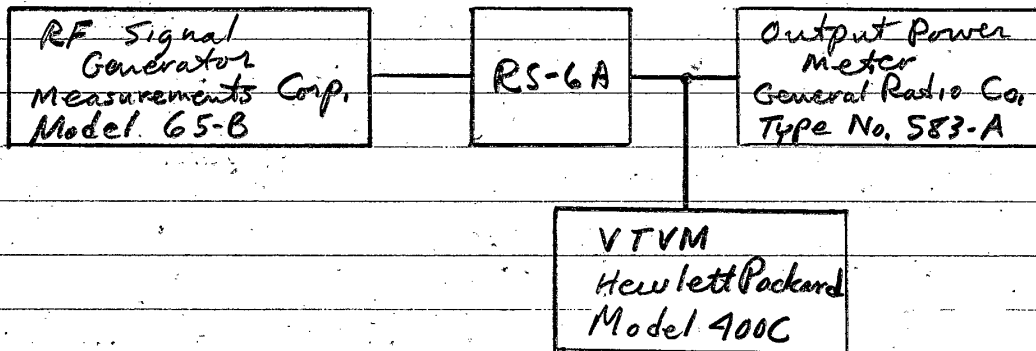
Test Results:

Frequency (Mc/s)	Direct Sensitivity (Microvolts)	Break-in Sensitivity (Microvolts)
4.5	6.5	6.2
10.0	7.0	6.3
10.0	6.2	6.7
22.0	4.3	4.2

The above test was conducted on Unit #8 and the results are considered satisfactory.

1.4. CRYSTAL SENSITIVITY

Set Up:



Method of Test:

As per Specification SO-A-1006-A, Section 4.8.6.

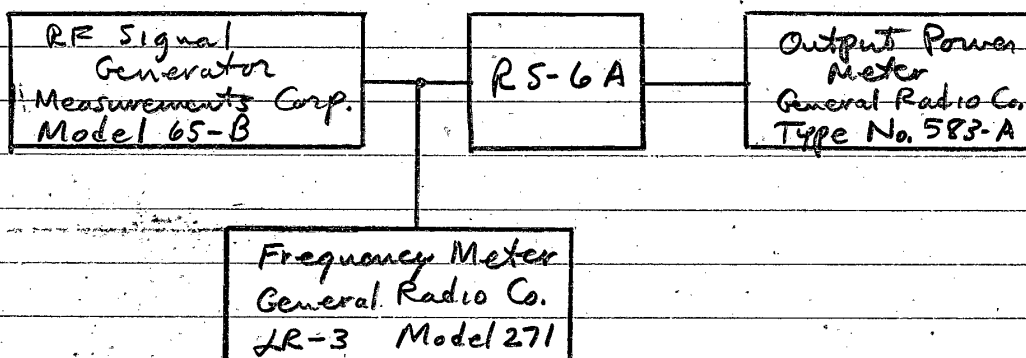
Test Results:

Crystal Frequency (Mc/s)	Harmonic Utilized	Raw Sensitivity-AM (Microvolts)
5.068	1	9.0
5.068	2	7.5
5.068	3	22.0

The above test was conducted on Unit #8 and the results meet specifications.

1.5. SELECTIVITY

Set Up:



Method of Test:

As per Specification 50-A-1006-A, Sections 4.6.12, 4.6.12.1.

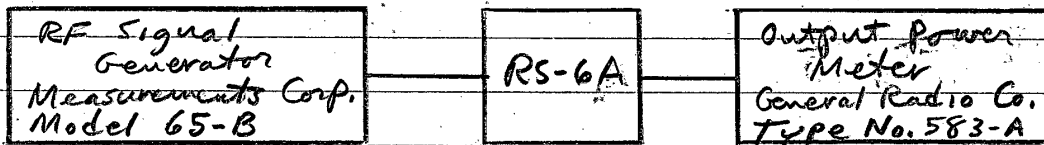
Test Results:

See the curve of Figure #1, Page 16.

The above test was conducted on Unit #8 and the results meet specifications.

1.6. IMAGE REJECTION RATIO

Set UP:



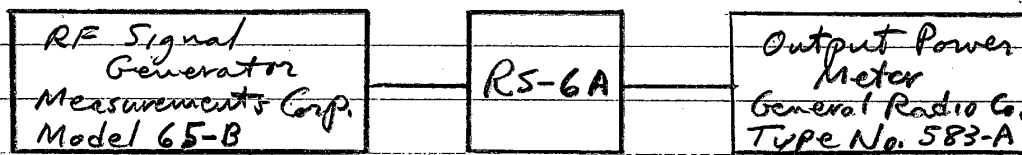
Method of Test:

As per Specification 50-A-1006-A, Sections 4.6.7, 4.6.7.1, 4.6.7.2.

Test Results:

Frequency (Mc/s)	Rejection (db)
Prototype #8	
4.5	58.7
7.0	42.1
10.0	40.4
10.0	50.7
16.0	33.3
22.0	33.6
Prototype #9	
7.0	45.8
16.0	31.3

The results of the above test meet specifications (see conclusion).

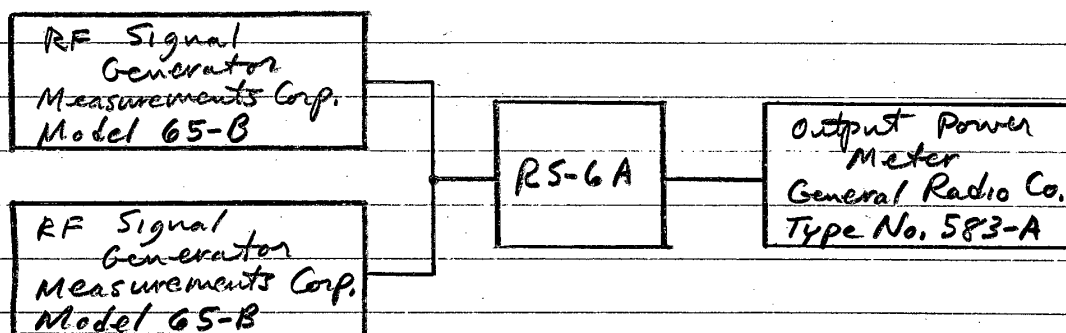
I. F.1.7. ~~REJECTION RATIO~~ REJECTION RATIOSet Up:Method of Test:

As per Specification 50-A-1006-A, Sections
4.6.6, 4.6.6.1, 4.6.6.2.

Test Results:

Frequency (Mc/s)	Rejection (db)
Prototype #8	
4.5	92.2
7.0	92.0
10.0	99.8
10.0	92.9
16.0	100.0 +
22.0	100.0 +
Prototype #9	
7.0	95.8
16.0	90.9

The results of the above test meet
specifications.

1.8. CROSS MODULATION DISTORTION PRODUCTSSet Up:Method of Test:

As per Specification 50-A-1006-A, Sections
4.6.10., 4.6.10.1, 4.6.10.2.

Signal Frequencies..... 2.7 and 7.3 Mc/s (low band)
6.0 and 16.0 Mc/s (high band)

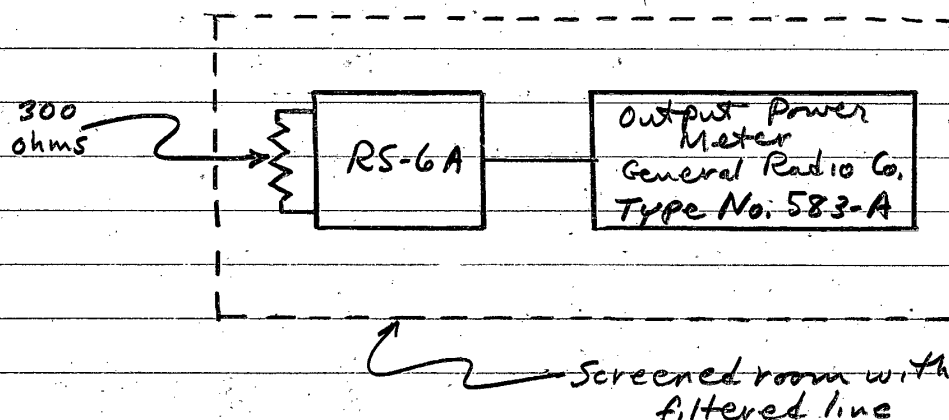
Test Results:

Condition	Rejection (db)
Low band difference frequency (4.6 Mc/s)	100 +
Low band sum frequency (10.0 Mc/s)	100 +
High band difference frequency (10.0 Mc/s)	100 +
High band sum frequency (22.0 Mc/s)	100 +

The above test was conducted on Unit #8 and the results meet specifications.

1.9. SPURIOUS RESPONSE (INTERNAL)

Set Up:



Method of Test:

No specifications given.

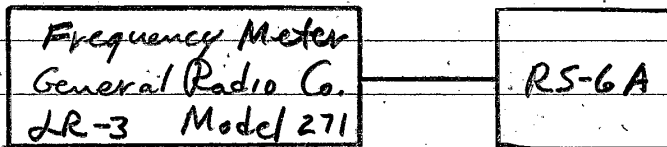
Test Results:

No spurious responses were detected which had a sufficiently high level to be objectionable in operation.

The above test was conducted on Units #8 and #9 and the results are considered satisfactory.

1.10. BFO TUNING RANGE

Set Up:



Method of Test:

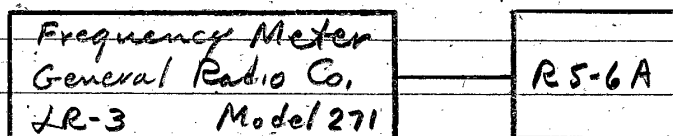
As per Specification 50-A-1006-A, Section 4.8.4.

^{Spec} Test Frequency - 7.0 Mc/s

Test Results:

Tuning Control Setting	BFO Frequency (Kc/s)
Maximum -	451.350
3	452.200
2	453.350
1	454.580
0	454.880
1	456.410
2	457.810
3	458.710
Maximum +	458.610

The above test was conducted on Unit #8 and the results meet specifications.

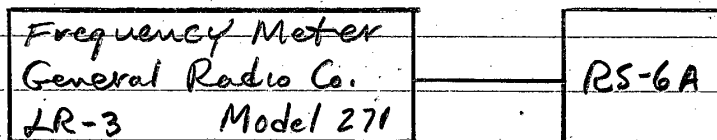
1.11. DIAL CALIBRATIONSet Up:Method of Test:

As per Specification 50-A-1006-A, Section 4.4.3.5.

Test Results:

Frequency (Mc/s)	Error (Kc/s)
4.5	9.8
7.0	28.3
10.0	8.5
10.0	3.3
16.0	79.7 ←
22.0	17.8

The above test was conducted on Unit #8 and the results meet specifications.

1.12. RESETTABILITYSet Up:Method of Test:

No specifications given

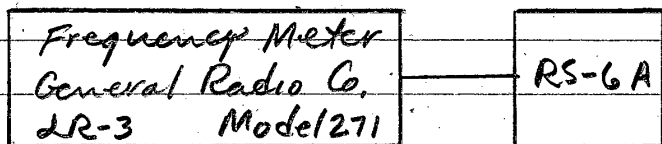
Test Results:

Frequency (Mc/s)	Maximum Error (%)
7.0	0.14
16.0	0.08

The above test was conducted on Unit #8
and the results are considered satisfactory.

1.13. CRYSTAL CALIBRATOR

Set Up:

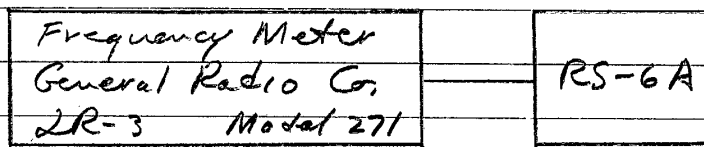


Method of Test:

No specifications given.

Test Results:

In both Units #8 and #9 the calibration oscillator's accuracy and readability were found adequate. ~~Accuracy~~
~~Accuracy~~

1.14. FREQUENCY STABILITYSet UP:Method of Test:

As per Specification 50-A-1006-A, Section 4.6.14.

Test Results:

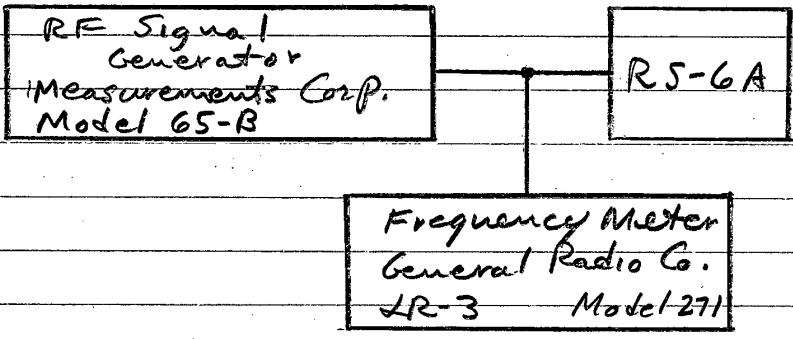
*Elapsed Time (Minutes)	Frequency (Mc/s)		Drift (cps)	
	#8	#9	#8	#9
0	7.062960	6.999740	0	0
5	7.061350	6.993800	-1610	-940
10	7.060060	6.993280	-2900	-1460
15	7.059190	6.992760	-3770	-1980
30	7.057800	6.992630	-5160	-2110
45	7.056580	6.992770	-6380	-1970
60	7.055920	6.993200	-7040	-1540
		Error -	0.099%	0.022%
0	16.077200	16.113500	0	0
5	16.078800	16.114700	1600	1200
10	16.079200	16.115400	2000	1900
15	16.079400	16.116000	2200	2500
30	16.080300	16.117100	3100	3600
45	16.081000	16.118800	3800	5300
60	16.081500	16.120800	4300	7300
		Error -	0.027%	0.045%

* At zero elapsed time the set had been on for a ten minute warm up period.

The results of the above test do not meet specifications.

1.15. OSCILLATOR FREQUENCY PULLING

Set Up:



Method of Test:

As per Specification 50-A-1006-A, Section 4.6.15,

Test Results:

At 7.0 megacycles, when the gain control setting is changed from maximum to minimum, the oscillator shift is negligible. It is also negligible when increasing the RF signal input level from 2 to 200,000 microvolts.

At 15.0 megacycles, when the gain control setting is changed from maximum to minimum, the oscillator shift is approximately 750 cycles. Increasing the RF signal input level from 2 to 200,000 microvolts causes a shift of approximately 900 cycles.

(next page)

~~The above test was conducted on Unit #8. The results do not meet specifications.~~

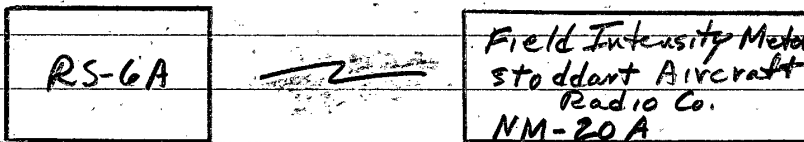
(Continued)

At 22.0 megacycles, when the gain control setting is changed from maximum to minimum, the oscillator shift is approximately 12,000 cycles.

The above test was conducted on Unit #8. Spot checks ~~showed a similar~~ on Unit #9 showed the pulling to be ~~comparable~~ ^{comparable}. The results ~~at 15.0 and 22.0 megacycles~~ do not meet specifications at 15.0 and 22.0 megacycles. Recommendations have been made for improvement of this situation and oscillator radiation in Section 1.16.

1.16. OSCILLATOR RADIATION

Set Up:



Method of Test:

As per Specification 50-A-1006-A, Sections 4.6.8, 4.6.8.1, 4.6.8.2.

This test was conducted in a screened room on a ground plane in accordance with JAN-I-225.

Test Results:

Harmonic Relation	Field Intensity (Microvolts/meter)			
	Local Oscillator		BFO	Calibration Oscillator
	5.5 Mc/s	10.5 Mc/s		
Fundamental	14,000	15,000	500	8,000
2 nd Harmonic	450	800	**	800
3 rd Harmonic	330	*	**	140

* Beyond ^{the} range of the Stoddart NM-20A
 ** Below the sensitivity of the Stoddart NM-20A



The above test was conducted on Unit #8. ~~_____~~

The radiation is excessive at the fundamental according to ~~the~~ specification. (next page)

(Cont)

Additional tests were made ~~on Unit #8~~ ^{on Unit #8} ~~with and without an antenna.~~ with and without an antenna. Then the ~~changes~~ ^{modifications} recommended below were made and the tests rerun ~~with the following results.~~ with the following results.

34
10
14

Frequency (Mc/s)	Field Intensity (Microvolts/meter)	
	No antenna	27 ft. antenna
Before modification		
15.0	3,500	45,000
22.0	5,000	80,000
After modification		
15.0	20,000	20,000
22.0	8,000	8,000

27 ft. antenna

Recommendations:

The grid lead for the RF stage should be rerouted so as to avoid coupling with the oscillator leads to the crystal socket.

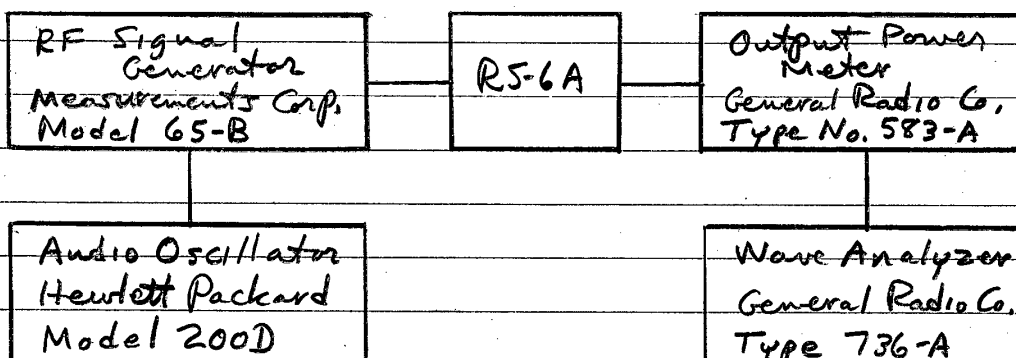
~~The~~

The antenna lead should be kept as far ^{away} as possible from the oscillator circuits.

8P
31
4P
-18
22

1.17. DISTORTION

Set Up:



Method of Test:

As per Specification 50-A-1006-A, Sections 4.6.5., 4.6.5.1., 4.6.5.2.

Test Frequency 7.0 Mc/s
Fundamental Audio Frequency... 150 cps

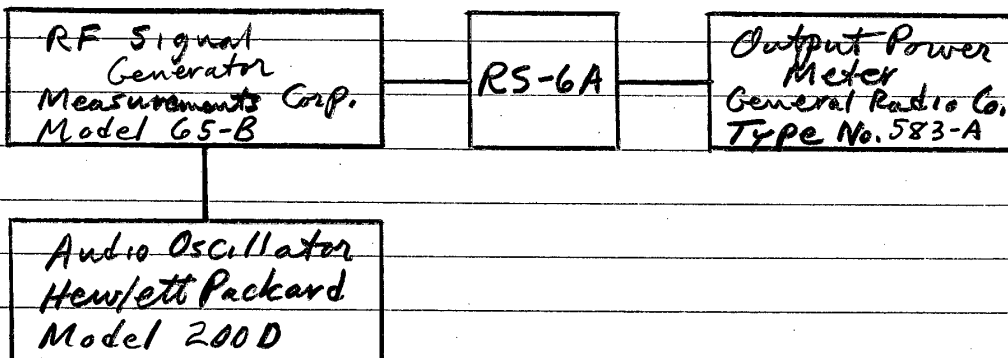
Test Results:

Frequency (cps)	Distortion (%)
150	100
300	5
600	1.5
1200	0.7

The above test was conducted on Unit #8 and the results meet specifications.

1.18. OVERALL AUDIO FREQUENCY RESPONSE

Set Up:



Method of Test:

As per Specification 50-A-1006-A, Section 4.6.5.3.

Test Results:

See the curve of Figure #2, Page 20.

The above test was conducted on Unit #8 and the results meet specifications.

2. TRANSMITTER TESTS

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2.1. POWER OUTPUT

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Set Up:



Method of Test:

As per Specification 50-A-1006-A, Technical Action Request #1

Power Calculation..... I^2R

Test Results:

(put next page here)

21

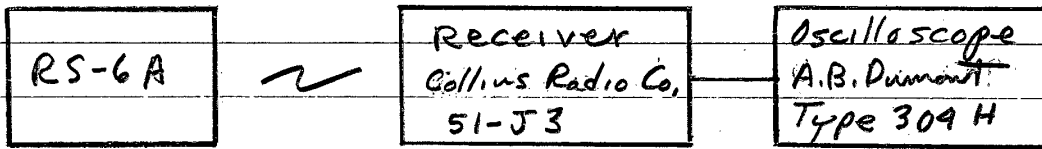
(power output continued)

Frequency (Mc/s)	Power Output (Watts)				
	73 ohms	146 ohms	300 ohms	600 ohms	1200 ohms
Prototype # 8					
4.5	6.8	8.0	7.3	9.0	8.8
7.0	9.0		9.1		11.5
8.0 (II)	9.1		9.7		11.4
10.0 (II)	9.1	12.4	10.3	11.4	11.3
10.0 (II)	5.6	7.1	6.0	7.6	6.2
14.0 (II)	7.8		7.5		8.1
16.5 (III)	7.9		7.7		8.1
21.0 (III)	8.0	10.4	7.8	9.2	7.7
Prototype # 9					
4.5	7.5		7.5		8.7
7.0		9.9		11.5	
8.0 (II)		10.0		11.5	
10.0 (II)	11.0		10.0		10.8
10.0 (II)	5.6		5.5		6.0
14.0 (II)		8.3		9.1	
16.5 (III)		8.9		9.0	
21.0 (III)	8.0		7.2		7.0

The results of the above test meet specifications.

2.2. KEYING CHARACTERISTICS

Set Up:



Method of Test:

As per Specification 50-A-1006-A, Sections 5.3.7., 5.3.7.2., 5.3.7.2.

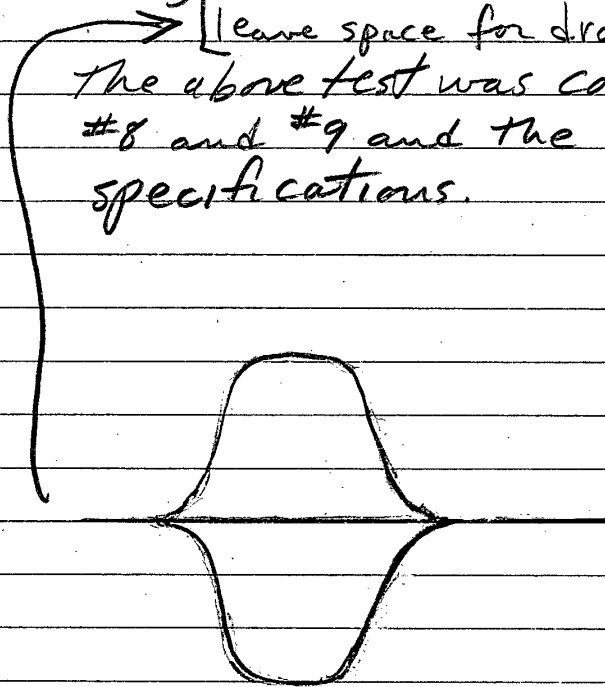
Test Results:

(see below)

The keyed waveshape at 60 words per minute was checked at various frequencies throughout the transmitter's range and found satisfactory.

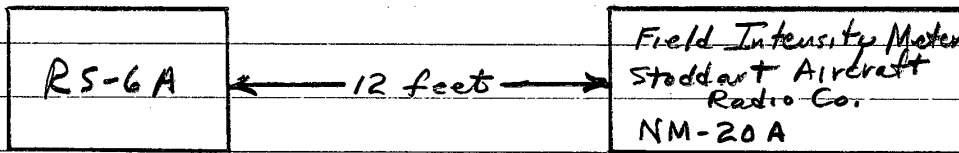
→ [leave space for drawing]

The above test was conducted on Units #8 and #9 and the results meet specifications.



2.3. HARMONIC OUTPUT

set up:



Method of Test:

As per Specification 50-A-1006-A, Section 5.3.8.

Test Results:

Frequency (Mc/s)	Harmonic Content (%)			
	Second	Third	Fourth	Xtal. Freq
Prototype # 8				
4.5	3.3	1.7	**	
7.0	1.6	0.6	*	
9.0 (II)	0.6	*	*	0.8
10.0 (II)	2.0	*	*	**
12.0 (II)	2.5	*	*	1.3
Prototype # 9				
5.5	**	**	**	
8.0 (II)	0.8	0.8	*	1.5
10.0 (II)	3.4	*	*	1.9
11.0 (II)	3.7	*	*	**

* Beyond the range of the Stoddart NM-20A

** Below the sensitivity of the Stoddart NM-20A

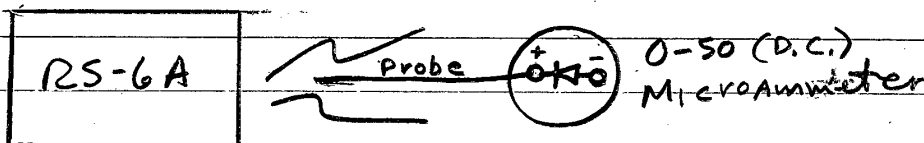
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The results of the above test meet specifications.

FREQUENCY

2.4. SPURIOUS ~~TEST~~

Set Up:



Method of Test:

As per Specification 50-A-1006-A, Section 5.3.9.

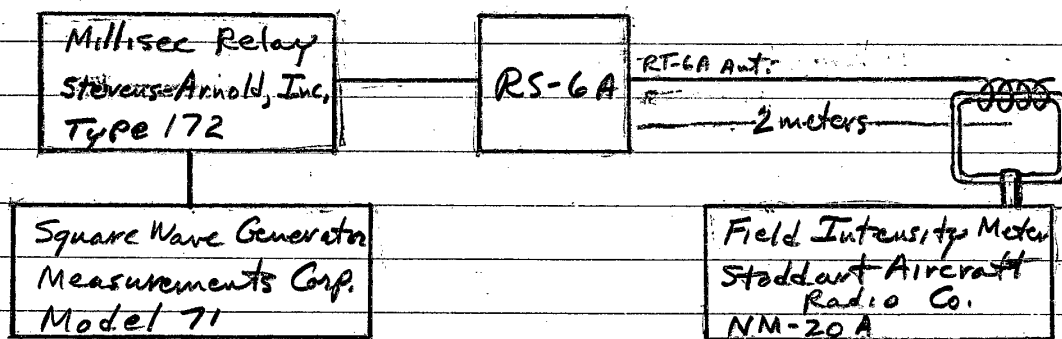
Test Results:

No spurious radiations were found under every possible tuning condition.

The above test was conducted on Units #8 and #9 and the results meet specifications.

2.5. RADIATED KEY CLICKS

Set Up:



Method of Test:

No specification given

The transmitter was keyed (25 wpm) with the crystal removed at a number of frequencies and under various loading conditions.

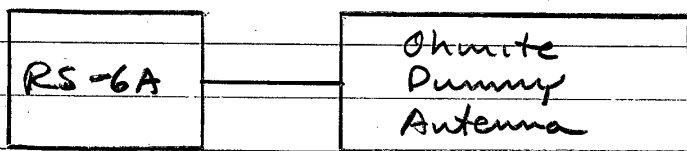
Test Results:

Under the worst set of conditions the key clicks caused an increase of only 2 microvolts over the normal 8 microvolt noise.

The above test was conducted on Units #8 and #9 and the results are considered satisfactory.

2.6. CRYSTAL CURRENT

Set Up:



Method of Test:

^{Space} No specification given

^{Space} The crystal current measurement was made by connecting a Weston RF Ammeter in series with the crystal.

Test Results:

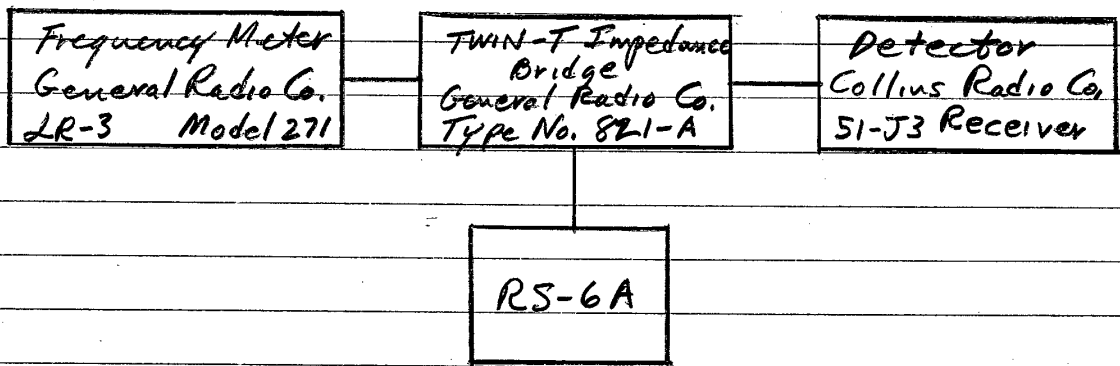
The crystal current varied from 33 to 99 milliamperes depending upon the frequency and loading selected.

The above test was conducted on Units #8 and #9 and the results are considered satisfactory.

DYNAMIC

2.7. INPUT CAPACITY

Set Up:



Method of Test:

As per Specification 50-A-1006-A, Section 5.3.6.

Test Results:

Units #8 and #9 were found to have an input capacity of 30 to 32 micromicro-parads.

The results of the above test do not meet specifications.

Transmitter Spurious
Radiated EMI Checks
Drawing of keyed waveforms

J

