POWER AND DISTORTION

THERE is no easy way of measuring power and distortion. Even with the most expensive and elaborate laboratory equipment it is quite a problem. For the kitchen-table type of enthusiast the best way of obtaining a rough and ready idea of power output is to put an a.c. meter across the voice coil terminals of the speaker and then use the chart shown here.

When reproducing music or speech it will be found that the needle will flicker and wave up and down according to the modulation, but you can get a very fair idea of the peak power which is actually going into the speaker. Power factor, phase displacement and many other finer points will make this reading anything but a true reading of power, but as a basis of comparison it has its uses.

To detect distortion it is best to put a millimeter in the plate circuit of the output valve. So long as the needle remains steady there is not much distortion. When the needle starts to flicker and jump about it is a sure sign of distortion. By watching the needle of the milliammeter with the eyes and keeping the ears cocked to listen to the output from the speaker you will soon find how easy it is to tell distortion by ear. After all is said and done, it is distortion which the ear can detect which is the important thing

BROADCAST COILS

Where shielding is specified, extruded aluminium can measures 2¼" high x 1⅜" dia. Base is of moulded bakelite; pins, which are numbered, and protrude 5/16" from base, are silver plated. Permeability iron core is locked with retaining spring. Eyebolts (⅛") complete with nuts, are fitted to can with 1⅜" mounting centres; 1" (minimum) chassis hole required. All windings impregnated with high frequency lacquer.

Types M5-M6-M7 are unshielded. Former measures 7/16" dia. x 1¾" long. Windings terminated on punched bakelite plate (1-1/8" x 1-1/8") fitted with eyelet lugs. Iron core carried by brass insert with internal locking spring. Mounting is by one ¼" hole—nut supplied. These coils primarily designed for use in portable receivers.

Types M19-M20-M21 are unshielded, aircore coils wound on former 1⅞" long x ¾" dia. Secondary winding is progressive wound to ensure low distributed capacity. Terminating lugs fitted at top of former—2 similar lugs provided at base, which may be soldered to chassis, for mounting.

Type		Retail
	AERIAL B/C	
M1	Aircore, Shielded	7/3
M5	Perm. Tuned, Unshielded	6/9
M9	Perm. Tuned, Shielded	8/9
M12	Aircore, Shielded, Reinartz	8/9
M19	Aircore, Unshielded, Prog. wound	5/–
	R.F. B/C	
M2	Aircore, Shielded	7/3
M6	Perm. Tuned, Unshielded	6/9
M10	Perm. Tuned, Shielded	8/9
M15	Perm. Tuned, Shielded, WITH Reaction Winding	8/9
M20	Aircore, Unshielded, Prog. wound	5/–
	OSCILLATOR B/C	
M3	Aircore, Shielded, 455 Kc. Converter as specified	7/3
M7	Perm. Tuned, Unshielded, 455 Kc. Converters ECH35, 6J8, 6A8, EK2, 1R5	6/9
M11	Perm. Tuned, Shielded, 455 Kc. Suitable for same converters as Type M7	8/9
M11A.	Perm. Tuned, Shielded, 455 Kc. For 1A7 Conv.	8/9
M11B.	Perm. Tuned, Shielded, 455 Kc. For 6SA7 Conv.	8/9
M11C.	Perm. Tuned, Shielded, 175 Kc. Same converters as Type M7.	8/9
M21	Aircore, Unshielded, Prog. wound (Converters as specified)	4/9

* * *

Padder Values:

455 Kc. Iron Core Coils—450 mmf. fixed.
175 Kc. Iron Core Coils—.001 mfd. fixed or 175 Kc. variable.
Aircore Coils: 175 Kc. or 455 Kc. Variable, as necessary.

* * *

	MISCELLANEOUS	
M16	B.F.O. 455 Kc. & 1600 Kc. (or as specified)	9/9
M22	Crystal Filter Input 455 Kc. (Circuit)	10/9
M17	Crystal Filter Output 455 Kc. (Available)	10/9
M22A.	Loop Aerial, wound on canvas bakelite former, oval in shape, measuring approx. 7¼" x 5". Windings terminated at centre with eyelet lugs. Coupling turn for external aerial provided. Matches AWA and "H" Gangs	5/9
M17A.	Loop Aerial, similar M17, but with loading coil for peak performance over entire band. Permeability tuned.	7/6

* * *

SHORT-WAVE COILS

All coils are unshielded and wound on bakelite former 1⅞" long, ¾" dia. Eyelet lug termination at top of coils. Iron cores carried by brass insert with internal locking spring—one hole mounting (¼"). Nut and washer supplied. Aircored types mounted by means of eyelet lugs on chassis, or tinned wire, direct to switch.

Type		Retail
	AERIAL 13-42 Metres	
H1	Aircore	4/3
H4	Permeability Tuned	4/9
	R.F. 13-42 Metres	
H2	Aircore	4/3
H5	Permeability Tuned	4/9

(Continued on next page)

OSCILLATOR 13-42 Metres

H3	Aircore 455 Kc.	4/3
H6	Permeability Tuned, 455 Kc. Converters ECH35, 6J8, 6A8, EK2	4/9
H6S.	Permeability Tuned, 455 Kc. for 6SA7 Converter	4/9

Note: S/W Coils are available for all frequencies up to and including 10 metres (30 Mc). As these types are not mass produced, cost is slightly higher than standard coils. Special data form available from Aegis distributors to ensure that all relevent information is supplied when ordering (Form NSF1).

TRANSFORMERS I.F.

Unless otherwise specified, I.F. transformers are fitted in extruded aluminium can measuring 3" high x 1⅜" dia. Base specifications are standard, with silver plated pins moulded into a unit of bakelite. Pins are numbered for wiring code purposes. Iron core in base is locked by means of a retaining spring. Eyebolts (⅛") at 1⅜" centres provide mounting facility—1" minimum) chassis hole required. The upper iron-core assembly comprises a turned brass insert to carry the iron core, which is locked by an internal spring—fibre spacing disc centres winding in can. All windings are impregnated with high frequency lacquer. Fixed mica condensers across wndings are impregnated to ensure stability.

Types J1-J2 are small aircore I.F.'s fitted in can measuring 2⅝" high x 1⅛" square. Heavy gauge tinned pins protrude ½" from punched bakelite base, which is color coded for wiring. Moulded trimmer condenser base is fitted at top of units, adjustment of which is primarily designed for use in portable receivers. The ideal replacement I.F. for old type receivers, being aircored, and of small physical size.

Type		Retail
	455 Kc	
J1	Aircore No. 1	10/6
J2	Aircore No. 2	10/6
J3	Perm. Tuned, Primary & Secondary Centre Tapped, No. 1	13/9
J4	Perm. Tuned, Primary & Secondary Centre Tapped, No. 2	13/9
J9	Perm. Tuned No. 1	13/9
J10	Perm. Tuned No. 2	13/9
J13	(General purpose I.F. providing high gain, with correct channel band width. Litz wire. 7 Kc. band width at 6DB.)	
	Perm. Tuned No. 1	16/6
	(Incorporates Tertiary Winding which may be switched in or out, thus providing variable selectivity. Circuit supplied in carton. Band width varied from 7 Kc. to 12 Kc. at 6DB, when tertiary winding is switched in.)	
J18	Perm. Tuned No. 1	13/9
J19	Perm. Tuned No. 2	13/9
	(A lower priced combination for general purpose use, incorporating solid wire. Ample gain for local receivers.)	
J20	Perm. Tuned No. 1 & No. 2	13/9
J21	Perm. Tuned No. 3	13/9
	(A medium selectivity group designed for the general purpose D/W Receiver employing two stages of I.F. amplification. As gain is slightly reduced to ensure stability, it is essential that these units be used in sets of three. Band width is 4.5 Kc. at 6DB. and 20 Kc. at 60 DB. "Miller Effect" de-tuning is eliminated.)	
J22	Perm. Tuned No. 1 & No. 2	15/–
J23	Perm. Tuned No. 3	15/–
	(In the design of this group maximum selectivity was achieved with gain adjusted for stability under all conditions. Most suitable for communications receivers. Aluminium Can measures 4" high x 1½" square. Windings terminated at eyelet lugs in punched bakelite base of best quality. It is essential that these units be used in sets of three (i.e. 2 I.F. stages) for maximum efficiency. Band width is 3.6 Kc. at 6 DB and 15 Kc. at 60 DB.	
	175 Kc.	
J11	Perm. Tuned No. 1	13/9
J12	Perm. Tuned No. 2	13/9
	(General Purpose Types)	

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about reproduction. By listening and watching, as mentioned above, you will soon develop a good ear for distortion.

Voice Coil Impedances

In order to obtain the maximum power output for a reasonable amount of distortion it is necessary to match the impedances of the output valve's plate to the input of voice coil of the speaker. This is usually done by using a step-down transformer. The ratio of step-down is varied, according to the square root of the impedance ratios.

Those few words just about cover the main facts of the position, but let us ramble about a bit and see what it all means in practice. The plate load rating for various types of output valves will be found by consulting the valve charts. It will be found to vary from about 2,500 ohms for some triodes up to about 15,000 ohms for a few battery-operated pentodes where power output efficiency is more important than the percentages of distortion. The plate load ratings have been selected by the valve manufacturers as optimum; they are the best compromise between power output and distortion. If you want the best all-round results you should make a point of following the recommendations as closely as possible.

In practice the loading is not quite as critical as you might imagine, but we will go into that later.

Whilst the plate loading is rated in thousands of ohms, on the other hand we find the impedance of the speaker rated at something between 1.5 and 15 ohms. Correct voice coil impedance rating for a speaker can be found from the chart which we show, or sometimes it is actually printed on the speaker.

There is no easy way of measuring the voice coil impedance of a speaker, as it is a rating of the motional impedance to a signal of a certain frequency, such as 400 cycles per second.

But once you know the plate load and the v.c. impedance at least you can calculate the correct turns ratio for the input transformer. It is simply a matter of

AEGIS COMPONENTS

(Continued)

dividing the plate load by the voice coil impedance and then taking the square root of this number. For a practical example, say the required plate load is 4,000 ohms and the voice coil impedance is 10 ohms. By dividing, we find that the required impedance ratio is 400 to 1. In order to find the turns ratio we take the square root. The square root of 400 being 20, this is the required turns ratio, viz., 20 to 1. The quickest way to find the turns ratio of any input transformer is to feed a small a.c. voltage into one side, such as 2½ volts from an old power transformer. By putting an a.c. meter across both sides it is then possible to determine the turns ratio quite easily.

There are, however, many side-issues to be considered in selecting input transformers. The turns ratio is not the only factor to be considered. Even in ordinary commercial applications it is desirable to specify a certain type of input transformer to suit a certain output valve when feeding into a certain type of speaker. For example, the correct input transformer for use with a small battery valve can be of quite different weight, size of core and gauge of windings to one which is required to operate with a big power valve drawing a heavy plate current. Then when you get out into the high-quality field many further factors become involved. High power and high fidelity call for special requirements.

In all cases it is safest to ask for a transformer to suit the particular application you require, but the above knowledge may be helpful to you in an emergency.

Further data on matching, the use of multiple speakers and so on, was given in the April, 1948, issue.

Tolerances

As with most things, in radio there are certain tolerances which

I.F. TRANSFORMERS (Cont'd.)

	1600 Kc	
J14	Perm. Tuned No. 1	13/9
J15	Perm. Tuned No. 2	13/9
	(General Purpose Types)	
	2000 Kc	
J16	Perm. Tuned No. 1	13/9
J17	Perm. Tuned No. 2	13/9
	(General Purpose Types)	
	10.7 Megacycles	
J24	Perm. Tuned No. 1 & No. 2	19/6
J25	Perm. Tuned No. 3 Ratio Detector	19/6
	(Designed for broad band F.M. Receivers. The physical specifications are similar to J1-J2 with the exception that iron-core screws protrude at each end. Suitable for use with Radiotronics No. 127 circuit. Resonating condensers and damping resistors fitted.)	

KITSETS

The term "Kitset" when coupled with the name "Aegis" is intended to indicate that every part required, and every detail of design necessary is embodied in the receiver concerned. When unpacked, all components, nuts, screws, solder, etc., will be found, together with a comprehensive booklet covering assembly and wiring instructions. A.R.T.S. & P. Transfers are attached to the chassis to enable full legal use of the superheterodyne circuit. Where necessary, all parts for the dial assembly are enclosed in a separate pack with the remaining hardware, thus simplifying the sorting of parts. The kitset is supplied in a compact corrugated carton.

Type		Retail
KS4/B	"METROPOLIS"—A four-valve B/C Mantel Receiver. Bakelite Cabinet. Edgelit straight line dial. Rola 5C Speaker. Cadmium plated chassis. Approx. size: 10" high, 9" wide, 6" deep. Valves: 6A8G, 6G8G, 5Y3G, 6V6G (not supplied)	£10/–/–
KS5/D	"LITTLE COMPANION DE LUXE"—A 5-valve D/W A/C Table Model. Attractive Walnut Veneer Cabinet. Rola 6H Speaker, Edgelit Dial. Instruction sheet includes the new Connoisseur Circuit with tone compensation network—superlative single ended output. Valves: 6J8G, 6G8G, 6J7G, 6V6G, 5Y3G (not supplied). Approx. sizes 14" wide, 9" high, 7½" deep.	£17/2/6
KSR/4	"RURAL FOUR"—The ideal country receiver, housed in attractive bakelite mantel cabinet. Rola 6H Speaker. Straight line dial. Long battery leads reach floor. Valves: 1R5, 1T4, 1S5, 3S4 (not supplied)	£10/–/–
KP4	"VOYAGER"—A 4-valve portable receiver in attractive leatherette case. Rola 3C speaker, 2 Minimax 45V batteries, 1 "A" battery 1.5V. Weight approx. 12 lbs. Size: 8" x 7" x 6½". Valves: 1R5, 1T4, 1S5, 3S4 (not supplied). Complete with batteries.	£12/12/–
PP4	"PERSONAL"—A four-valve receiver measuring only 9" x 4" x 5" and weighing under 5 lbs. Minimax 67½V battery and 2 No. 2 Torch Cells provide power. Rola 3C speaker. Attractive leatherette or plasticised linen-covered case with electronically fused adjustable carrying strap. "Pencil Case" slide lid for easy access to cells. Leightweight balsa wood case. Valves: 1R5, 1T4, 1S5, 3S4 (not supplied). Complete with batteries. Chassis cad. plated and already punched to facilitate addition of fifth valve, I.F., etc.	£12/12/–
PP4/5	CONVERSION KIT—Contains necessary components for conversion of PP4 to 5 valve(including valve)	£2/7/6

(Continued on next page)

KITSETS (Cont'd)

KS3/B	"ECONOMY THREE"—A 3-valve A/C mantel receiver eminently suitable for a second set and particularly for the beginner. Bakelite cabinet, with edgelit straight line dial. Chassis cadmium plated. Valves: 6J7G, 6V6G, 5Y3G (not supplied)	£7/7/–
KD/5U	"UNIVERSAL FIVE"—A five-valve D/W AC/DC Receiver for 240 Volts. Housed in attractive walnut veneer cabinet, Rola 6H speaker, edgelit dial, chassis cadmium plated. Incorporates Aegis coil assembly type K1. Valves: 12SA7GT, 12SK7GT, 12SQ7GT, 35Z5GT, 50L6GT, 1954 (not supplied). The ideal receiver for an area now on D/C and likely to be converted in the future to A/C.	£17/17/–

FOUNDATION KITS

These kits are useful for those who have sundry parts and desire to use them in circuits of their own design. All kits are packed in cartons and clearly labelled.

Type		Retail
FK1	Comprises 5V. Console chassis—USL32 Dial, Coil Assy. Type K1, 2 Aegis I.F.'s J9-J10, A.W.A. Gang, Connoisseur circuit	£7/1/–
FK2	Comprises bakelite cabinet, dial assy. and chassis similar to "Metropolis Four"	£3/4/3
FK2B	Similar to FK2, but for "Rural Four"	£3/4/3
FK3	Similar to FK2 but with additional parts as follows B/C, Aerial and Osc. Coils, I.F. Transformers J9-J10, 40 m/a Power Transformer, Rola 5C Speaker	£8/15/–

COIL ASSEMBLIES

K1	A dual-wave assembly incorporating permeability tuned Aerial and Osc. Coils for B/C (550-1600Kc.) and S/W (7-23 Mc.) Trimmers and Padder (fixed) condensers fitted. Iron Core adjustment is made from above chassis (Trimmers from beneath). Suitable for "H" & "A.W.A." Gangs. Measurements: 2½" long, 3¾" wide, 1⅞" high. Available for converters 6J8, 6A8, ECH35, EK2, 1C6. "Oak" Type Switch built in with 3" long x ¼" shaft	50/–
K1-S	As K1 but for 6SA7 Converter	50/–
K2	A dual wave assembly with same coverage as K1 type and incorporating R.F. stage. All coils permeability tuned and matched for "AWA" and "H" Gangs. Constructed on sub-chassis measuring 5¾" long, 2⅞" high, 5½" wide. Concentric air trimmers fitted, also fixed capacity padders. S/W core adjustment from above chassis—B/C core and trimmer adadjustment from beneath chassis. "Oak" switch shaft 1¾" long x ¼" dia.	140/–
K2-S	As K2 but for 6SA7 Converter	140/–
K3	This triple-wave coil assembly incorporates permeability tuned coils covering the B/C band (550-1600 Kc.) and S/W bands 13-42 and 40-110 metres. Physical details same as K2. Efco dial type USL46, 3 band AWA available to match.	160/–
K3-S	As K3 but for 6SA7 Converter	160/–
KC4	A four band unit which is the ultimate in coil assembly design. Actually constructed in 3 subsections comprising R.F. converter and oscillator stages. Finally assembled in one unit, which incorporates band set and band spread condensers, together with 2 slow-motion drive assemblies and directly calibrated plastic dial. 4 Wave Bands—550-1500 Kc., 1500 Kc.-4 Mc. 4 Mc-11 Mc., 11 Mc-30 Mc. Band Spread On—3.5-4.0 Mc. 80 metres; 6.9-7.3 Mc. 40 metres; 14-14.4 Mc. 20 metres; 20.5-22.0 Mc. 15 metres; 27-30.0 Mc. 10 metres. Overall dimensions: 8½" wide, 6¾" deep, 5⅜" high.	£26/5/–

(For details of other Aegis products write direct to the manufacturers.)

can be allowed. As the scientists can prove to you, even an inch on a ruler is seldom a true inch, but nearly always plus or minus a fraction of a thousandth part of an inch. Such is tolerance, and a thing which we would like to see more in evidence in politics, personal relationships and radio technique.

The plate loading of a valve is seldom critical. A triode type of output valve is not at all critical and it is most difficult to detect the difference in performance with a triode feeding into a load of 2,500 ohms and 10,000 ohms. Pentodes are a little more critical if you want maximum power output, but it is fortunate that a lower impedance than according to rating will mean only lower distortion and lower power output. When using a large single pentode, such as an 807 it is sometimes worthwhile to sacrifice a little power output by using a lower impedance rating. The lower level of distortion is sometimes worth the sacrifice.

Tolerances, however, are out of place when you go after the highest of high fidelity. For example, in the Radiotron A515 amplifier (the local version of the English Williamson circuit) the output transformer is a most important item and factors such as primary inductance, leakage inductance and insertion loss have to be considered in order to ensure that phase displacement is kept at a minimum.

Further data on this point is given in the August, 1947, issue, which dealt with the original Williamson circuit.

HAM CALL SIGNS

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Latest lists of alterations, amendments and new issues are published regularly. Watch for this feature.