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NAVY DEPARTMENT
BUREAU OF ENGINEERING

Report of
Test of Head Telephone Receivers, Type CW49003.

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WASHINGTON, D.C.

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AUTHORIZATION

1. This work was authorized by Bureau of Engineering letter, reference (a). Other pertinent correspondence is listed as references (b) and (c).

Reference: (a) BuEng.ltr.NL40s/62457 (1-29-W8) of 14 July 1936.
(b) BuEng.Specifications RE 13A 511A.
(c) N.R.L. Report No. R-1066.

OBJECT OF TEST

2. The object of the test was to determine whether the high impedance head telephone receivers submitted by the Graybar Electric Company in connection with contracts NL40s-62457 and NOS-46352 comply with the governing specifications, reference (b), and are suitable for Naval use.

ABSTRACT OF TEST

3. The receivers were tested to determine the following characteristics:

- (a) D.C. resistance.
- (b) Effect of mechanical shock.
- (c) Impedance at the frequency of primary resonance.
- (d) Efficiency factor at the frequency of primary resonance.
- (e) Primary resonance frequency.
- (f) Magnitude of the secondary resonance peaks.
- (g) Band width of the primary resonance peak.
- (h) Band width of the secondary resonance peak.

CONCLUSIONS

(a) The receivers submitted for test under contracts N140s-62457 and NOs-46352 comply with the governing specifications in all respects except that the band width of the primary peak exceeds in more than 20% of the samples, the width specified at 8 db down from the peak, and under contract N140s-62457, at 4db down.

(b) These receivers are considered suitable for Naval use.

RECOMMENDATION

(a) It is recommended that these receivers be considered suitable for Naval use.

MATERIAL UNDER TEST

4. The material under test consisted of 20 pairs of high impedance head telephone receivers manufactured by the Western Electric Company and submitted by the Graybar Electric Company, 10 pairs under each contract. They bear the type number CW 49003.

METHOD OF TEST

5. The receivers were tested in all respects as outlined in the specifications, reference (b), except that the humidity test of paragraph 5-6, and the subsequent tests 6-8 to 6-11 inclusive, were omitted. This part of the test was omitted in accordance with verbal authority of the Bureau of Engineering in order to expedite the report. A general description of the method of test involving the use of the artificial ear equipment is given in reference (c), paragraph 5.

DATA RECORDED DURING TEST

6. The data recorded during the test, or values computed therefrom are given in Table 1 and Table 2.

PROBABLE ERROR OF RESULTS

7. The errors in the determination of the various values are within the limits given below.

D.C. resistance	$\pm .1$ ohm
Impedance	$\pm 10\%$
Frequency	± 3 cycles
Efficiency Factor	$\pm 15\%$
Band widths	$\pm 0.5\%$

RESULTS OF TEST

8. Certain observed or computed test data are given in Table 1 for each of the 20 receivers of contract N140s-62457, and in Table 2 for those of contract N0s-46352. In tables 3 and 4 the weights obtained by each receiver in each of the tests, (a) to (h) inclusive, listed in paragraph 7-4 of reference (b), are tabulated, together with the total weight of each receiver and the average total weight of each lot of 20 receivers. Since tests (i), (j) and (k) listed in paragraph 7-4 were not made, each receiver was given full weight for these tests, so that a receiver meeting the requirements of tests (a) to (h) receives a total weight of 100. In compiling tables 3 and 4, the probable error of measurement was taken into consideration and the proper allowance made, with the result that any receiver is considered to have passed the test if the observed value, after being adjusted by the amount of the probable error, lies within the limits. The average mark achieved by the receivers was 93.7 for contact N140s-62457, and 95.7 for contract N0s-46352.

9. The following comments on the results of the test refer to the similarly numbered paragraphs in the specifications, reference (b):

- 6-1. The d.c. resistances of all the receivers were between 1035 and 1093 ohms, and hence do not exceed the limit of 1100 ohms.
- 6-2. Every receiver withstood the shock test without any visible loosening or damage to parts.
- 6-3. The measured impedance of 9 receivers, out of each group of 20, exceeded the specified limit of 10,500 plus 10%, after allowance for 10% error in measurement; however, all the values fall within the specified limits. (See Tables 1 and 2, column (c)).
- 6-4. The efficiency factors of 80% of the first group of 20 receivers, and 90% of the second group were above the specified minimum of 900 bars squared per microwatt after applying the probable error to the computed values. The average efficiency factor without allowance for error was 905 for the first group, and 1060 for the second group. (See Tables 1 and 2, Column (d)).
- 6-5. The primary resonance peaks of all the receivers lay within 1005 and 1138 cycles and hence within the specified limits of 1000 and 1200. (See Tables 1 and 2, column (e)).
- 6-6. The secondary resonance peak was less than 4 db below the primary resonance peak in 10% of the receivers. In these cases the secondary peaks were from 3.2 to 3.6 db below the primary peaks.
- 6-7. The band width of the primary peak 4 db down from the peak lies outside of the tolerance (10 to 15% of the primary peak frequency) in 30% of the first group of 20 receivers, and in 20% of the second group; the band width 8 db down lies outside the tolerance (20 to 25% of primary peak frequency) in 75% of the receivers of the first group and in 80% of those of the second group. The actual values are given in column (g) of Tables 1 and 2, from which it may be inferred that the primary peak is usually broader than that detailed in the specifications.
- 6-8. The band widths of all secondary resonance peaks conform to the requirements of the specifications.

CONCLUSIONS

10. The receivers, submitted for test under contracts N140s-62457 and NOs-46352, comply with the governing specifications in all respects except that the band width of the primary peak exceeds in more than 20% of the samples, the width specified at 8 db down from the peak, and under contract N140s-62457, at 4 db down.

11. These receivers are considered suitable for Naval use.

TABLE 1

DATA ON HEAD TELEPHONE RECEIVERS TYPE CW49003
 (Contract N14Os-62457)

(Letters in column headings correspond to
 those in Par. 7-4 of Specifications
 RE 13A 511A)

Sample Test No.	Impedance (ohms) (c)	Efficiency Factor (d)	Peak Freq. (Cycles) (e)	Primary Band Width %	
				4 db	8 db (g)
156	12175	959	1061	13.34	25.25
157	11805	726	1074	12.72	25.41
158	10170	827	1037	15.82	29.60
159	11390	1142	1055	14.22	27.97
160	11610	882	1048	14.03	27.30
161	11920	1048	1068	14.05	27.08
162	11130	826	1055	13.65	27.50
163	11380	982	1138	10.81	21.27
164	11440	1227	1091	14.57	20.54
165	11720	1153	1056	14.30	27.94
166	11340	894	1054	16.04	29.04
167	10910	829	1027	16.95	33.60
168	11020	792	1015	16.06	33.90
169	11560	894	1040	14.90	28.67
170	10180	768	1042	16.70	32.45
171	11830	713	1052	14.45	26.53
172	11270	955	1027	16.37	33.03
173	12080	1017	1073	14.26	27.04
174	11700	784	1051	12.85	27.78
175	11310	690	1041	12.97	25.45

TABLE 2

DATA ON HEAD TELEPHONE RECEIVERS TYPE CW49003
(Contract NOs-46352)

(Letters in column headings correspond to
those in Par. 7-4 of Specifications
RE 13A 511A.)

Sample Test No.	Impedance (ohms) (c)	Efficiency Factor (d)	Peak Freq. (cycles) (e)	Primary Band Width %	
				4 db	8 db (g)
176	11410	860	1026	15.99	31.20
177	11550	1045	1044	14.75	28.36
178	11670	564	1068	12.68	25.56
179	11910	893	1062	12.05	24.76
180	12350	1253	1086	13.35	25.42
181	10870	1265	1037	13.02	27.78
182	12020	954	1043	15.15	29.82
183	11400	1037	1030	15.53	30.49
184	11760	975	1045	15.02	28.80
185	11460	1226	1077	13.93	26.47
186	11180	989	1005	16.59	36.63
187	11140	1134	1071	13.26	26.06
188	11570	1324	1056	14.68	29.17
189	11060	1031	1049	14.87	28.61
190	11720	1139	1064	13.53	26.14
191	11180	900	1031	14.76	27.97
192	12020	600	1008	16.47	33.84
193	11900	1479	1098	14.12	26.33
194	11520	1167	1040	13.37	26.16
195	11460	1375	1051	12.75	25.31

TABLE 3

TABLE OF WEIGHTS

HEAD TELEPHONE RECEIVERS, TYPE CW 49003
(Contract N140s-62457)

(Letters in column headings correspond to those in Par.7-4 of
 Specifications RE 13A 511A).

Sample Test No.	D.C.R. (a)	Shock (b)	Imped- ance (c)	Eff. (d)	Peak Freq. (e)	Sec. Peak (db) (f)	Pri. 4 db	Band Width 8 db (g)	Sec. Band Width 3 db (h)	Total Weight
156	2	5	20	20	20	2	2	2	2	100
157	2	5	20	0	20	2	2	2	2	80
158	2	5	20	20	20	2	0	0	2	96
159	2	5	20	20	20	2	2	0	2	98
160	2	5	20	20	20	2	2	0	2	98
161	2	5	20	20	20	2	2	0	2	98
162	2	5	20	20	20	2	2	0	2	98
163	2	5	20	20	20	2	2	2	2	100
164	2	5	20	20	20	2	2	2	2	100
165	2	5	20	20	20	2	2	0	2	98
166	2	5	20	20	20	2	0	0	2	96
167	2	5	20	20	20	0	0	0	2	94
168	2	5	20	20	20	0	0	0	2	94
169	2	5	20	20	20	2	2	0	2	98
170	2	5	20	0	20	2	0	0	2	76
171	2	5	20	0	20	2	2	0	2	78
172	2	5	20	20	20	2	0	0	2	96
173	2	5	20	20	20	2	2	0	2	98
174	2	5	20	20	20	2	2	0	2	98
175	2	5	20	0	20	2	2	2	2	80
Average										93.7
Per Cent Failures	0	0	0	20	0	10	30	75	0	20

TABLE 4

TABLE OF WEIGHTS

HEAD TELEPHONE RECEIVERS, TYPE CW 49003
(Contract NOs-46352)(Letters in Column headings correspond to those in Par. 7-4 of
Specifications RE 13A 511A)

Sample			Imped-		Peak	Sec.	Pri.	Band	Sec.	Total
Test	D.C.R.	Shock	ance	Eff.	Freq.	Peak	Band	Width	Band	Weight
No.	(a)	(b)	(c)	(d)	(e)	(f)	4 db	8 db	3 db	
							(g)		(h)	
176	2	5	20	20	20	2	0	0	2	96
177	2	5	20	20	20	2	2	0	2	98
178	2	5	20	0	20	2	2	0	2	78
179	2	5	20	20	20	2	2	2	2	100
180	2	5	20	20	20	2	2	2	2	100
181	2	5	20	20	20	2	2	0	2	98
182	2	5	20	20	20	2	2	0	2	98
183	2	5	20	20	20	2	0	0	2	96
184	2	5	20	20	20	2	2	0	2	98
185	2	5	20	20	20	2	2	0	2	98
186	2	5	20	20	20	0	0	0	2	94
187	2	5	20	20	20	2	2	0	2	98
188	2	5	20	20	20	2	2	0	2	98
189	2	5	20	20	20	2	2	0	2	98
190	2	5	20	20	20	2	2	0	2	98
191	2	5	20	20	20	2	2	0	2	98
192	2	5	20	0	20	0	0	0	2	74
193	2	5	20	20	20	2	2	0	2	98
194	2	5	20	20	20	2	2	0	2	98
195	2	5	20	20	20	2	2	2	2	100
Average										95.7
% Failures	0	0	0	10	0	10	20	85	0	10