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R. A. E.

RADIO DEPARTMENT

TECHNICAL NOTE

No RAD. 310

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Technical Note No. Rad. 310

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July 1945

ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH

Freya Receiver Type DNE 141A02

-by-

W. Brodie

Summary

This note describes a Freya receiver with a frequency range of 197 to 207 Mc/s. It is an isolated case and there is no associated transmitter or aerial equipment.

Contents

1. Introduction

This receiver is generally similar to that described in Tech. Note No. Rad. 223. The chassis of both the R.F. and I.F. units are the same and the circuit alterations are only those appropriate to the higher operating frequency of 200 Mc/s. A general view of the receiver is given in Fig.1.

The number of I.F. stages remains the same but the use of two I.F.'s - 15 Mc/s and 7 Mc/s has been discontinued and 7 Mc/s is used throughout.

Only one unit has been examined, Type DNE 141A02 Serial No. 681. Neither the R.F. nor the I.F. units has any identification type number and there is no evidence of labels ever having been attached.

All valves are the same as those used in the 125 Mc/s type previously described.

2. Description of Receiver

2.1 General

Receiver characteristics are:-

Normal receiving frequency range	197 - 207 Mc/s
Gain at normal working level	126 db.
Bandwidth	585 kc/s at 6 db. down.
Noise factor	16 db.
Local oscillator frequency coverage	190 - 200 Mc/s

There is also a clearly defined second channel frequency coverage of from 183 to 192.7 Mc/s. To obtain a given output with the same gain setting the input voltage for second channel must be 47 db. above that of normal channel.

A frequency response curve for the believed normal receiving conditions is given in Fig.4.

2.2 R.F. Unit

The unit is shown in Fig. 2 and Fig. 5 gives the circuit diagram. The 200 Mc/s input from the aerial is inductively coupled to the tuned circuit in the grid of the R.F. amplifier. Both primary and secondary are single turns and the grid of the amplifier is connected to a point near the centre of the secondary, through a condenser and parallel grid-leak. The tapping of the coil and the insertion of condenser and leak are new to the amplifier circuit.

The single turn coil in the anode circuit is also tapped near the centre and no trimmer condenser is provided across the variable turning condenser of the mixer valve.

An interesting feature in the modification of oscillator circuit is a small, obviously not commercial, component connected between grid and the normal grid-leak and condenser circuit. This consists of a small former 0.25 cm. dia. of systoflex with one thin insulated wire wound on it to give two sets of three turns. It would appear to be an inductive resistance. The resistance is only a few ohms.

The drive for the variable condenser in the oscillator circuit has a fixed rotation of about 355°. This may be to allow for a calibration of the frequency of oscillation which is not possible in the old circuits where more than one rotation of drive is necessary for total change in capacitance.

2.3 I.F. Unit

The I.F. is 7 Mc/s and the unit consists of five I.F. amplifier stages, a detector, video amplifier and D.C. restorer. The circuit is given in Fig.6 and side view is shown in Fig.3.

Comparing with the I.F. channel described in Tech. Note No. Rad. 223 the inductance coils of the first two stages have been modified for the change from 15 Mc/s to 7 Mc/s. The 22 Mc/s oscillator has been removed and the filter circuit which followed the mixer has been replaced by a single inductance coil in the anode circuit of the third stage which is now simply an amplifier. The remainder of the circuit has been left substantially the same as before.

3. Conclusion

The operating frequency of 200 Mc/s is an interesting feature. Neither transmitter nor aerial array for this frequency has come to hand yet and the type of Freya with which it is used is not known.

The fact that it would be better to use only one I.F. was commented upon in the earlier report mentioned. Certainly the beat effects obtained in the I.F. response curve of the earlier sets can no longer take place.

4. Parts List

No.	Component	Description
100	H.F. Coil	
101	" "	
102	" "	
103	" "	
104	" "	
105	Ceramic Holder	
106	" "	
107	Valve	R.L.12.T.1.(Oscillator)
108	Stabilivolt	S.T.V. 280/80
111	Trimmer Condenser	4pF (+20%) + 17pF 500V.
113	Variable Condenser	
114	" "	
115	" "	
117	Condenser	200pF ± 10% 500V.
118	"	2pF ± 10% 500V.
120	"	0.05μF ± 20% 500V.
121	"	300pF ± 10% 500V.
122	"	0.05μF ± 20% 500V.
123	"	200pF ± 10% 500V.
124	"	200pF ± 10% 500V.
126	"	0.05μF ± 20% 500V.
127	"	200pF ± 10% 500V.
129	"	200pF ± 10% 500V.
130	"	200pF ± 10% 500V.
131	"	0.05μF ± 20% 500V.

Parts List (contd.)

No.	Component	Description
132	Resistance	1K ± 5% 0.25W
133	"	200K± 5% 0.25W
134	"	50 K± 5% 0.25W
135	"	2K ± 5% 0.25W
136	"	200K± 5% 0.25W
137	"	3K ± 5% 0.25W
138	"	50K ± 5% 0.25W
139	"	100 ± 5% 0.25W
140	"	8K ± 5% 0.25W
142	"	10K ± 5% 0.25W
143	"	2K ± 10% 30W
144	"	500K± 5% 0.25W
146	"	500K± 5% 0.25W
147	"	2.5K± 10% 30W
148	Thermal Resistance	1500± 15% 4W
149	Transformer	
150	Thermal Resistance	1500± 15% 4W
170	Inductive Coupling	
176	Tuning Coil	
177	Valve	A.F. 100
178	"	"
179	"	"
180	"	"
181	"	"
182	"	"
184	"	"
185	"	R.L.12.P.10
187	Trimmer Condenser	
188	" "	
189	" "	
191	" "	
192	Double Trimmer Condenser	
194	Trimmer Condenser	
196	Condenser	0.05 μF ± 20% 500V.
197	"	0.05 μF ± 20% 500V.
198	"	200pF ± 10% 500V.
199	"	0.05 μF ± 20% 500V.
200	"	0.05 μF ± 20% 500V.
202	"	200pF ± 10% 500V.
205	"	0.05 μF ± 20% 500V.
207	"	0.05 μF ± 20% 500V.
208	"	200pF ± 10% 500V.
210	"	0.05 μF ± 20% 500V.
211	"	0.05 μF ± 20% 500V.
214	"	200pF ± 10% 500V.
215	Electrolytic Condenser	60 μF + 30 - 20% 10V.
216	Condenser	0.35 μF
217	"	0.35 μF
218	"	0.01 μF ± 20% 500V.
219	Resistance	100K ± 5% 0.25W
220	"	125 ± 5% 0.25W
221	"	3K ± 5% 2W
222	"	1K ± 5% 0.25W
223	"	
225	"	2K ± 5% 0.25W
228	"	300± 5% 0.25W
229	"	70K± 5% 0.25W
230	"	

Parts List (contd.)

No.	Component	Description
232	Resistance	50K ± 5% 0.25W
233	"	1.5K ± 5% 0.25W
234	"	125 ± 5% 0.25W
235	"	20K ± 5% 0.25W
237	"	8K ± 5% 0.25W
238	"	150 ± 5% 0.25W
239	"	3K ± 5% 2W
241	"	6K ± 5% 0.25W
242	"	1K ± 5% 0.25W
243	"	300 ± 5% 1W
244	"	7K ± 5% 1W
246	"	2M ± 5% 0.25W
247	"	100K ± 5% 1W
248	Potentiometer	10K ± 20%
249	Electrolytic condenser	25 μF

File 4761

Attached:

Fig. 1 General view of receiver Neg. No. 61740

" 2 R.F. Unit } Neg. No. 61741
" 3 I.F. "

" 4 Frequency response curve Diag. No. 12049B

" 5 Circuit diagram R.F. amplifier Diag. No. 12050B

" 6 " " I.F. " " " 12051B

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Appendix I

Measurement of Noise Factor

With no signal input to the receiver, the current in the cathode of the detector was measured. The C.W. input from a signal generator required to double this current was then found. The measured noise voltage was taken to be equal to this C.W. input voltage. The voltage produced in the detector circuit by thermal agitation in the input impedance was calculated from the formula $n^2E^2 = 4KTR\delta f$.

where $K = 1.37 \times 10^{-23}$, T = Absolute Temp., R = input resistance,

δf = bandth of receiver, n = gain of receiver, nE = voltage in detector

$$\text{Noise Factor} = 20 \log \frac{n \text{ Measured Noise Voltage}}{nE} = 20 \log \frac{\text{Measured Volt}}{E}$$

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FREYA RECEIVER TYPE DNE 141A02 FIG. 1.

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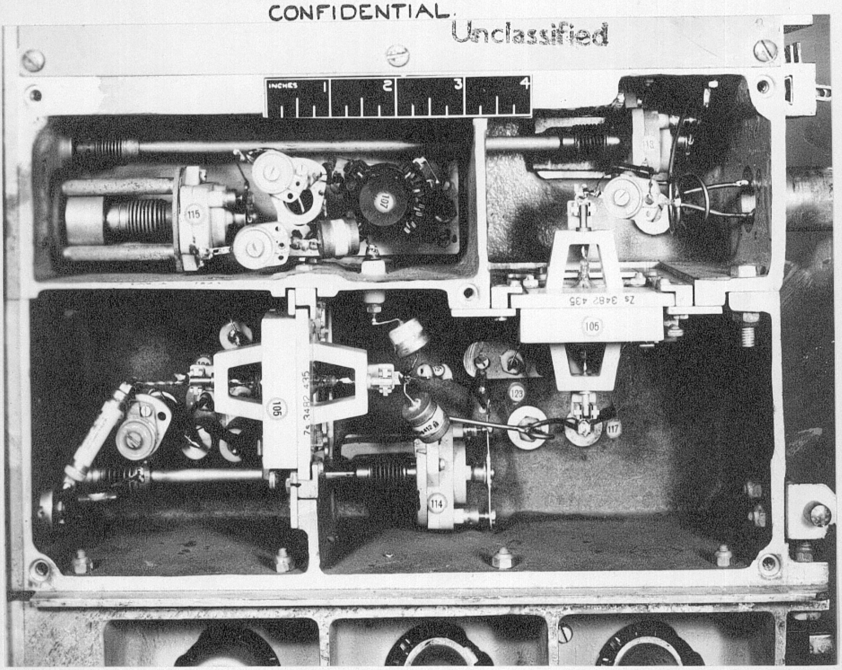
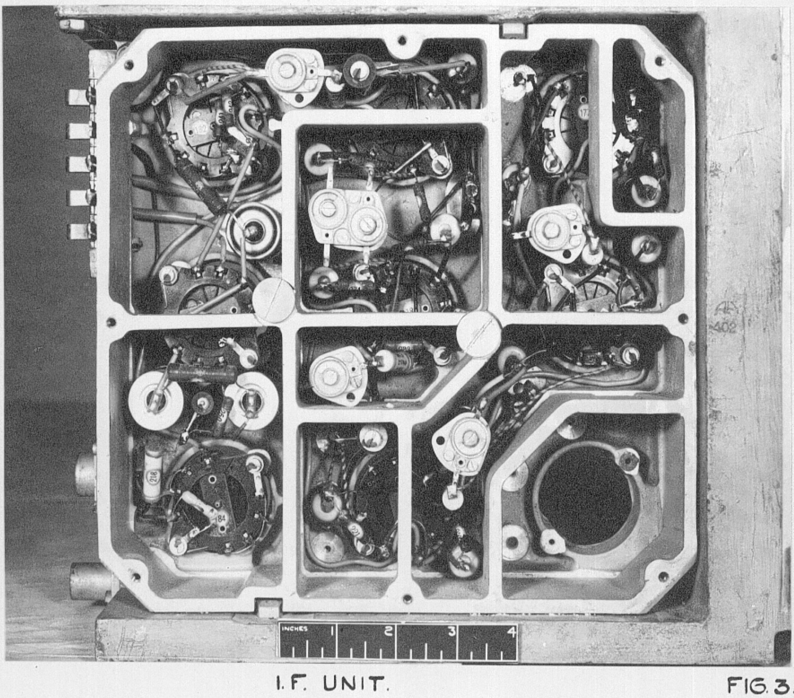


R.F. UNIT. FIG. 2.



I.F. UNIT. FIG. 3.

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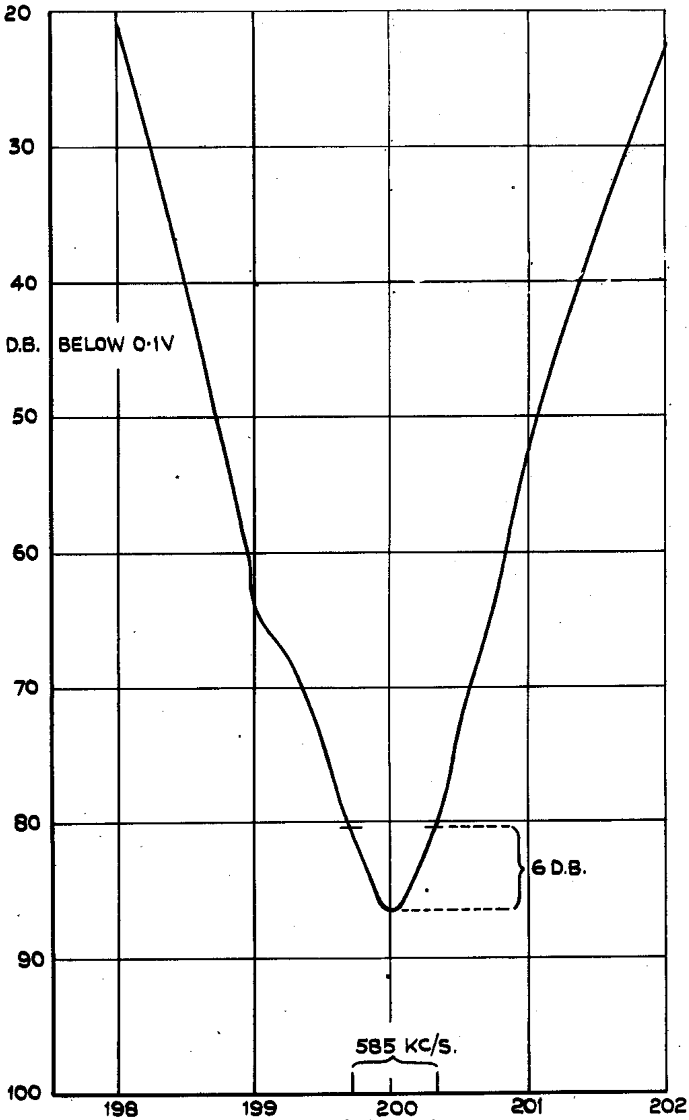
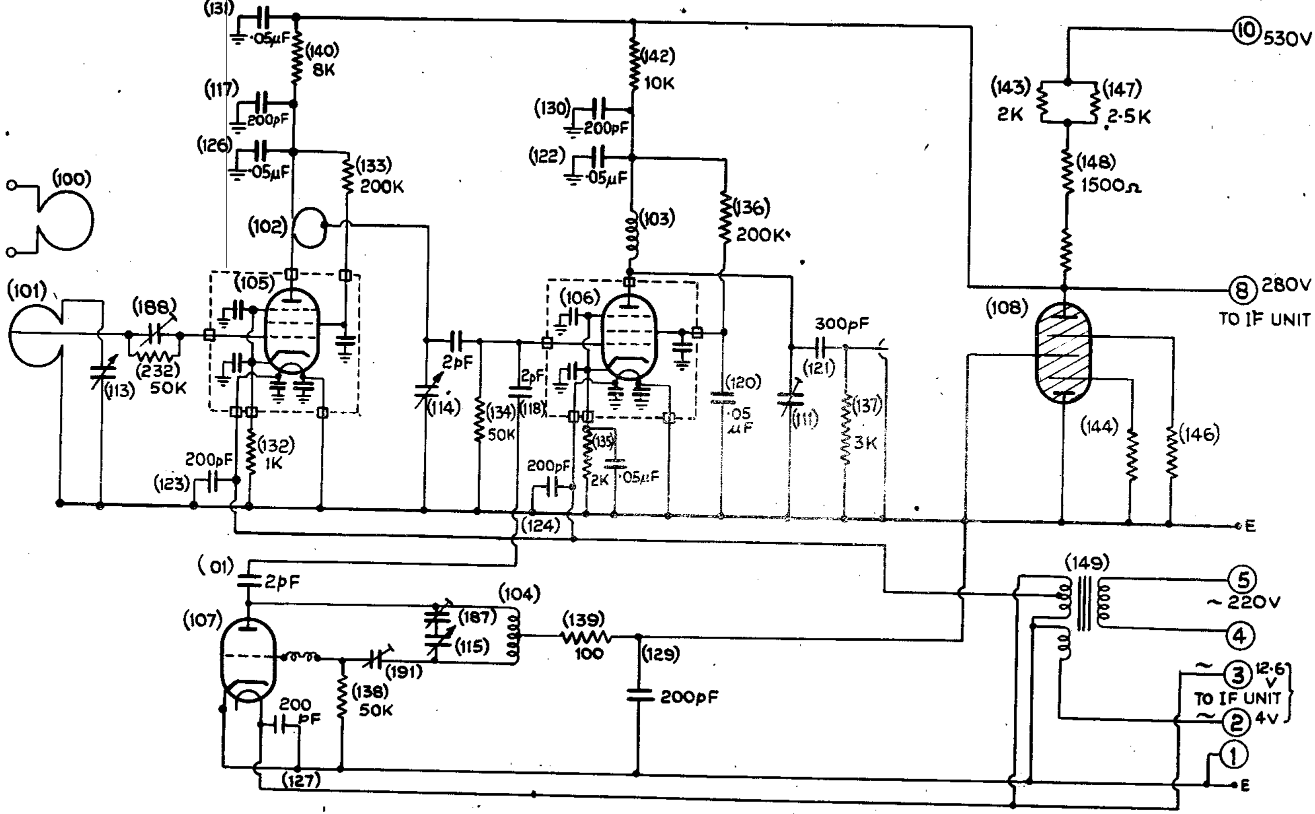
CONSTANT OUTPUT MEASURED BY CHANGE IN DETECTOR CATHODE CURRENT PRODUCED BY THE INPUT SIGNAL.
GAIN POTENTIOMETER = 2,100 OHMS



FREYA RECEIVER D.N.E. 141A02
FREQUENCY RESPONSE

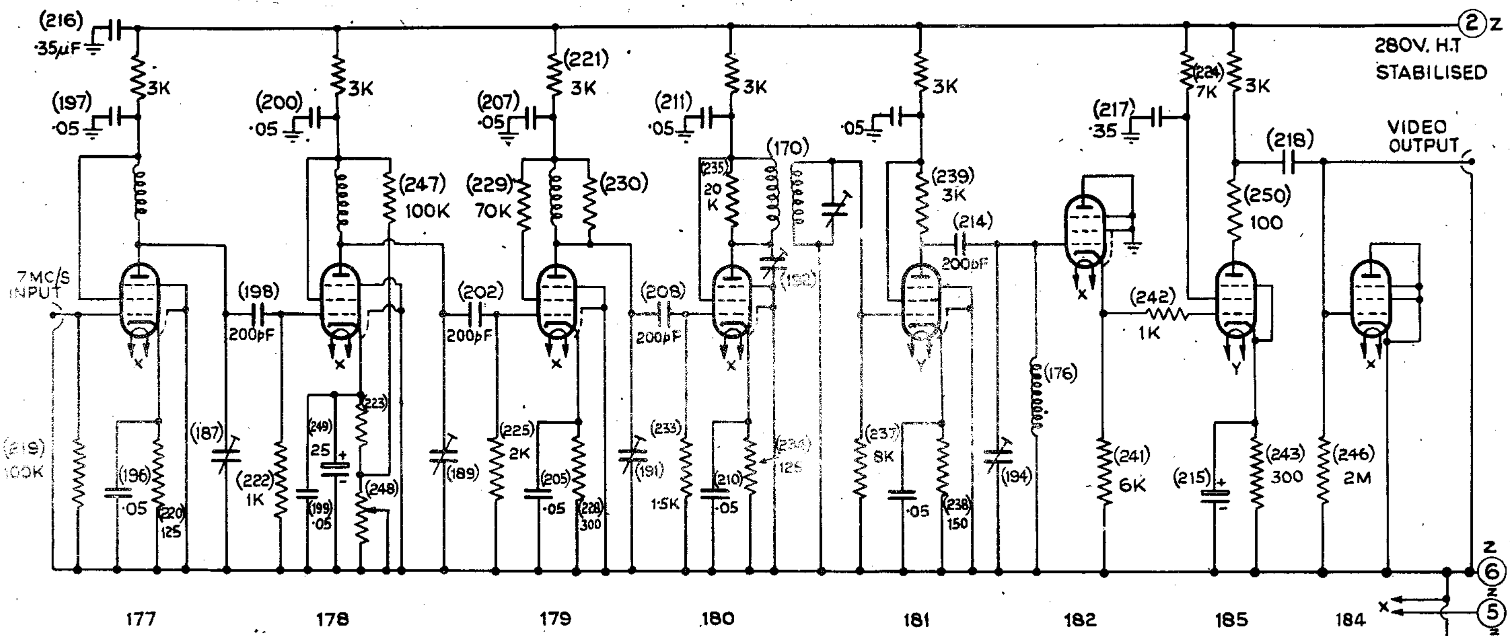
FIG. 5



R.F. AMPLIFIER

FREYA RECEIVER D.N.E. 141A02

ER 31.5.45



I.F. AMPLIFIER UNIT

FREYA RECEIVER D.N.E. 141 A02