W/T EMERGENCY EQUIPMENT

The Emergency W/T Arrangements in ships has recently been reviewed, and a standard policy based on action experience and power supplies of modern ships has been decided on for the various classes.

This article is intended to give to the Fleet some preliminary information as to the equipment which, to implement that policy, is now being fitted in new construction vessels and in ships undergoing a modernisation refit.

Before going on to the particular items of equipment to be fitted, it may be as well to provide a brief description of certain items of apparatus, included in the emergency arrangements, that are not yet very generally known.

The equipment is intended to comply with the broad principle of emergency arrangements, which is that future emergency transmitters and receivers should be capable of operation from the ship's normal power supplies, and in an emergency would obtain their supply from a source entirely independent of the ship's normal or secondary power supplies.

This principle is best illustrated by an existing system which, although, strictly speaking, is not part of the Emergency W/T arrangements, is now generally fitted in cruisers and above. This is the A.C. supply outfit DWA which provides for automatic emergency supply to the Type 406 W/T installation. It consists of a motor alternator driven by battery power with an A.C. output capable of operating the Type 406. The system automatically comes into operation on every occasion of the failure of the normal W/T A.C. supply which in turn is dependent upon the ship's 220 volt D.C. supply.

Two other small A.C. supply outfits, having the same fundamental principle but not automatically operated, have since been developed and are now being fitted in new construction ships. These are DWB and DWE and both derive their input from a 24 volt battery, and their outputs are capable of operating a receiver which requires a supply of 230 volts 50 c.p.s. with a power consumption of up to 85 watts.

DWE is fitted where no other piece of apparatus is deriving power from the same battery and DWB, which has auto voltage control incorporated, where power is taken from a battery which also supplies power for an associated emergency transmitter.

It will, of course, be realised that at present, and for some time to come, in existing ships certain departures from the broad principle laid down for operation in the emergency state will remain in being. The table of equipment to be fitted in the various classes therefore gives alternative arrangements.

It should be noted that the battery operated receiver B.19 has been omitted, and is now considered obsolescent, being replaced by an existing receiver which in the emergency state becomes the emergency receiver, and obtains its power from battery source via A.C. outfit DWE or DWB. This enables either a receiver B.28 (CDC) or a receiver B.29 (CDF), which normally are supplied from the particular A.C. supply fitted, to be operated when ship's power fails.

The table below shows what equipment is being fitted or will be fitted in the several classes to provide for the requirements called for by the latest policy for emergency W/T arrangements in ships.

Site	Transmitter	Receiver	Power Supply i.e. Battery outfit and where applicable, A.C. power unit.
	CAPITAL SHIPS AND CRUISERS.		
Forward B.R.R.	TCS	CDC	BBn DWB
		CDC or CDF	BBn DWE
	or 60 EQR	CDC or CDF	BBq DWB
Aft U.T.R.	602 E Transceiver 86M	CDC	BBy DWB
	or 60 EQR Transceiver 86M	CDC	BBq DWB
	FLEET AND LIGHT FLEET AIRCRAFT CARRIERS.		
Forward B.R.R.	TCS	CDC	BBn DWB
		CDC or CDF	BBn DWE
	or 60 EQR	CDC or CDF	BBq DWB
Aft. In the most suitable office.	602 E	CDC	BBy DWB
	Transceiver 86M (two in number)		BBn (two in number)
	60 EQR	CDC	BBq DWB
	or Transceiver 86M (two in number)		BBn (two in number)
	FLOTILLA LEADERS		
Forward. Main W/T Office.	602 E Transceiver 86M	CDC CDF	BBy DWB
	or 60 EQR Transceiver 86M	CDC CDF	BBq DWB
Aft. Second W/T Office.	602E	CDC	BBy DWB
	or 60 EQR	CDC	BBq DWB

DESTROYERS AND LIGHT CRAFT DOWN TO AND INCLUDING CASTLE CLASS CORVETTES.			
Site	Transmitter	Receiver	Power Supply i.e. Battery outfit and where applicable, A.C. power unit.
Forward. Main W/T Office.	As for the Main W/T Office of a Flotilla Leader.		
Aft. In a selected position.	TCS (Transmitter)	TCS (Receiver)	BBn

The normal W/T equipment being fitted in vessels other than those mentioned above fulfils the Emergency W/T requirement.

Except in the case of aircraft carriers, where transceiver Type 86M is shown the requirement is that either transmitter is available for operation from the battery outfit indicated but not simultaneously. This facility is provided for by a D.P. two-way switch for switching the battery supply to the required set. It is, however, a requirement that Emergency reception can be carried out simultaneously with the operation of the V.H/F Transceiver 86M.

A C.A.F.O. will shortly be promulgated which outlines the policy governing the fitting of the above equipment, and this will be closely followed by one giving full details of equipment, and action to be taken to implement the fitting thereof. The intention is that the Emergency W/T arrangements in existing ships will, as opportunity offers, be brought up to date with the latest policy.

No mention has been made of emergency whip aerials, but it can be stated that the development of certain types of whip aerials is proceeding, and will eventually be incorporated as part of the Emergency W/T arrangements. For the present the aerials requirement is that a Battle aerial for main transmitting sets, and a minimum of two emergency receiving aerials are to be permanently rigged from the ship's structure as opposed to topmasts or yards.

EXTRACT FROM A RECENT EXAMINATION PAPER.

QUESTION.

"Write short notes on A.S.E. Haslemere".

ANSWER.

"This will sweep a given area, pick up an echo and hold it without any human aid".

W/T TRANSMITTERS IN THE 600 SERIES

Articles on these transmitters have appeared in earlier numbers of the Bulletin as follows :-

June 1944	(RH.600(2))	- Page 10
September 1944	(RH.600(3))	- Page 51
December 1944	(RH.600(4))	- Page 78

To some extent these articles have become out of date, since development has been progressing throughout this period, and is continuing. In the main, however, the information given in previous articles is till accurate.

CONTROL CIRCUITS.

One of the chief "snags" in development was brought about by control circuit requirements. The transmitters had to be partly re-designed to allow them to be controlled by a number of different W/T and R/T control outfits. Originally, it was the intention that they should be controlled by simple "Keying" and "Switching on" lines, together with Microphone lines, and simple lamp indicating circuits. Later, it was decided to fit the sets retrospectively into existing C.W.S. ships (control outfits of the KDA series), and also into a new W/T and R/T control outfit employing many features of C.W.S. This new outfit is called KCT and the first ship to be fitted with it is H.M.S. "VANGUARD".

The difficulty has now been overcome by arranging for the utmost flexibility in the transmitters themselves. The "A" terminal block in each transmitter cabinet, to which all outside lines are connected, has been provided with sufficient terminals to enable any of the required control outfits to be connected to it. It will be appreciated that not all these terminals will be used in all cases; but the important advantage is that the transmitter itself is standardised or "frozen".

The control outfits which are envisaged are :-

(i) KCH series. Non-C.W.S. new construction ships. A W/T and R/T control system including a W/T C.C.X. and exchange facilities for R/T lines. No indicating lamps will be used.

(ii) KFD/E. Aircraft Direction Control Outfits (C.A.F.O. 441/44). R/T Ready and R/T Busy lamps.

(iii) KDA series. Existing C.W.S. ships. Transmitters will require an external Selector Unit. Usual C.W.S. lamp indications.

(iv) KCT. Certain new construction cruisers and above. Includes a W/T and R/T C.C.X., and employs the C.W.S. dialling system and lamp indications at receiving bays; these are converted to "W/T or R/T Ready" and, where required, "R/T Busy" at R/C positions, by means of a Converter unit.

Notes: (a) It is not intended to fit these transmitters into the C.C.S. type of outfit, which is obsolescent.

(b) Where the 600 series are fitted <u>early</u> in existing C.W.S. ships, it is possible that they will go in with a separate control outfit of their own, of the KCH type; in such cases they will not be patched into the KDA outfit as in (iii) above.

(c) In control outfits employing the dialling system, remote control of all three types of modulation (C.W., M.C.W. or R/T) will be possible with the Low Power sets. In the Medium Power sets it will only be possible to select M.C.W. or R/T remotely, since H.T. to the amplifier valves must be increased in the C.W. full power condition. C.W. must therefore be selected at the transmitter.

EMERGENCY R/T.

It was stated in the September article that Type 602E would not be capable of transmission on R/T or true M.C.W. when in the emergency condition. The reason for this is that the power consumption from the emergency batteries would be excessive if the modulator unit was supplied with power, in addition to the transmitter units.

I.C.W. is available instead of M.C.W., by providing an unsmoothed 500 volt H.T. supply for the anodes and screens of the transmitter power amplifier stages.

A scheme is now under consideration for providing Low Power R/T in the emergency condition, by use of series anode modulation, as this was felt to be a requirement of an emergency transmitter. By this means, good quality R/T could be provided without exceeding the total anode and screen H.T. supply normally used on C.W. Carrier power will of course be correspondingly reduced but will be of the order of 10 - 12 watts.

AERIAL MATCHING ARRANGEMENTS.

In the past, it must be admitted that the Navy paid insufficient attention to the scientific matching of transmitters to aerial impedances, so as to ensure the greatest possible transference of power from the transmitter to the aerial. We tended to rely exclusively on "brute strength and ignorance": on large transmitters developing large powers, fed straight into the trunk and aerial. Frequently the result was that on certain frequencies the transmitter could not be loaded to more than a quarter its normal power. Sometimes a large proportion of the power was dissipated inside the T.R.

In the 600 series particular attention has been paid to this matter. Furthermore, the H/F aerial matching and tuning units have been designed to match into the widest possible range of aerial plus trunk impedances, so that the transmitters will load fully, over their whole frequency range, into any combination of trunk and aerial lengths likely to be found on board.

For this reason, the actual range in miles achieved by a Type 603 may be expected to be not less than that of a Type 57, even though their rated outputs are approximately 400 watts and 2,000 watts respectively on C.W. In this connection it may also be pointed out that the full rated power of Types 601 - 605 is available on M.C.W. and R/T since they are anode modulated. Previously only about $\frac{1}{4}$ of the nominal C.W. power was available under modulated conditions.

A more detailed explanation of the aerial matching arrangements of Type 601, and the H/F side of Type 602E (1.5 to 24 Mc/s), follows. These are the Low Power (50 watt) sets.

(A) Ideal Arrangement.

The ideal arrangement would be to have a matching and tuning unit immediately under the aerial; and to connect the matching and tuning unit to the transmitter (perhaps several decks below) by R/F coaxial feeder cable. A trunk would not be required, since losses and peak voltages in the feeder would be kept to a minimum owing to it being correctly terminated.

The matching and tuning unit could then be used to tune the aerial to resonance and to transform the aerial impedance to the impedance of the coaxial feeder, to which the output of the transmitter would be already matched.

The objections to this scheme are :-

(i) Complications in changing wave. The set would have to be tuned by two ratings with telephone or voicepipe communication, which would be most unsatisfactory; or alternatively some form of remote control of the matching unit tuning would be necessary.

(ii) Matching unit would be in a vulnerable position, exposed to weather and enemy action. The H/F feeder cable would be impossible or difficult to repair after action damage.

(iii) Interlock circuits - as used in the 600 series - would lead to considerable additional wiring.

(iv) Additional topweight - especially as Matching Unit must be watertight.

On the whole this scheme is considered unsuitable for the flexible conditions demanded by the Service. However, a similar scheme will be used in the case of whip aerials, both receiving and transmitting, chiefly for emergency conditions.

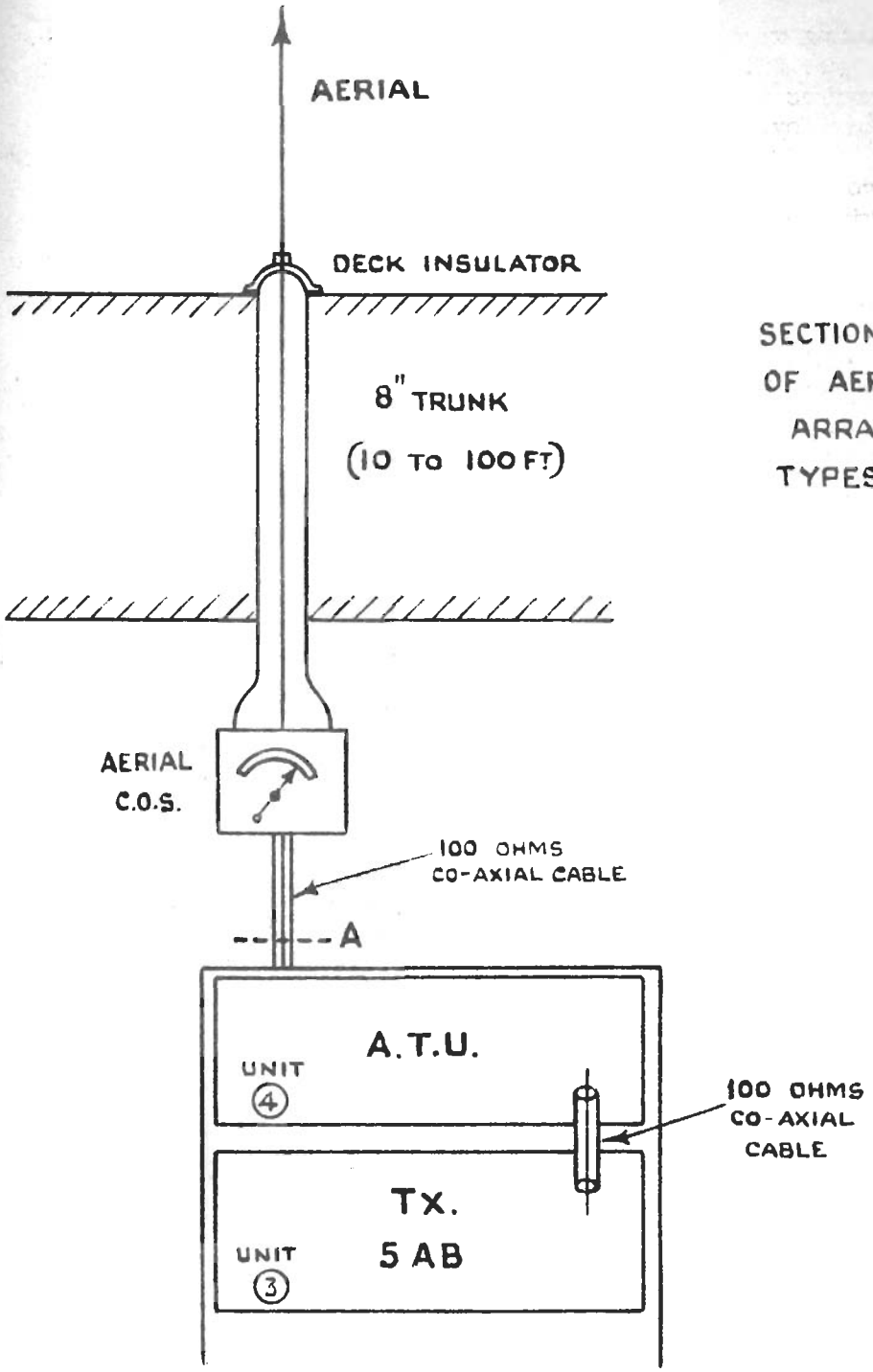
(B) Actual Arrangement.

The output from transmitter 5AB (see schematic) is arranged to match to 100 ohms i.e. maximum possible output from the transmitter is achieved when the final stage "sees" an impedance of 100 (resistive) ohms.

This output is connected to the Aerial Tuning Unit (A.T.U.) by a length of polythene coaxial cable of 100 ohms characteristic impedance. The prime function of the A.T.U. is to match the impedance of the aerial to the output of the transmitter.

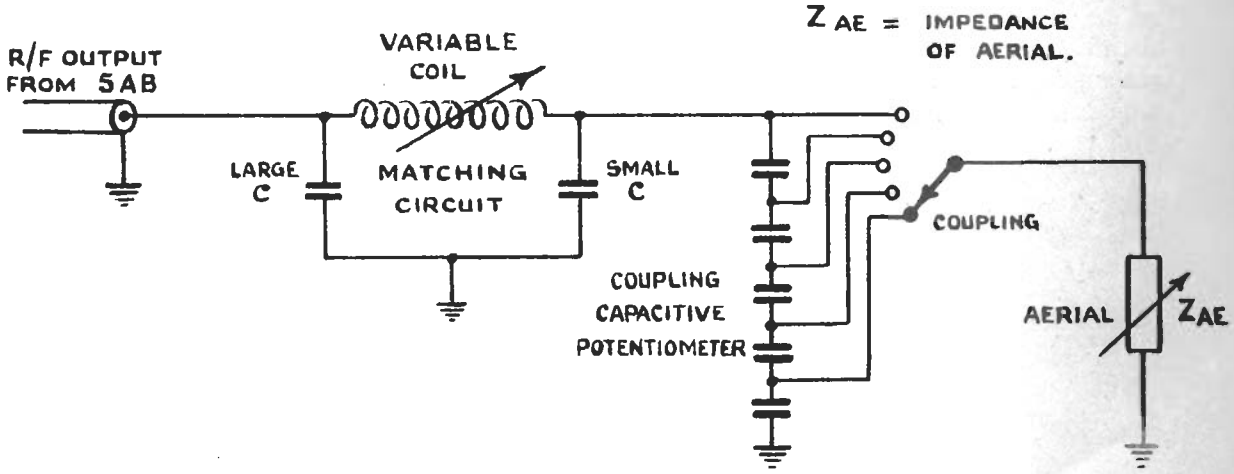
The aerial (which can be considered to consist of the aerial itself, the trunk, and the aerial C.O. switch) represents a certain impedance to the A.T.U. at the point A. This impedance may consist of reactance and resistance. Matching is achieved, broadly speaking, by means of a tuned circuit (called the Matching circuit) in the A.T.U. which, when tuned to the working frequency, balances out the reactive components of the aerial impedance, so that a purely "resistive" impedance is presented to the transmitter.

The value of this resistive impedance is adjusted by a suitable choice of coupling between the aerial and the Matching circuit, and between the Matching circuit and the 5 AB. In effect, it is transformed to 100 ohms in all cases.



SECTIONAL SCHEMATIC OF AERIAL MATCHING ARRANGEMENTS TYPES 601, 602 E.

SIMPLIFIED CIRCUIT SCHEMATIC OF AERIAL TUNING UNIT FOR TRANSMITTER 5 AB (TYPES 601, 602 E.)



The Matching circuit in Types 601 and 602E is arranged in the form of a "Pi" type filter circuit. This has the additional advantage of passing harmonics of the working frequency to earth. Variable coil tuning is employed.

The above matching arrangements will load into aerials of impedances varying between 3,000 ohms and about 15 ohms - in general, long aerials; or with any service aerials (including whip aerials) when the working frequency is above 4 Mc/s. With short aerials and frequencies between 1•5 and 4 Mc/s, an extra tuned circuit in the A.T.U. is brought into play; this consists mainly of a loading coil which in effect lengthens the aerial. (The term "long" or "short", of course, when applied to an aerial, means that it is long or short compared with the wavelength - or, more precisely, a fraction of the wavelength - in use).

The flexible connection between the A.T.U. and the Aerial C.O. Switch is also of 100 ohms coaxial cable, to prevent losses by radiation.

Note: The "lumping together" of aerial and trunk to present a combined impedance at point A is, of course, a great simplification. But with the system described, it is what the operator actually does.

M/F Transmitter - Type 602E (200 - 500 kc/s).

Efficiency is always low on M/F as the radiation resistance of the aerial is only a fraction of the ohmic resistance. Transmitter 4AD, operating as a combined self-contained transmitter and aerial tuning unit, will work relatively efficiently, provided the combined trunk and aerial resistance and capacity lies between 1 and 10 ohms, and 138 to 1100 pF.

EQUIPMENT FREQUENCY CHARTS

Included in this issue, on pages 76 and 77 are two Equipment Frequency Charts, which we hope you will find useful.

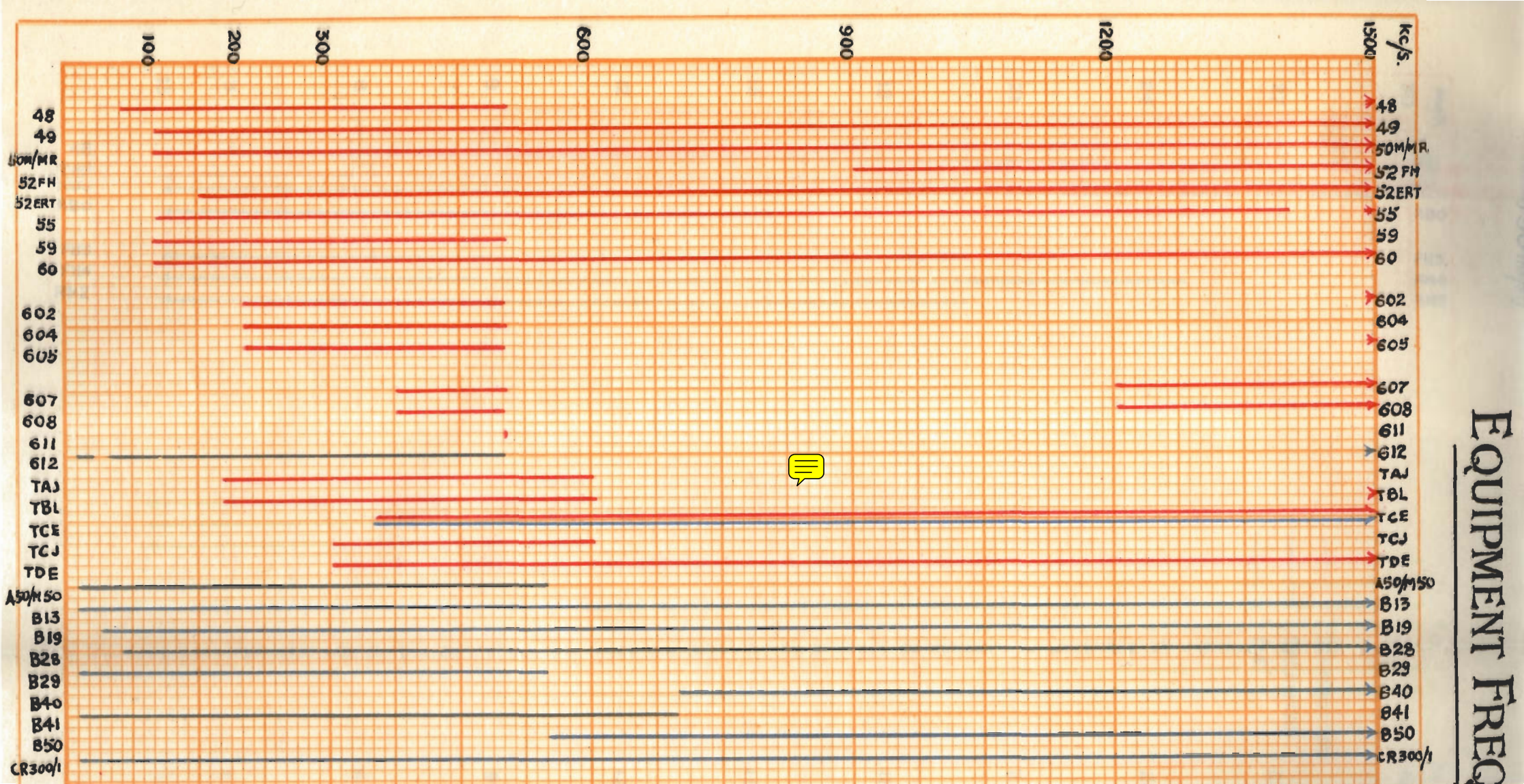
These two charts are from 0 - 1•5 Mc/s and from 1•5 - 30 Mc/s, There is a sister chart 30 - 330 Mc/s available, but as it had to be graded "Secret" it cannot be included in the Bulletin. This chart however, and a limited number of further copies of the other two charts, can be obtained on application to A.S.E. Haslemere.

Don't be worried about types of sets you have never heard about, they are probably the ones at present under development. For instance Types 690/1/2 are replacements for 86M and 87M, and Type 612 is the replacement for Type 52ERT.

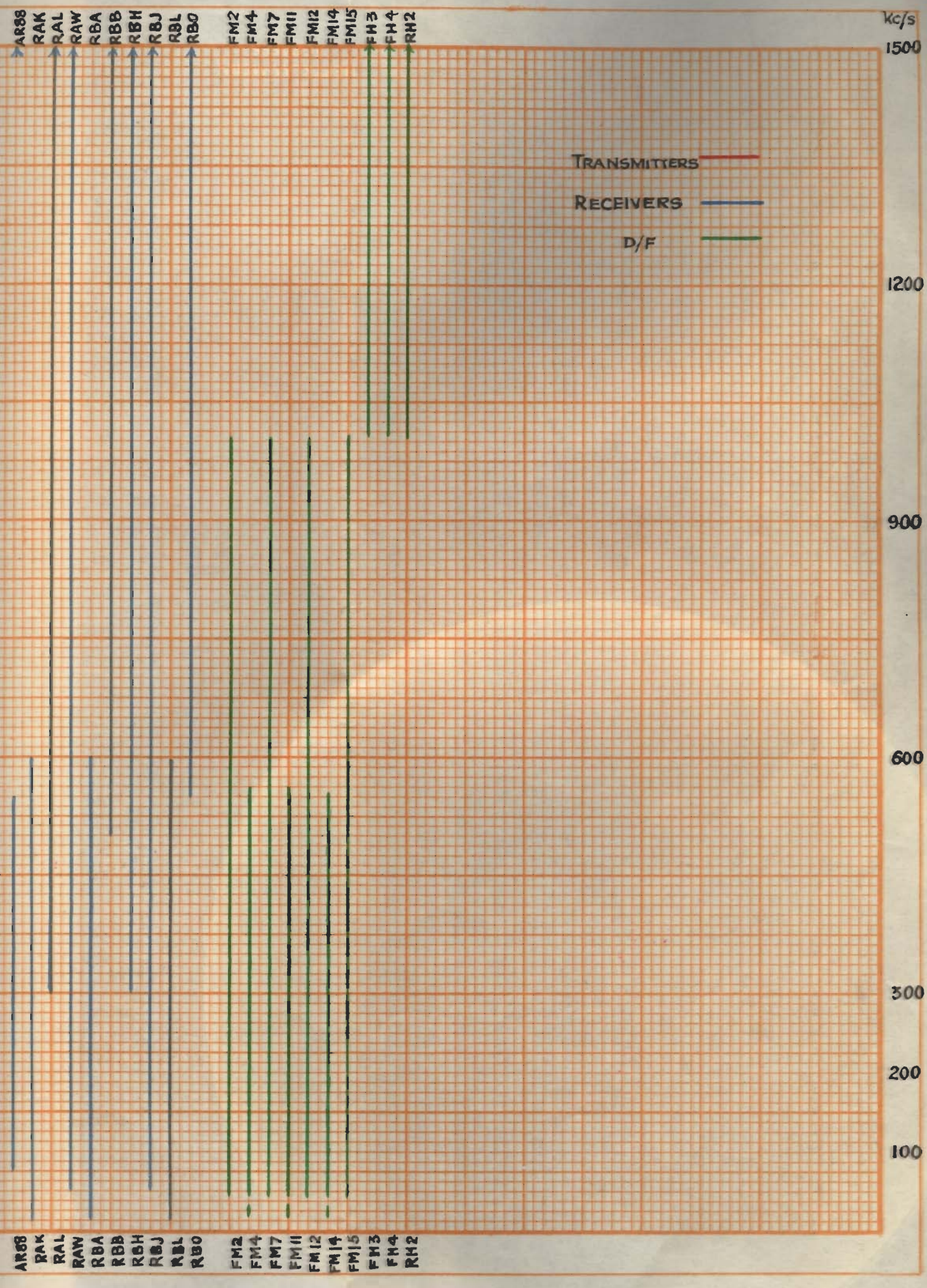
The charts are intended to give you a comparison between various sets, but if you want full details of the frequency of a particular set, it can be found by reference to the appropriate Handbook.

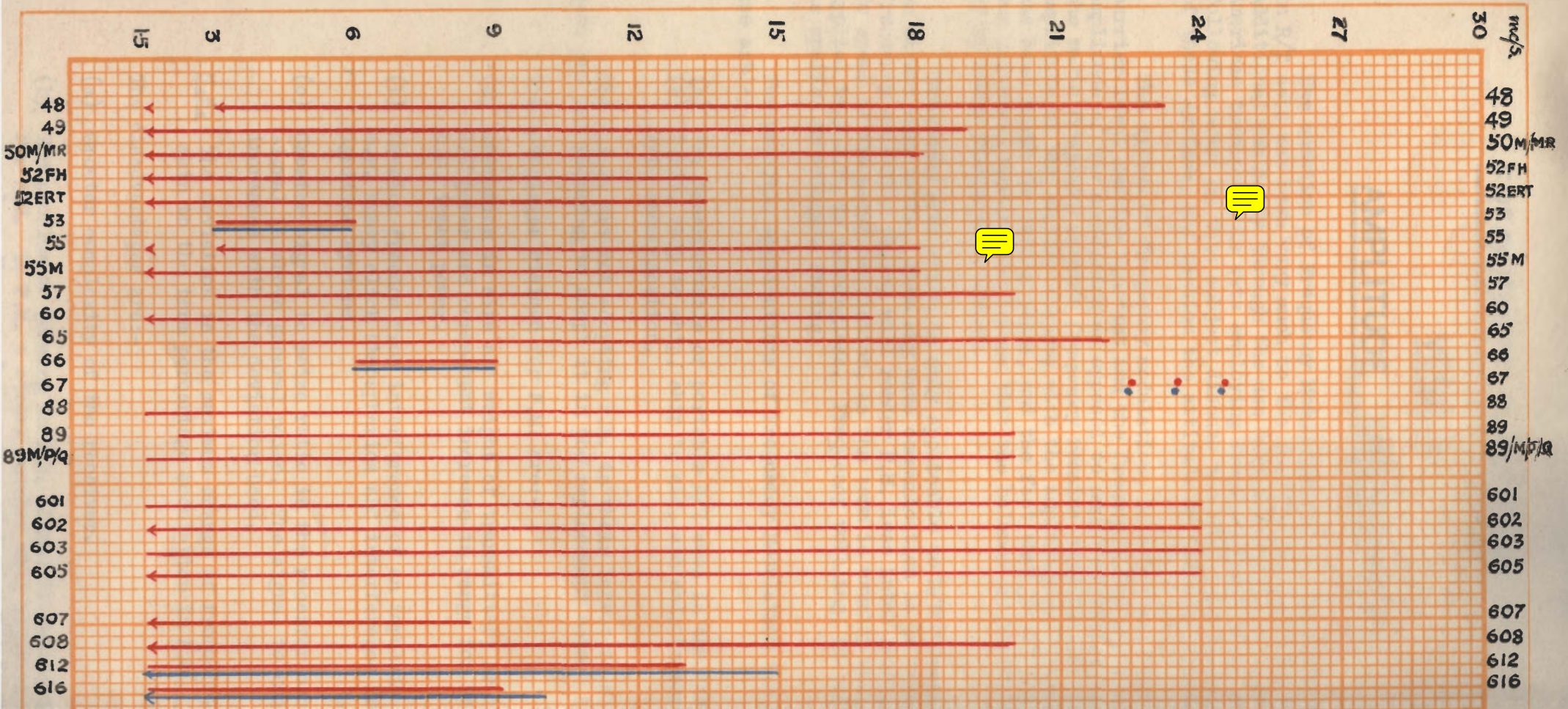
ERRATA.

For errata in these charts, see STOP PRESS. Please amend charts accordingly.

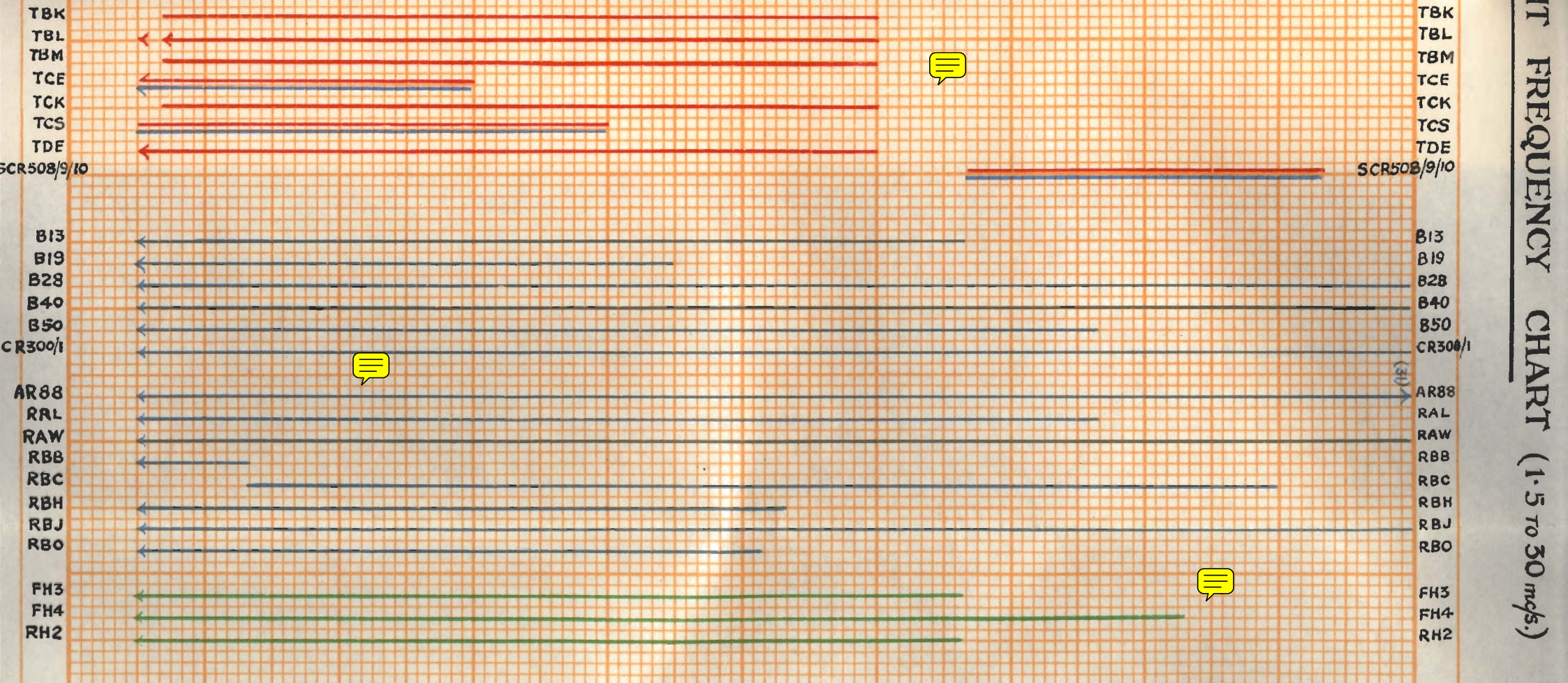

100
200
300
600
900
1200
1500
kc/s.
48
49
50M/MR
52FH
52ERT
55
59
60
602
604
605
607
608
611
612
TAJ
TBL
TCE
TCJ
TDE
A50/M50
B13
B19
B28
B29
B40
B41
B50
CR300/1
EQUIPMENT FREQ

QUENCY CHART (0 TO 1·5 mc/s.)




mc/s
3
6
9
12
15
18
21
24
27
30
48
49
50M/MR
52FH
52ERT
53
55
55M
57
60
65
66
67
88
89
89M/P/Q
601
602
603
605
607
608
612
616

EQUIPMEN



FREQUENCY CHART (1·5 TO 30 m/s.)