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Hi-Fi Choice No 19
Receivers, Tuners & Amplifiers by David Watson & Paul Messenger

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Note: many of the value judgements within this publication are based on the estimated typical prices printed. While every effort is made to ensure that these are correct at the time of going to press, they are subject to variation and fluctuation, and are clearly only applicable to the UK market. Readers should therefore bear in mind the current prices operating when interpreting value for money comments.

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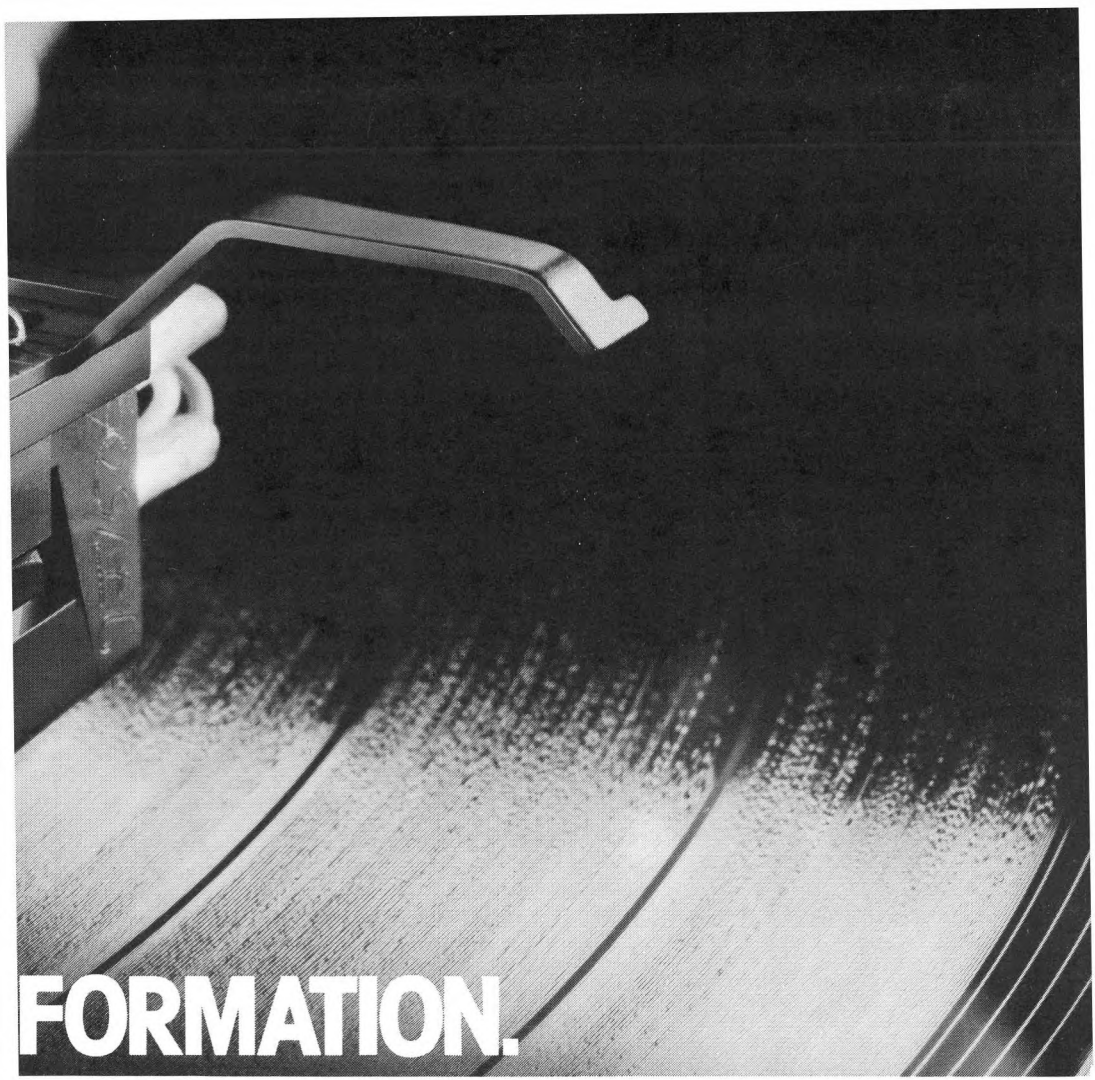

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This book follows the format we have developed over the years in the *Choice* series, so regular readers should have no difficulty in finding their way around; for the newcomer, the book is divided up for convenience into a number of sections. First is a short *Editorial Introduction,* which is an opportunity to explain the reasons behind some of the decisions made concerning the project as a whole, and also make a few excuses for the products that have been left out!

The *Consumer's Introduction* is an attempt to discuss many of the recent aspects of receivers and their performance in non-technical language that is as jargon-free as possible. This has to be a fairly long piece of writing even to cover the subject superficially, and it is therefore divided into four main chapters. These begin with a discussion on the features and facilities fitted to tuners, amplifiers and receivers. The second chapter concentrates on the tuner side, examining the way radio works, and the job the tuner has to do to get it to work, with some details on the meanings of the measurements we have undertaken, while the third chapter follows a similar course for the amplification section. The fourth chapter entitled *Choosing and Using* tries to give advice on how to go about buying a hi-fi receiver, and how to get the best performance from it once you have bought it. The *Technical Introduction,* freed from constraints of avoiding technicalities, explains in some detail the test procedures adopted and their *rationale.*

The *Reviews* themselves provide a straightforward written description of the various receivers and combinations, conveniently grouped under subheadings which discuss the design itself, its lab performance, the results of our listening tests, and a general summing-up. Each report is accompanied by selected data from our tests to enable the product's compatibility with other components to be established, and the basis of our judgements to be examined.

The *Conclusions* looks in retrospect at the overall findings of the project, discussing such trends as may have been established, while the *Best Buys and Recommendations* highlights those products that have performed particularly well, both in absolute terms, but specifically in relation to their price.

The *Overall Comparison Chart* is another summary section, which presents a selection of the data obtained for each amplifier in tabular form, to enable the would-be purchaser to easily short-list models that best meet his or her specific requirements.

We should point out that there are dangers in ignoring the detailed parts of the book and merely relying upon the summaries. If we felt that some sections of the book were unnecessary, we wouldn't have gone to the trouble and expense of writing and publishing them! A summary always leaves a lot unsaid, and if relied upon can be misleading. They are published because they are a useful way of presenting our findings accessibly, but receiver reviewing does not readily lend itself to the 'pithy one-word characterisation', and the summaries should not be regarded as substitutes for the reviews themselves. Furthermore our value judgements and recommendations relate to the stated typical price, and our assessments of what things are important. Far better for the individual reader to work out his own 'recommended' listing.

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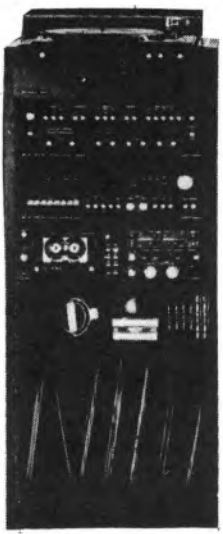

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In discussing the *rationale* behind this project, it is best to start with a look at the hi-fi marketplace itself. To start with, we have decided to produce a combined book of receivers and tuner plus amplifier combinations simply because the market is moving away from the receiver (fashion being the only obvious reason), and neither is it economic for us to devote an entire book to tuners. The influence of fashion in the marketplace does bring other problems however: because the hi-fi market is traditionally 'seasonal', peaking in November and December, new products tend to be launched to the trade in May, and to the public in August/ September; moreover we are now entering an era when product lines are being revamped annually. Now because a Hi-Fi Choice takes about five months to prepare, it is difficult even to get early samples of the coming season's products into an issue that is published at the end of the summer. We have done our best to get in as many of the latest models as possible, though inevitably some 'famous names' couldn't meet our deadlines with their Autumn '80 models (*eg* Harman Kardon, Hitachi, Pioneer, Sansui). More irritating from our point of view was the belated discovery that some models we had already started to test were shortly to become obsolescent! However it is worth noting that an 'obsolete' model may be just that from the importer's point of view, but stocks are likely to remain in the shops for some months, and often 'last year's model' can be on offer at a very attractive price. (In view of the looming recession, and general reports from dealers, this Autumn could become a consumer's bonanza from this point of view.)

A constant source of controversy in hi-fi writing concerns reviewer prejudice. It is my opinion that all critics have some prejudices, but these only become dangerous when they are unable to admit or recognise them. What are our prejudices then? Well, first and foremost, we do believe that electronic components like amplifiers and receivers 'sound' different, and that the differences are important and not only when the components are working near their limits. This is a belief which is widely shared (and likewise disputed), though there is no scientifically proven case on either side. That said, we do rely to a degree upon listening tests, but to avoid bias the majority were carried out blind, and several different tests were undertaken; where results are consistent we naturally feel that they have some meaning, and where they are inconsistent we are not embarrassed to admit the fact (an unshakeable belief in one's infallibility is as dangerous as ignorance of one's prejudices).

It is also true to say that we are both biased in favour of records rather than radio as a music source, simply because most of the time the results can be markedly superior. This is because the BBC record players are unexceptional if not antediluvian by hi-fi standards; live brodcasts are few and far between for much of the time, and their major content is restricted to classical music; the FM transmissions in the UK are totally scrambled by being taken over for educational services.

The third possible prejudice that springs to mind is a general fondness towards home-produced equipment. This is not mere jingoism, though it is difficult to specify precisely the reasons; perhaps its to do with the comparative longevity of a model, allowing one to become accustomed to it and know it well; perhaps because the designers' personalities and philosophies are closer to our own, and are reflected in and give integrity to the products; perhaps its harking back to those days of innocence (only a decade or two ago) when a new product was an event, and when music was more important than marketing hype.

A further source of worry is that David's involvement with retailing, as manager of Russ Andrews High Fidelity in Edinburgh, might prejudice him in favour of the particular product that he sells. Where there is any danger of this I have tried to point it out, but there are plenty of safeguards built in (blind testing etc.) in any case, and the reaction to our last co-authorship suggested that this fear had been proved groundless. Moreover his involvement with reviewing and retailing is certainly symbiotic: his retailing experience making him better at reviewing and *vice versa*.

Assessment of amplifiers is neither easy nor particularly reliable, because the measurements one can take do little more than establish the competence of the design and give indications of possible troublespots, and can in no way be regarded as reliable discriminators. Likewise the listening tests have a penchant for unreliability, which one tries to combat by repetition, but cannot ignore nonetheless. Assessing tuners is perhaps more difficult still, though the measurements do tend to be rather more relevant. Major stumbling blocks arise from the fact that there is no such thing as a 'typical' radio reception area (and this includes

signals generated *via* test apparatus). Once again we hope to have gone some way towards combating this problem by carrying out several listening tests in different environments, though problems arise when trying to listen 'off-air' because the programme source quality is very variable and uncontrollable (and there was no 'live' BBC music broadcasting anyway during some of the tests, due to the MU industrial action!) To help balance our personal negativism towards radio, we also obtained the services of self-confessed 'radio nut' Norman McLeod, a creative engineer with a particular interest in AM broadcasting, and his comments are incorporated where appropriate.

Another new name to regular 'Choice' readers is Adrian Orlowski, author of the *Consumer Introduction*. A relative newcomer to hi-fi writing, his background in philosophy and interest in music provide a firm and refreshingly literate base, while a mis-chosen career in accountancy acts as an added incentive! In the past I have tended to write the *Consumer Introductions* myself, but felt that as I was writing the rest of the book this time this might be too much of a good(?) thing, and that a change would be as good as a rest.

I don't propose to go into great detail about the tribulations that seemed to dog much of this project, but if the book should appear late (which it probably will) they included: a vicious history of test gear malfunctions; a theft of half a dozen items in transit; difficulties in getting review items in on time (one poor importer, baffled at the non-delivery of his very latest machinery, discovered that they had spent ten days sitting in a warehouse because no-one there was sure what to do with them); a computer that dumped its memory when someone inadvertently pulled the plug.

At any rate I hope the result has been worthwhile, and reflects the effort that has been involved. I also hope that it is fair to the product reviewed; it is difficult to ensure this, though it is made easier I feel by the collaborative authorship we have used, which reactions to our previous joint effort on amplifiers seemed to confirm. I would finally like to stress that the 'recommendation' categories in *Choice* should not be considered rigid barriers, and often the dividing line can be appallingly thin. Apart from the more expensive products that may be recommended on quality alone, cheaper products are assessed in terms of value for money *based on the typical price that we have printed.* The market is currently very volatile on pricing, so variations may well need to be taken into account.

Paul Messenger

To be comprehensive, a consumer introduction such as this inevitably becomes unwieldy. To help the reader through what could become a maze, the structure is arranged as follows. After a couple of introductory pages, which includes a discussion of the differences between receivers and separate amplifier and tuner components (terms that should be considered interchangeable throughout), the first main chapter examines the various features and facilities normally offered, proceeding in stages from inputs to outputs. The second chapter concentrates on the tuner, and necessarily becomes a little more technical in explaining how FM radio works, what the tuner has to do to receive the radio signals, and the sort of measurements that we have carried out in the reviews to assess performance. The third chapter follows a similar course in discussing the requirements, behaviour and specifications of amplifiers. Finally there is a chapter entitled 'choosing and using', which seeks to give some practical advice on finding the receiver that suits one's needs/tastes, and in getting the best results from a new purchase.

Of the many technological innovations and discoveries which make up the hi-fi system as we know it today, perhaps the most important (excepting Edison's original breakthrough) is electrical amplification. Arguably of course, stereophony, FM, microgrooves, etc., could lay similar claims, but once we extend our vision beyond the purely domestic milieu of hi-fi, it can be seen clearly that electronics have had the greater impact on society, revolutionising communications on a global scale.

At the turn of the century, the hi-fi system of the day (if we dare describe it as such!) was a purely mechanical affair, with the stylus transmitting its vibrational energy directly to a diaphragm at the beginning of a horn; this then amplified the sound waves as they passed down it. It worked – but only up to a point. The invention of the electron-tube valve amplifier, however, not only meant louder sound capability, but enabled rapid development in cartridges, loudspeakers and recording techniques, with considerable attendant improvements in sound quality because it freed the elements of the system from their previous physical and mechanical limitations. Essentially, the system of today with its electro-mechanical transducers at each end, and electrical amplifier in the middle, follows the pattern set in the 1920s, although with the digital disc in the offing this may not be true for very much longer.

Even so it is also true to say that electronics really only came to sound reproduction by way of wireless radio, towards which the main thrust of technological research was being directed at the time. Radio soon became established as a medium of popular entertainment alongside the disc, but when the post-war innovation of the now familiar microgroove LP emerged, the standard format of broadcasting on the Medium and Long Wave bands by the process of amplitude modulation (AM) was beginning to show its age.

The reason for this lay not so much in any inherent limitations in the process, but on the contrary rather that it was a runaway success, and consequently the sheer proliferation of radio stations on the medium and long-wave bands (in Europe at least) precluded interference-free broadcast and reception of a high-fidelity nature. Thus the frequency modulation (FM) process of radio transmission was introduced, and to avoid the congestion which continues to plague AM broadcasting, it was allocated new frequency space on what is known as Band 2 at Very High Frequencies (VHF 88–108MHz). The planners of the system may be credited with rare foresight in these times of unexpected breakthrough and rapid obsolescence, since in the twenty-five years since its introduction there is still no sign of any changes being necessary now or in the immediate future.

In this same period, hi-fi itself has changed quite dramatically, not least in terms of the equipment (Compact Cassette tape recording, stereophony, semiconductors, micro-integrated circuits). But from being a decidedly esoteric way of spending one's spare time, it has now achieved 'consumer durable' status, and the hi-fi system usually joins the car, washing-machine, colour TV, camera, etc., on the shopping list. But it remains a luxury item, and is thus unfortunately rather more subject to the cyclic recessions inherent in the free economy than some of those other items.

Receiver or Separates?

The question whether to buy a receiver or separate amplifier and tuner (which amounts to much the same thing) deserves close attention; the assumption being that the high-quality radio source is considered essential to the prospective purchaser.

Given that equipment manufacturers who produce both amplifiers and tuners usually also make receivers, which are effectively the two separate items packaged in a single unit, it is almost invariably true that the receiver is cheaper to buy than the equivalent separates – sometimes by a significant margin. The electronic circuitry is likely to be very similar in both instances, with the cost saving being achieved through not having to double up on power supplies, wiring looms, ergonomics/cases and transport costs. In addition the receiver has other advantages over separates in being rather simpler to set up, requiring fewer connections to be made, and being more convenient to use. In the ordinary course of things then the receiver has much to commend it, and in most cases will be the better buy.

The disadvantages of a receiver, however, tend to be rather more conspicuous in particular circumstances, and lie in its inflexibility when compared with separate items. One may for instance have the misfortune to live in an area of difficult reception, in which case a particularly good tuner front-end performance may be necessary. Such a tuner can then be purchased without having to fork out for an expensive integral amplifier as well, by choosing to buy separates. Alternatively one may wish to be guided entirely by considerations of sound quality, which could preclude *any* receivers in a given budget. Moreover, some specific feature or facility may be required which can only be found on separates. Finally, if upgrading is envisaged in the future, this might be less painfully accomplished by purchasing separates in the first place.

FEATURES AND FACILITIES

If one's sole experience of sound reproduction has been with a portable radio or cassette recorder, on initial acquaintance hi-fi is likely to appear somewhat confusing, particularly the electronics side of it. This is therefore an appropriate place to get on terms with the receiver (or combination) and find out what all the facilities are for. What they do, why they are there, how they fit in with a system, and what must be connected where to get it all to work. In this part of the Introduction the emphasis is on the receiver as a 'box with knobs on,' and the discussion will progress logically from the inputs, through the various features and facilities, finishing at the outputs.

Aerial Inputs

The aerial requirements of a tuner or receiver depend in the first instance on the radio-frequency bands it is capable of processing, such as FM radio, operating at VHF (Very High Frequencies), and AM radio, which covers the Long- and Medium-Wave Bands (operating at Low and Medium Frequencies). Consequently two different aerial types are required. Where the receiver features AM reception, a basic but often adequate ferrite aerial is usually provided with the equipment – but in fact many receivers feature FM only, because AM radio is no longer capable of the performance parameters necessary for high-fidelity broadcasting and reproduction, and its provision on hi-fi receivers is often little more than an afterthought.

FM radio will require a separate external aerial; just what is required in specific instances, and what can be obtained, is dealt with more fully in the later *Choosing and Using* section. But for the record a few points should be borne in mind. A receiver can only deliver its designed optimum performance if it is supplied with a good signal. This doesn't automatically mean getting the best aerial available, because the most appropriate aerial will depend on the location where it is to be installed. However the bits of 'string' supplied with some receivers which masquerade as FM aerials are not likely to give a good performance either, unless one happens to live virtually underneath the transmitter. Remember that for the same background noise-level ('mush' and hiss along with the signal) for stereo as achieved in mono, the stereo signal from the aerial must be ten times greater (20dB) than the mono one, and only a good aerial will provide this.

At the aerial input on the receiver there will be one of two types of socket – sometimes both are fitted. One type will accept a coaxial plug of the sort found on television aerials, and uses a coaxial cable. The other is a 'ribbon' feeder, being two wires spaced a short distance apart inside a flat plastic sheath. These are referred to respectively as 72/75 ohm and 240/300 ohm types, or sometimes as 'unbalanced' and 'balanced', and their purpose

is to ensure that the aerial is correctly matched electrically to the receiver: if it isn't, an effective loss of signal strength occurs, and reception will seem poorer than it might be. Aerials themselves are either of the 72/75 ohm type or the 240/300 ohm type, and should be used with appropriate input on the receiver. Where either the aerial or receiver is of the 'wrong' sort, it is happily not necessary to dispose of one or the other, since transformers called 'baluns' are available to correct the match! These are inserted between aerial and receiver. In the individual reviews aerial requirements and types (both FM and AM) are detailed.

To obtain the best signal strength, all aerial systems attempt as far as possible to match in size the wavelength of the frequency they wish to receive. This is convenient enough in the VHF region, but naturally poses problems in the AM medium and long wave bands, where wavelengths vary from 200 to 2000 metres! The ferrite rod aerial fitted to most receivers is a poor though convenient solution, and for better results a long piece of wire – the longer the better – should be used. For the serious AM listener this could stretch around the garden and double as a clothes line!

The disc input

One could write a small book on the ins and outs of the disc source and its amplifier connection, so this section is necessarily very superficial. Most connections will be made *via* (2) phono sockets, usually with an extra earth lead, though occasionally a 5-pin DIN will be encountered. When in doubt make the earth connection between record deck and receiver if provided; earthing can pose tricky problems that do not make for glib generalisations, so if hum problems are persistent a dealer's services may be required.

Pickup cartridges come in two major types: moving magnet, and moving-coil; the former is by far the most popular, but the latter has been gaining ground significantly in recent years, despite its comparatively high price. The standard disc input fitted to all receivers is designed to match the typical moving magnet cartridge in terms of its impedance and input sensitivity. There remains the problem that some such cartridges are sensitive to the total capacitance into which they are working, and some receivers are provided with facilities to make slight 'tuning' adjustments (similar but cruder adjustment may also be made by varying the impedance slightly, though this is usually less satisfactory). The optimum loading and the cartridge's sensitivity to load variations can probably be found in our companion volume *Cartridges and Headphones,* and the load 'seen' by the cartridge is that of the receiver input (see reviews) plus the wiring from the record deck (full details in *Turntables and Tonearms*). Extra capacitance may always be added using special accessories and it is worth a little trouble to get this equation right.

Most moving-coil cartridges require a totally different input matching, though many receiver designs now offer this as standard (hitherto m-c enthusiasts had the disincentive of forking out an extra £50 or so for a special 'in-between' head-amp stage). Moving-coil cartridges are fortunately little affected by load changes – fortunate that is because there is no agreed standard for the input impedance. Values of 60–100 ohms offer the best compromise, though 20–200 ohms should pose little problem. Some of the less costly m-c cartridges incidentally are designed to work directly into the normal m-m input, and are normally load-insensitive.

Though the cartridge provides the electrical signals directly for the receiver, the turntable's influence must not be ignored. Turntables and arms not only give significant differences in sound quality – often dominating the sound of the cartridge – but may bring other problems in their wake. For example, the editor of another magazine recently told me that they had all-but written-off the performance of an amplifier, until they replaced the system's turntable with a superior design. This revealed that the amplifier was really quite respectable, but that its performance had been spoilt by having to accept and try to cope with a considerable amount of 'garbage' from the indifferent turntable that was feeding it! Clearly there is still no substitute for careful system listening tests!

Tape Input/output

As might be expected from the story so far, there doesn't exist a single standard for the interconnection of tape recorders and amplifiers either! The two standards which exist are notionally based on different connection socketry, one using separate 'phono' sockets for each channel and for inputs and outputs (making a total of four), the other being the DIN standard and usually using a single 5-pin DIN for all signals. The two standards are effectively incompatible in terms of an electrical

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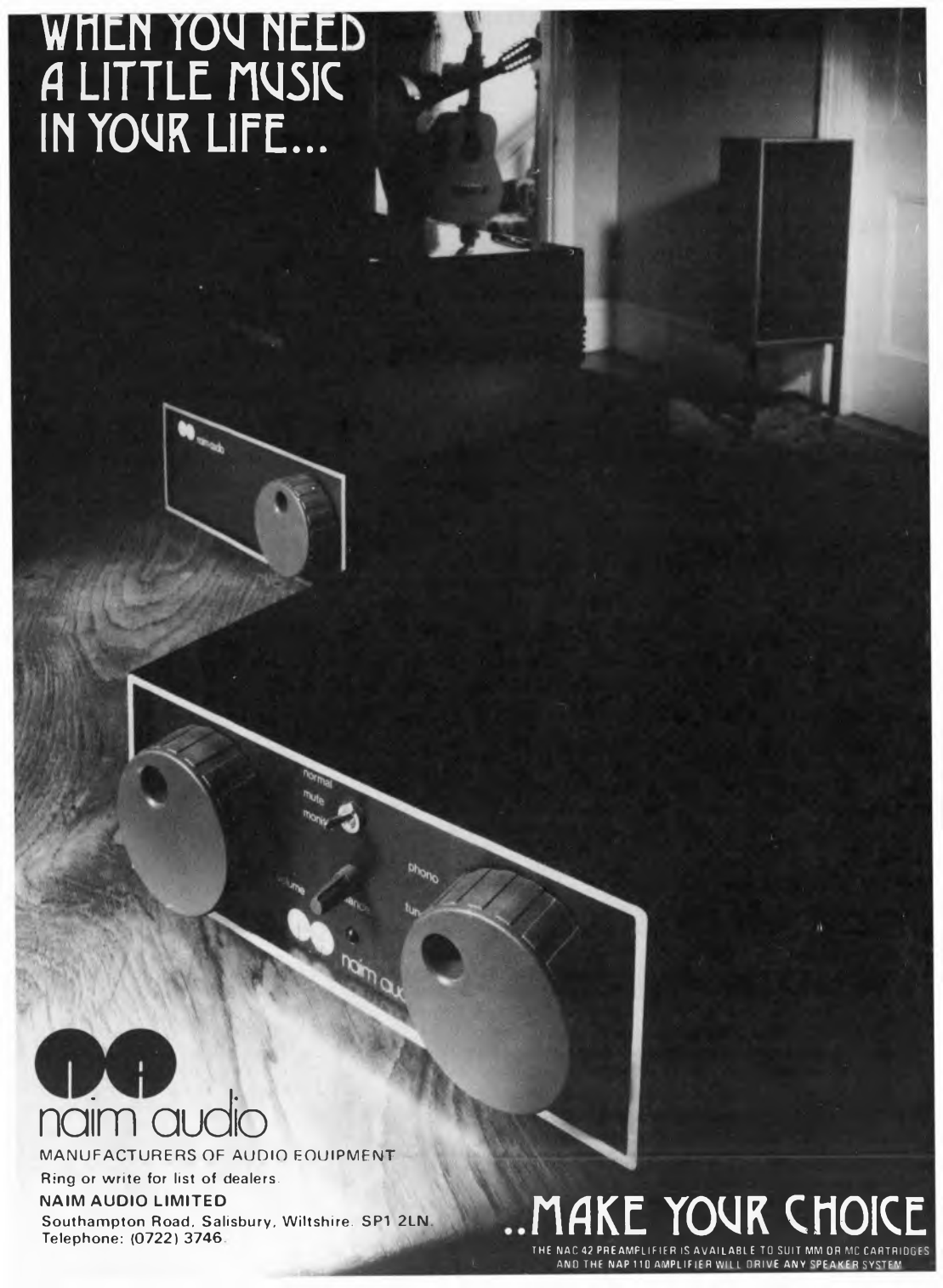

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mismatch, so normally the interconnection should be kept either DIN-to-DIN or phono-to-phono.

There is a problem however in that some equipment uses a DIN socket but conforms to phono instead of DIN standard. Here the existence of a DIN-type connection is for convenience of hooking together the equipment, since only one plug is required instead of four, and shouldn't be taken as sanctioning the use of equipment actually conforming to the DIN standard. In the equipment reviews in this book any deviations from the rule that a certain type of socket implies its associated standard are made explicit.

However, the following generalisations may be found useful for identifying whether an input or output conforms to the DIN- or the phono-standard. On the phono standard signals are fed from a low impedance into a high impedance. Typically then, the output impedance on this standard will be in the range 500 ohms to 10k ohms (most often tending to the lower value), while the input impedance will be between 50k ohms and 150k ohms. The DIN standard conversely normally feeds the signals from a very high impedance to a significantly lower one. So here the output impedance will be between 50k and 1000k ohms, and the input typically around 3k and 300k ohms. These values are typical ones, and unfortunately it is not possible to indicate them with greater precision since considerable variations exist, even between models from the same manufacturer. Occasionally values exceeding these limits are found on equipment, but unless they fall on the 'wrong' side of the range – in which case there may be a compatibility problem with certain tape machines – this is of no consequence.

Other inputs/outputs

Besides a possible duplication of inputs/outputs on the main functions described above (*ie* connection of extra turntables, or both phono and DIN sockets for tape output), most equipment also features an auxiliary input. This usually merely duplicates the tape or tuner input specifications and allows further sources to be connected into the hi-fi system, for example a cartridge-player, a TV sound tuner, or a transistor radio (for wavebands not covered by the receiver).

An additional facility which is sometimes fitted is a preamp-out/power amp-in socket. Frequently a pair of wire-linked phono sockets, but sometimes an internally-wired DIN plug, this has several possible uses, including, for example, the insertion of extra signal-processing units (*eg* noise-reduction unit, graphic equaliser) by re-routing the preamp output signal through the additional unit and then back into the power-amplifier; it is also useful where a sub-woofer loudspeaker is envisaged, as these often have their own power amplifier(s) built in, and so require only a preamp output-level voltage. A further use for this facility is in the so-called 'active' speaker-system approach: rather than have the power amplifier drive a loudspeaker containing two or three distinct drive units (woofers, tweeters, etc.) and their associated signal dividing network (crossover), as is the normal case, the 'active' approach uses a separate power amplifier to drive each speaker unit, the necessary divisions of the signal being achieved by an electronic network placed between the preamp and the individual power amps. Although this approach is costly since it means doubling (or trebling) up on power amplifiers, it is one which appears to be gaining in popularity, as is considered by many to result in improved overall sound quality.

Tuner section ergonomics and facilities

Although doing the same basic job as an FM transistor radio, the tuner section on a hi-fi receiver tends to be rather more sophisticated, which is reflected in the number of features and facilities provided. Probably the only feature common to both is the tuning knob, which on the hi-fi tuner or receiver is likely to possess a much extended travel and a larger tuning scale, to enable one to home-in on stations with greater precision. And on some receivers there is not even this resemblance, since the tuned frequency may be displayed as a digital readout, and in some cases the tuning function is actually performed by an internally fitted electric motor! Such sybaritic features, however, tend to be both costly and rare, although doubtless as the costs of providing them come down they will become available on cheaper equipment (though their virtue beyond marketing incentive remain somewhat obscure).

Rather more common and useful – though again usually at a slight cost premium – is pre-set tuning. This is simply a series of buttons, each with its own miniature tuning spindle discretely hidden from view, which are pre-tuned to favourite stations, enabling them to be selected at the touch of a button, similar to the system in widespread use on

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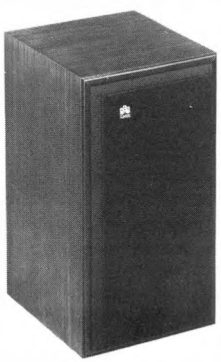

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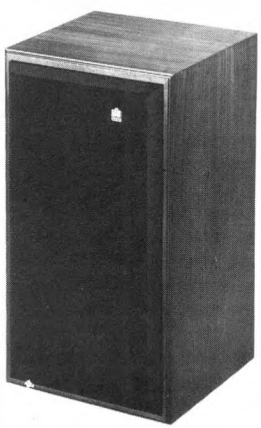

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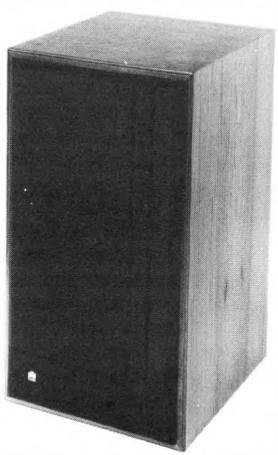

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TV sets. Pre-set tuning remains something of an extra, and tuners incorporating this will normally do so only in addition to a normal cursor tuning scale.

Certain other features are often included to assist in tuning the receiver, and again of course their provision and quality is usually related to price. Most receivers have an AFC (automatic frequency correction control) which prevents 'drift' once a station has been selected, but which may be disengaged to help receive a weak station adjacent to a strong one. Many also have a 'mute' switch for use when tuning: this effectively cancels the receiver's output when the aerial is not supplying an input signal above a certain threshold strength at the tuned frequency; this means that the irritating inter-station hiss is removed automatically when scanning across the dial.

Two other features useful for tuning are a signal strength meter, which gives a relative indication of just that, and whose usefulness depends on the appropriateness of the scale chosen by the manufacturer, and a centre-tuning meter which indicates by deviation from a centre position how accurately the station is tuned; here the usefulness will be determined by how accurately this has been aligned in the first place.

Some expensive receivers feature a variable selectivity control to assist in tuning, with a normal or wide position for maximum deviation in general use, but with a narrower selectivity which can be switched in if an adjacent channel causes interference problems. Such a feature incidentally would be of great benefit in coping with the 'after dark' syndrome on the AM bands, though we know of no current models thus equipped.

Because of the nature of the multiplexing process, stereo FM reception tends to be far noisier than mono for a given aerial signal strength, so a mono switch is usually provided to disconnect the stereo decoder when stereo reception is unacceptably hissy. (Some models offer a 'hi-blend' facility, which serves to reduce noise to an extent by providing a 'halfway house' between mono and stereo).

Besides the digital display of the tuned frequency mentioned earlier, some exotic designs have digital 'frequency synthesising', whereby the tuning across the waveband is done automatically in small discrete steps (often under microprocessor control). The advantage here is that stations can be tuned with far greater accuracy than can be achieved manually, and this should ensure optimum distortion performance, separation and signal-to-noise ratios every time.

Amplifier section ergonomics and facilities

The most important control function must be that of adjusting the volume level, and ergonomically therefore the volume control should be easily accessible and identifiable. On equipment with many controls it is usually the largest knob on the front panel, and strangely its operation seems to be the most widely misunderstood. The volume control doesn't operate within the power amplifier proper, but at the stage preceding it, and it provides a variable attenuation of the signal voltage fed to the power amplifier, rather than a direct control of the power being supplied by power stage; this stage, being designed for a fixed voltage gain (which, developed across a load yields the power) means that the only way the voltage – and hence the power – can be varied is by 'backing off' some of the input voltage.

Although the subject of popular misconception, it is not possible to get any idea of the power being delivered by the receiver by the position of the volume control, without full details on the input signal and the overall gain. What is important is that the amplifier inputs should offer appropriately flexible inputs for the sources to be used, that the volume control should enable the rated input sensitivities to just 'clip' the power stages at its maximum setting, and that this can be reduced progressively and evenly without channel imbalance tracking errors over a very wide range indeed. In fact the volume control setting needs to offer much finer discrimination at the low end of the range, which is not always the case. Fashion has dictated the introduction of 'stepped' volume controls on domestic equipment, though their virtues remain obscure, and there is clearly some disadvantage in only permitting the controls to be adjusted in little jumps, rather than smoothly and continuously.

One useful feature deserving more widespread use is a 'mute' switch working in conjunction with the volume control. When activated it usually reduces the loudness by about 20dB, so besides helping to 'stretch' the range of the volume control and so increase its sensitivity to fine adjustment, it can also be quite useful in answering the telephone, etc., while maintaining the desired main volume setting.

The last of the 'essential' controls adjusts the stereo balance, *ie* the relative loudness of left and right channels. Though not as important as the volume control, it is nevertheless extremely useful in several ways: compensating for a listening position which is slightly off-centre; checking for faults by comparing L&R channels alone; compensating for a channel imbalance in the cartridge, or slightly different speaker sensitivities; and compensating for a mis-tracking volume control, *ie* where the channel balance shifts slightly with different volume settings.

Of the less-essential controls the stereo/mono mode facility is probably the most useful, since in its mono position it can assist in reducing surface noise from discs, or noise on radio reception. This facility usually takes the form of a straightforward mono/stereo switch, but may offer channel reverse, or left/right only capability.

Sound Shapers

Tone controls are almost universal, and these usually consist of bass and treble controls, but are sometimes duplicated for each channel, offer different turnover frequencies, and may be accompanied by a 'middle' control. They function by selectively boosting or reducing the level of a part of the audio frequency spectrum, and for this reason are often referred to as 'sound-shapers', and they affect the tonal balance of the sound rather than, say, stereo width.

It is true to say that tone controls were once more useful than they are today because the quality of the signal sources was much poorer, and they served as a crude tool to achieving a 'flatter' overall response. Nowadays quite cheap components can give a better response than traditional tone controls can improve, while the continuing imperfections of loudspeakers and their room interactions need the fine discrimination only available on professional (expensive) graphic equalisers to stand any real chance of improvement. Furthermore, as a general rule, tone controls cannot improve the bass performance of an inadequate speaker system, though their gentle application may help compensate for a poorly balanced recording.

Although most manufacturers continue to offer tone controls which provide a simple 'slope' response change either side of the midband, some have vociferously denounced them on technical grounds, while others have gone further the other way by incorporating simple graphic equalisers (*eg* JVC, Rotel) or intelligently thought out special compensations (*eg* Quad 44, not reviewed here in the absence of a matching tuner). Admitting some personal sympathy with the 'no tone controls' school of thought (no knobs, no distractions), we feel that a bypass switch option should be a mandatory part of fitting them in the first place.

Besides tone controls, certain other features found on receivers fall into the sound-shaping class. The 'loudness' or 'contour' control is one such item, its operation applying simultaneous bass and treble lift by an amount which is usually fixed (though it is sometimes variable and/or linked to the operation of the volume control). The reason for fitting such a feature is that at low levels the ear is less sensitive to high and low frequencies compared to middle frequencies than it is at high levels, and therefore by applying this compensation the impression of loudness can be created. While this has a valid psychoacoustic basis it remains doubtful whether it actually succeeds in deceiving the ear as to the loudness at which a hi-fi system is being played; perhaps the more successful deception is the impression of detail and clarity at high frequencies, and of power at low frequencies on rock music. It is however a deception with only a semblance to reality, and this is particularly obvious if it is applied on classical music. Personally speaking this author finds the loudness control about the least useful of all the facilities.

The final category of sound shaper is the filter, which normally operates only at the extremes of the audible frequency range, and consequently can be fairly subtle in effect, though in practice some only duplicate the tone controls. Filters operating at low frequencies are also known as 'rumble' or 'high pass', though in practice few hi-fi turntables suffer from audible rumble these days; more useful perhaps is an LF filter which operates subsonically to remove this unwanted 'garbage' at the disc input; fixed filters to accomplish this are often fitted to British designs, and this technique may well become incorporated into the international disc replay standard. At the high frequency end, the 'scratch' or 'low pass' filter, if properly designed, may help make noisy discs or 'peaky' cartridges more acceptable, though at some technical and musical compromise. The problem of disc surface noise is rarely helped much by the HF filter, which also of course removes some of the music; more satisfactory results are likely to be found by

changing the cartridge or the whole disc playing system. Once again 'fixed' rather than optional filters are often fitted just above the audible range by British and European designers, a simple and elegant technique for avoiding a number of possible HF distortions.

Switching

A number of special switch functions can make the job of interconnections easier (if not always simpler). A few receivers usefully enable the tuner signal to be passed to a tape deck while the amplifier section is playing discs; this can be particularly useful if entertaining, but not wishing to miss a particular radio broadcast. (With separate components the tuner may of course be directly plugged into the recorder on such occasions.)

Most equipment incorporates a tape monitoring facility, though this is only really useful when using a three-head tape deck which permits monitoring off-tape, when an almost instant check on recording quality can be made; with the more common two head decks one merely compares the source from which one is recording with the results of its passage through the recorder's electronics, which is of comparatively little value. Elaborate switching is also sometimes provided to connect two tape recorders and permit dubbing from one to the other and *vice versa*. If it seems unlikely that many people will find this facility useful, those models which duplicate the second tape socketry on the front panel do at least make connecting a friend's machine very convenient.

Further switching is often incorporated into the outputs of the receiver, notably to select between pairs of loudspeakers and/or headphones. Some people consider that switches in the output path prejudice the sound quality, though their convenience cannot be denied. However it should be remembered that most amplifiers are designed to give their best power delivery into a single pair of 'normal' loudspeakers, and 'doubling up' for the occasional party is in fact unlikely to enable greater loudness to be achieved; the purpose is really to permit extra speakers to be used in a second room, and without doubt some compromise is involved.

FM AND THE TUNER SECTION

For convenience the tuner section can be said to comprise two distinct and effectively different parts: a 'front-end', which accepts the radio signals from the aerial and converts them to an audio signal; and (to coin a phrase) a 'back-end' which then processes the audio signal prior to feeding it to the amplifier. Although it's the front end which is undoubtedly the more complex piece of engineering, it may be the back-end – which includes the stereo decoder – which in fact makes the more significant impact on the overall sound quality.

This is not to say that the contribution of the front-end can effectively be ignored on this point, but rather that front-end performance is more indicative of how the receiver will work in different reception conditions; *ie*, how well it will cope with all the signals being picked up by the aerial (which will consist mainly of unwanted frequencies), whether it will generate spurious signals because of this, how well it will receive weak stations, and how effectively it will extract them from nearby stong signals, etc., etc. So even though a receiver may not rank in the first grade as far as its front-end performance is concerned, it may nevertheless be capable of fine sound quality if it is not used in adverse signal conditions which might strain its capabilities, provided it possesses a good back-end. In a receiver this is of course contingent on the rest of the audio sections (pre- and power amps) being of comparable goodness. But a receiver with poor audio signal processing capabilities will not yield good FM sound quality (or disc quality for that matter) however good its VHF front-end performance.

FM radio

With this in mind, we can now look at how the typical receiver tuner section is specified – but it will be helpful first to take a brief look at the 'mechanics' of FM radio. In this method of radio transmission, the audio signal information is encoded onto the radio wave by the process of frequency modulation (FM), whereby the audio frequencies are translated into a frequency variation of the radio signal. So although FM radio stations nominally operate at a fixed frequency, this is actually the frequency of the carrier upon which the audio signal rides, and in the normal course of transmission the radio signal swings a little either side of this nominal frequency. But if it's easy to see how the radio wave accommodates the frequency (pitch) information of the audio signal, how can it also accommodate the amplitude (intensity) information of the signal, which isn't

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itself a frequency?

The crux of FM broadcasting is that both the amplitude and frequency information of the audio signal are translated into frequency variations of the radio signal. This clever ruse means that the audio signal cannot be affected by variations in the radio signal strength, and is therefore largely inpervious to the level of background noise which is inevitably present in the broadcasting and reception of radio. Compared to the AM system, in which the audio signal is mapped into an amplitude variation, we can thus see that FM system is potentially capable of successfully handling high quality audio signals which have a large bandwidth and a large dynamic range.

The radio carrier then is made to modulate (alter its frequency) by an amount proportional to the intensity of the audio signal up to a maximum of 75kHz either side of the carrier (which isn't a lot, given that the Band 2 VHF carrier will be between 88 and 108MHz, *ie* some thousand times greater in frequency). The loudest sounds broadcast will thus produce a swing in the radio frequency of about this amount, which is referred to as 100% deviation or modulation. The frequency component of the audio signal is encoded by varying the rate at which the carrier deviates, from a minimum of around 30Hz (about the lowest audio frequency broadcast) to a maximum of 15kHz, which is near the upper limit of hearing. This rate of variation of the radio signal is known as the modulation frequency, since it is itself a frequency. The modulation frequency is determined by the bandwidth of sounds we want to transmit, but the deviation frequency isn't so restricted; however, by making it larger than the modulation frequency it's possible to achieve significant reductions in the noise level of the reception of radio.

But although the maximum deviation is ±75kHz, its constant varying produces additional frequency components known as sidebands, which must also be captured and processed by the receiver if distortion of the audio signal is not to result. Ultimately the fidelity of the recovered audio waveform will depend on how many of these sidebands are captured; in practice a bandwidth of 240kHz is deemed sufficient. This figure, or its approximation 200kHz, which is often used in technical tests, can be taken as defining an FM radio station's bandwidth, and hence is the critical width required of the receiver's tuning filter, which must pass the wanted carrier and sidebands of the wanted station and reject all the other frequencies which have been captured by the aerial and presented to the receiver.

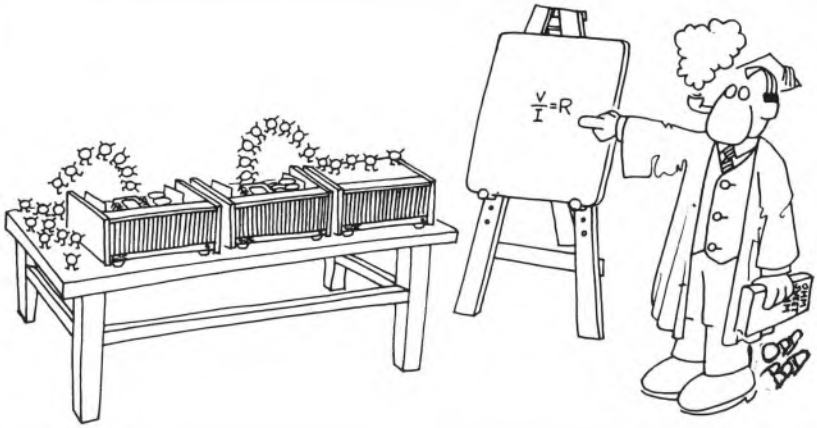
The other technical marvel encountered in FM radio is the broadcasting of two stereo channels on the same signal. This is done by the neat trick of broadcasting the signal as an algebraic matrix and having the stereo decoder sort it out. What is actually broadcast is the summed (added together) Left and Right signal (which is the same as the mono signal to be had from combining two stereo channels), and a difference signal which contains the essential stereo information. If we can extract these signals separately then:

$$(\text{Left} + \text{Right}) + (\text{Left} - \text{Right}) = \text{Left channel only}$$

$$(\text{Left} + \text{Right}) - (\text{Left} - \text{Right}) = \text{Right channel only}$$

which gives us the stereo we want. In practice the mono sum-signal occupies the modulation frequency up to 15kHz, whilst the difference signal is encoded onto a subcarrier of 38kHz, and occupies modulation frequencies between 23 and 53kHz. The stereo information is actually broadcast as an amplitude modulation of the frequency modulated radio wave, and the 38kHz subcarrier suppressed to give more deviation room to the main sum signal. Instead a 'pilot tone' of 19kHz is inserted and from this the stereo decoder must reconstruct the 38kHz subcarrier required to extract the difference signal.

The tuner section then has quite a complex job to do, and the first task is tuning to the required station. This in fact is combined with the task of converting the radio signal to an intermediate frequency for further processing. Tuning activates an internal variable frequency generator whose signal, when mixed with the aerial signal, produces an image of the aerial signal, but which is at the constant (main) frequency of 10.7MHz regardless of the radio frequency being tuned into. This neat trick of converting all input frequencies to the same intermediate frequency simplifies the design of amplifier and filter circuits in the tuner, and obviates the difficult problems of variable frequency filters and wideband amplifiers. Having then amplified the intermediate frequency and filtered out unwanted signals, the i.f. signal is passed to an FM detector which recreates the audio signal. From here it passes to the stereo decoder, and then onto the output amps, which



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Tuner specification and assessment

With very many different frequencies present at the aerial input of the tuner, and with three distinct signal frequencies present in the different stages of the tuner, clearly the main problems are concerned with minimising any frequency interactions which would create interference and distortion, whilst at the same time maintaining the low noise and wide dynamic range necessary for high quality sound reproduction. These distortions are not restricted to the sort which need instrumentation for their detection, but can produce audibly idiosyncratic results: burbling and twittering (called for obvious reasons 'birdies'), whistling, crackling, pumping, and spitchiness, comprise the more commonly encountered sorts.

Of the specific problems, front end selectivity is perhaps the most important, with a good i.f. filter response necessary to avoid creating spurious signals. In addition it is necessary to ensure good selectivity at the tuning stage – and the difference between receiver quality is often in the number of tuned circuits cascaded to make up this stage.

To review then how front-end performance is specified:

Limiting. With different stations being received with quite different aerial signal strengths, and atmospheric conditions causing fluctuation on a single station in any case, the FM listener would be forever adjusting his volume control were this not carried out by a limiter circuit, which automatically keeps the tuner output constant for signals above the *limiting threshold.* Clearly the lower this threshold is, the easier it will be to enjoy weak stations. Good limiting also helps to avoid interference from motors and other electrical equipment.

Sensitivity is a measure of how well the receiver will respond to weak stations, referenced to the background noise which is at all times present. Specifically, it is the aerial signal strength required to suppress the background noise a certain degree below, and is typically specified for a 30dB signal-to-noise ratio in mono, and 50dB S/N ratios in both mono and stereo. The lower the figures here the better.

Capture ratio gives an indication of how the receiver might be expected to cope with two FM stations on the same frequency. It indicates in dB the smallest difference in level between the two aerial signals that will result in the weaker one being rejected by the front end electronics, and pushed down in level to 30dB quieter than the stronger one. So the lower the capture ratio, the less susceptible will be the receiver to disturbance from co-channel stations, which will be useful in busy signal areas.

Selectivity is broadly similar to capture ratio, but is concerned with the receiver's performance when two stations are at different frequencies, but still quite close to each other, specifically in the adjacent channel (200kHz away) and the alternate channel (400kHz). The signal strength in the adjacent and alternate channels to a station, necessary to cause breakthrough is measured, and the higher the figure the better, 10dB represents good performance on the adjacent channel, while 60dB is a good figure on the alternate channel.

Image response (also called *repeat-spot suppression* or *half i.f. response*) is a similar two-signal test, but with the signals at half the i.f. apart, 5.35MHz. Again, higher values indicate a better result.

Radio Frequency Intermodulation (RFIM) may be caused when two or more strong stations interact to produce signal mixtures which can crop up annoyingly at unexpected parts of the dial. The RFIM test is designed to evaluate how susceptible the receiver is to disturbance by these intermodulation products; the higher the value the better the rejection of these spuriae, with good figures being in excess of 75dB.

This basically concludes the specification of tuner-section front-end performance. It will I think be appreciated that all these performance areas have some degree of overlap, whilst at the same time do not represent all the tests which could be made; in particular they might be held to be unrepresentative of actual working conditions, which are considerably more complex and stressful than the test conditions. Nevertheless such tests are useful general indicators of the sort of performance which can be expected in practice, and especially so in a relative way when performance figures of different receivers can be directly and unconditionally compared, as they can for the tuners and receivers in this book.

Whether one should try to obtain the best front-end performance one can for one's money is another question. The virtue of a good front end is that it will cope with a wider range of working conditions than one which is not so well specified. For example, in the proximity of a strong trans-

mitter there is a danger of the tuner being overloaded by that station, or of excessive spuriae being generated in the reception of weaker, more remote stations, so selectivity and rejection parameters will become particularly important. Alternatively, in remote locations reception is likely to be difficult at the best of times, in which case a good front end sensitivity is virtually mandatory.

However, tuner front-end performance has come quite a long way in the last few years, with the result that medium-price equipment is now commonly capable of results which would have been considered state-of-the-art a decade ago. So budget models excepted, perhaps it would be more accurate to represent present-day performance capabilities as ranging not so much between mediocre and good, as between good and superlative. Given this state of affairs then, unless one wants to receive more than local radio stations, or has the misfortune to be plagued by difficult reception conditions, the majority of receivers should prove quite adequate as regards their front-end performances provided a decent aerial signal is provided.

Having extracted an audio signal from the front-end, it remains to reconstitute the left and right channels and provide some amplification before passing them on to the control amplifier. Although audio signal performance is dealt with in detail below, there are specific problems involved in the tuner back-end in connection with the design of the stereo decoder, so it'll be useful to consider what they are at this juncture. As explained earlier, the stereo decoder has to perform a little basic algebra to derive the stereo channels from the multiplexed audio input signal; to help assess its effectiveness, certain measurements are taken.

Crosstalk. This is the breakthrough of a signal on one channel into the other channel. In stereo equipment this should in any case be as low as possible, but in the decoder this is especially critical since the crosstalk signal often comprises quite substantial distortion products, which can interfere with the existing signal on that channel and produce audible degradation, *eg* coarseness and transient spluttering. The greater the stereo separation (*ie* the lower the crosstalk), the less chance there should be of problems.

Pilot-tone suppression. The output of the decoder will contain, besides the wanted audio signals up to a frequency of 15kHz, residual components at higher frequencies (called sub-channel spuriae), and also the 19kHz pilot-tone which activates the decoding process. As this 'garbage' might unsettle amplifiers and tape machines (not to mention the household pets – for whom 19kHz is clearly audible!) a steep low-pass filter is included to remove it. Pilot-tone suppression then is a measure of the efficacy of this filter, being an indication of the level to which the pilot tone is reduced.

Frequency response. This multiplex filter is actually quite difficult to design, since it must strongly attenuate the pilot tone, but also leave unaffected the audio signal, which contains information up to 15kHz. Poorly designed filters fail to achieve the latter, resulting in a frequency response which exhibits ripples at high frequencies. Although in most cases the frequency response deviation will not be severe (no worse than that obtained with many cartridges), affecting perhaps only the degree of openness of the resultant sound quality, the steepness of the filter in conjunction with these ripples may be indicative of ringing at HF, *ie* a slight loss of control.

Although these measurements are fairly useful at a basic level in depicting the goodness of tuner back-end performance, it is unfortunately not possible to deduce the sound quality of the tuner from them, and, in the last analysis, the only way to do this is by careful listening. What will be heard though is contingent on the quality of the remaining audio (amplifier) sections, and it is to these areas that we now turn.

AUDIO AMPLIFICATION

Most of the electronics in the receiver are concerned with processing the *audio* signals from disc, tape, or the tuner section. 'Processing' really covers two functions: amplification, and frequency response correction (equalisation). These need not be combined in a circuit stage, but in practice, equalisation tends to be built into an amplification stage rather than at points between stages. Although amplification may be considered the prime function of the amplifier, equalisation also fulfils an important part in signal recovery, not only in the sound-shaping facilities already mentioned, but actually in extracting an audio signal in the first place: FM is broadcast with a high frequency 'pre-emphasis' (boost) which must be corrected by a similar corresponding 'de-emphasis' in the tuner, and similar processing is involved in recording onto tape (though the Dolby process works in a rather

different manner).

Tuners and tape recorders have their various equalisation circuits incorporated, so the signal fed to the amplifier is already 'flat'; not so disc players, where this task is carried out at the disc input stage. Basically because of the transducer systems used (velocity sensing), and to keep LP record playing time sufficiently long without compromising the rendition of low and high frequencies in the programme, the audio signal must be cut onto the disc with a continuous treble boost and bass reduction over the whole frequency range. To recover the programme, bass boost and treble de-emphasis (cut) must be applied to the cartridge output signal, otherwise it would sound hideously tizzy and lacking in bass. This whole procedure conforms to standards set down by the Recording Industries Association of America (and other bodies), so this particular section of the amplifier is also known as the RIAA-eq stage. Happily, acceptance of the RIAA standard is virtually universal.

The replay end, however, is not without its technical problems, most of which stem from careless parsimony on the part of the manufacturer: simplicity of design may indeed be elegant, but a circuit must still (first) satisfy necessary electronic criteria! The main *desiderata* of this part of the amplifier are that the circuit must have low noise; must accurately compensate the RIAA characteristic; must not suffer from interactions with the cartridge which modify the resultant frequency response; must maintain a good overload margin for high-level inputs over the whole cartridge output range (a particularly 'grey' area); must simultaneously give some overall amplification; and must not produce distortion of the audio signal.

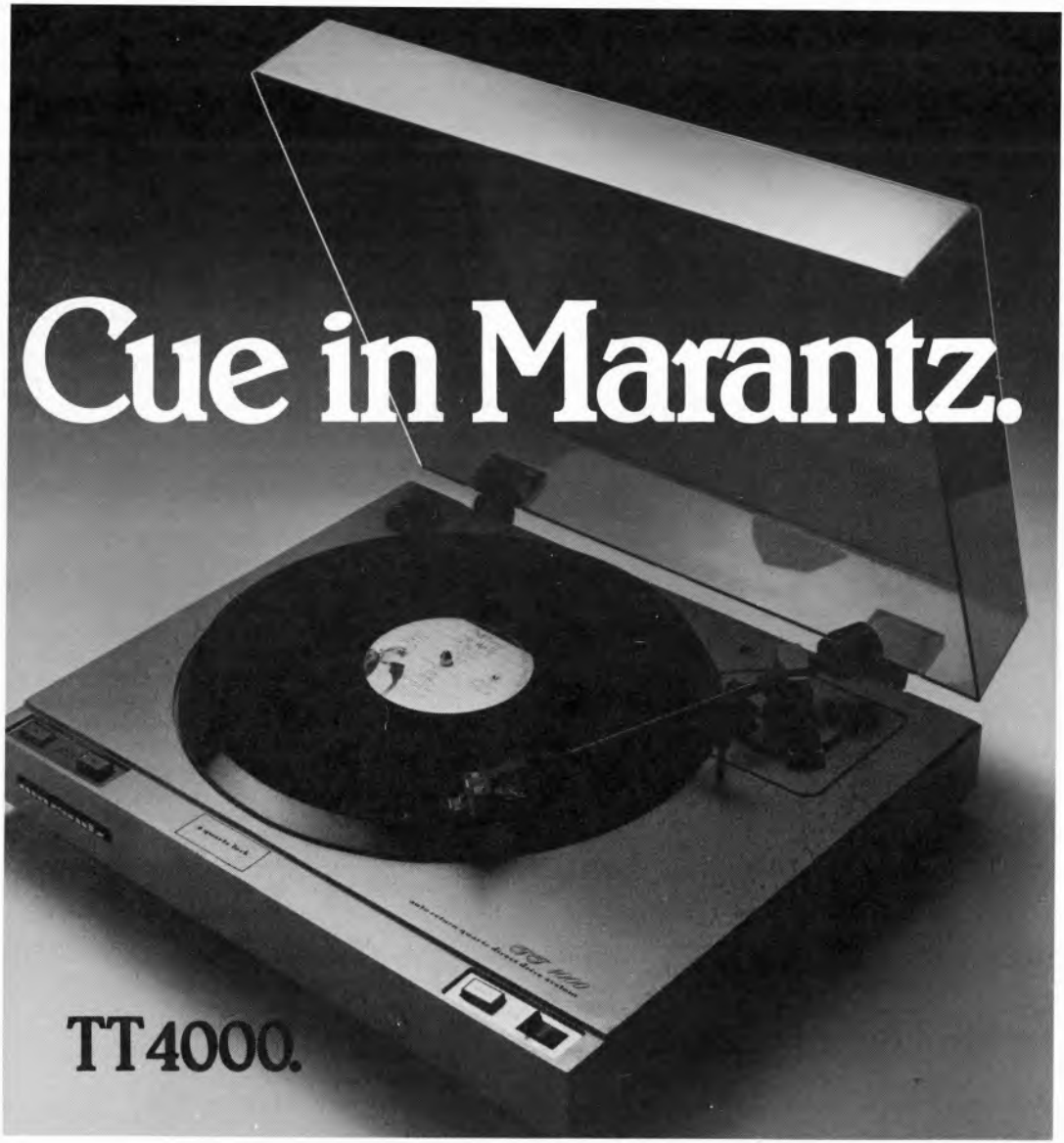
Whatever the actual circuit topology, and whatever a maker's claim as to the benefits of his own particular design configuration, too little is known about the behaviour of different arrangements on music signals to be able to say categorically that one particular technique is to be exclusively preferred on all counts; each case is really only a balance of considerations which have been weighted by the designer to produce what he thinks is the best overall compromise – and which is often determined not on electronic grounds but with regard to cost/effectiveness, and/or prevailing fashion. But it is actually rather difficult, especially after some basic parameters have been achieved (input impedance, satisfactory overload margin, low measured distortion, etc.) to evaluate the circuit very much further by technical measurements. This means that while it is possible on the basis of measurement to criticise a circuit for being inadequate, once its apparent adequacy has been demonstrated, it becomes difficult to say how good it is without resorting to listening. And though this can be remarkably discriminating between amplifiers, it is notoriously unsatisfactory when it comes to making quantitative judgements about those qualitative differences.

This curious situation, wherein unaided human faculties are the final arbiter of sophisticated technology, extends to the whole of hi-fi electronics assessment, and isn't restricted to disc-input stages. But before dealing with the whys and wherefores of this, let's consider that other most essential section of the receiver – the power amplifier.

The power amplifier

The difference between the 'processing' amplifiers and the power amplifiers really comes down to the topic of power. Up to this point, all the electronics needed to do was preserve the quality (*ie* shape) of the audio signal; now the power amplifier has the real job of work to do – driving the loudspeaker to actually produce some acoustic energy. The three fundamental constituents of electrical behaviour are voltage, which is the 'driving force', current (I, measured in Amps), which represents the quantity of electricity flowing, and resistance or impedance (measured in Ohms) which is the means of getting it to do some work, *ie* a load for it to work against. These are linked by the powerful equation known as Ohm's Law, V=I(current) X R; furthermore the multiplication of voltage and current is a measure of power (and this in turn is related to energy).

The audio signals originally captured by microphones are 'modelled' electrically for transmission and processing by the electrical voltage, and because power is not needed at this stage and would be inconvenient to handle in any case, the signals tend to stick to high impedance circuits. When it comes to driving loudspeakers, however, we need plenty of current to do the work, while the amplified voltage continues to model the audio signal. Now when one presents a voltage across a load, it is the load that determines how much current will be drawn. A good analogy is that the amplified voltage acts as a sort of tap between the



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power supply and the speaker, and the important task for the power amplifier is to keep that voltage proportional to the original while allowing the speaker to draw the current it needs. The designer's job is to do this as inexpensively as possible, so he and the speaker designer get together to decide what load the speaker will offer, and then the amplifier is designed to deliver accordingly. Typically then a 20 volt amplifier would need to supply an 8 ohm loudspeaker with 2.5 amps, which represents a power of 50 watts. In practice these simple concepts do not take account of the fact that audio signals are alternating currents and voltages, though to deal with that particular can of worms properly and simply would take a book in itself, and these simplified general concepts are still useful.

If we measure the impedance (resistance) of a loudspeaker at different frequencies, most designs stay above 5–6 ohms across the range, so the amplifier designer usually arranges for his power section to continue to provide current to maintain the maximum voltage down to about 4 ohms (*ie* 5 amps, 100 watts). It is clear that the ideal 'voltage amplifier' should have unlimited supplies of current to satisfy the demands of the load without stressing the power supply (which may have undesirable consequences for the voltage that can be supplied). Most amplifiers make some attempt to do this for the likely operating impedances of the speakers they will encounter, though the 'ideal' of doubling the power for every halving of the load is rarely actually achieved.

At this stage we have at least established that the power of an amplifier can only be specified in respect of a particular load, and that the way the power changes with the load may have some significance. However, the speaker is more complex in its behaviour than the impedance measurement shows, because the current and voltage requirements may get 'out of step' with one another, though with care it is still possible to keep these within reasonable limits. However some designers have suggested that when one is faced with the complexities of the audio signal the situation is much more serious than theory predicts, with constant starting and stopping requiring instantaneous extra current capability; as yet there is no firm evidence to substantiate such a claim.

Specifying power

The foregoing should be enough to show that the description '20 watt receiver' is pretty meaningless by itself. To get some idea of the quality of the power delivered (in terms of its relevance through reproducing music through loudspeakers) we need to measure the power under different loads and circumstances, and see how the power supply stands up to heavy demands. So in addition to looking for power-doubling as the load is halved, it is often informative to compare the maxima achieved with one or with both channels driven. Another interesting parameter is the 'burst' power, which is an attempt to assess the maximum power that can be delivered for an extremely short period; a good figure here can be very useful in indicating how easily the amplifier will be overloaded on a music transient, and how much power it has in reserve to handle these.

Power = Loudness?

In most people's minds the reason for buying a more powerful amplifier/receiver at higher cost is presumably to enable them to drive the system louder. Unfortunately the relationship between power and loudness is quite complicated, and things are not always what they appear. The fact is that for one amplifier to sound twice as loud as another, it needs to produce ten times the power (other things being equal). So even the most powerful devices at 200 watts are only going to go twice as loud as the much cheaper 20 watt budget model.

The characteristics of the loudspeaker may be just as important as the amplifier. The measure of loudspeaker *sensitivity* relates the electricity voltage supplied to the loudness produced. In Hi-Fi Choice *Loudspeakers* we found a wide range of sensitivities which, like amplifier power, covered about 10dB; in other words some speakers will sound twice as loud as others for the same amplifier drive. Interestingly, the more sensitive loudspeakers rarely cost much more than less sensitive designs (though to be fair they tend to make greater technical compromises particularly at the bass end). So choice of speakers may be as important as amplifier power in determining the loudness of a system, and may indeed be a good deal more cost-effective.

It is apparent that power ratings measured in watts may be misleading, so some commentators have been introducing systems based on dB/W, which relate rather more meaningfully to perceived loudness. In the simplest of these systems, a base

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level of 1 watt = 0dB is taken, from which the rest follow from the relationship mentioned earlier, *ie* 10 watts = 10dB/W, 100 watts = 20dB/W etc., etc. This places commercial amplifier maxima firmly between about 10dB/W and 25dB/W (which contrasts with the ears discrimination of a total range of about 120dB). It also shows that a manufacturer's large range of amplifier models with step by step increases in power and price is often related more to specmanship and marketing than to commonsense!

Exasperatingly this is still not the whole story, and further practical advice and information will be found in the 'Choosing and Using' chapter of this Introduction. Loudness levels need to be matched to the size and furnishings of the room, and to some extent one's taste in music. Furthermore, prospective purchasers often attempt to equate power output with speaker power handling capabilities, assuming that this will provide a good match. In fact even very powerful amplifiers are rarely a problem and are usually a blessing, because providing one keeps within the working power range, maximum power is only used for fleeting instants: measurements by KEF Electronics showed that for peaks of 100 watts, the average power being used was only 8 watts on classical and 17 watts on disco music, so it is very useful to have either plenty of reserve power for peaks (or an ability to overload without causing distress and instability in the amplifier), even though only a fraction of the rated power will be used most of the time.

Amplifier distortions

Current starvation may be said to be a distortion-causing mechanism, one which occurs when the amplifier – and this need not only refer to the power amplifier stage – is being pushed to work beyond its limits by the audio signal. Historically however investigations into amplifier distortions have revolved around the audio voltage signals themselves, since after all they are apparently central to the amplifier's purpose rather than being an adjunct to it like the current component. Nor is it any coincidence that it is much easier to measure (without causing interference) voltage than current. Furthermore investigations have concentrated on the performance of amplifiers when they are working inside their limits; after all, no machine can reasonably be expected to work beyond its limits (?) These voltage limits for amplifiers are two-fold: a limit on the amplitude of the signal it can handle; and on the slew-rate of the signal, *ie* its rate of change, which increases with both signal amplitude and frequency. Exceeding these limits produces clipping and slew-rate limiting respectively, both of which are forms of overload and create unpleasant distortions.

In principle, investigating the distortion performance of amplifiers when they are working inside their limits should give us information about how good or bad the amplifier is. But although to a certain extent distortion investigations can give us some information, the measurements quoted glibly by manufacturers and reviewers are by themselves in fact insufficient to constitute more than the most basic appraisal of an amplifier or receiver.

What distortion figures refer to are measurements made on certain laboratory-generated signals after they have been processed by the amplifier. So what is measured is a pattern of distortion which has been produced on that particular signal. Thus harmonic distortion is a pattern of additional frequency components which are produced when a single-frequency tone is applied to the input, the spurious distortion products being integral multiples of the test frequency. Intermodulation distortion is a pattern of distortion spuriae produced when two tones are applied simultaneously. If the input frequencies are f and f′, harmonic distortion of f will produce distortion components at frequencies 2f, 3f, 4f, etc. When f and f′ intermodulate however, the components are given by (f+f′), (f+2f′), (f+3f′), (f−f′), (f−2f′), etc. The quantity of distortion spuriae produced is expressed as a percentage (sometimes a dB ratio) of the amplitude of all the distortion components generated by the test tone to the amplitude of the test tone itself, and typically in hi-fi amplifiers and receivers is much less than 0.1%, which is markedly less than that produced by loudspeakers and in extracting a signal from disc or tape.

It seems to be almost universally agreed that low harmonic distortion levels in an amplifier are not a reliable indicator of sound quality, since musical instruments produce so many natural harmonic components that a little extra of what is already there is effectively imperceptible. Intermodulation distortion however *is* a significant indicator of possible audible differences (though to what precise extent is still to be determined), and measurements done on equipment for Hi-Fi Choice *Amplifiers* showed some correlations in

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some instances with the results of listening tests.

The real assessment problem in hi-fi electronics is that distortion measurements are only at best symptomatic. As in medicine, where a disorder may show several different symptoms – none of which will actually be the cause of the malady – it is rather difficult to determine what the state of the 'patient' is simply from being presented with one or two external clues. So in hi-fi, presented with a distortion measurement, it may be quite impossible to say if it's being caused by clipping, slewing, crossover distortion, transient intermodulation distortion, or something else we don't even know about. The analogy with medicine can be pushed even further, for the lack of any determinable 'objective' symptoms is not conclusive proof that the 'patient' is in perfect health (*q v* psychology and psychiatric medicine). Other pertinent facts about the subject's condition which we must take into account include his or her behaviour, and while amplifiers and receivers aren't gifted with the faculty of language, like humans, their behaviour can be *described*, and this is the importance of listening to equipment. But if there's a difference in this analogy, it seems to be that describing the behaviour of hi-fi is still often accompanied (particularly among audio engineers) by an existential anguish which doesn't at all perturb the issue when we describe the behaviour of people! (One also notes that before the advent of psychiatry, mental illness was ascribed to possession by devils and spirits; likewise unexpected behaviour or failure of electronic equipment since the earliest days has been metaphysically personified as the work of a species of malicious demon known as 'gremlin'.)

In the circumstances then the most reasonable attitude to evaluating audio amplifiers in general would encompass both listening and measurement tests. For listening, although capable of discriminating between subtle nuances of sound, is unreliable when it comes to quantifying differences, and can also be misled by certain factors (overall loudness levels, tonal balance, etc.) if due care is not taken to guard against them. Measurements are necessary to keep a check on the sorts of things which may be inferred from the results of listening, but contrariwise isolated measurements in themselves carry little weight in the appraisal process. It is really necessary to conduct an extensive (and excessively time-consuming and expensive) matrix of tests on particular areas of performance to gain a realistic impression of the equipment's overall performance.

Input/output impedances. For purposes of matching, it is important to specify loading requirements, both for equipment to be connected to the receiver's outputs, and for any equipment which will be feeding signals into the receiver. This has been covered in some depth in earlier sections, and it remains only to point out that precise measurements of impedances are included in the equipment reviews. Normally sufficient impedance information can be expressed in Ohms, but at the moving magnet disc input the capacitance plays a significant role, so this value in picoFarads (pF) is included.

Input/output sensitivities. Input sensitivities are the signal voltages required at the inputs to produce the full output power from the receiver when the volume control is set at its maximum. Input voltages in excess of this figure merely enable clipping to occur in the power amplifier, but this of course can be obviated by simply turning down the volume control. Output sensitivities similarly are the output voltages generated into a typical load (see *Technical Introduction*) upon inserting a specified signal voltage into the disc and auxiliary input sockets (measured in volts and ohms impedance).

Input overload margins. Input stages may be caused to clip or otherwise overload by a high level signal voltage input, even though the output stages perhaps wouldn't because of the volume control setting. Such signal headroom is clearly important to keep the receiver from running into trouble, and is more important at the disc input stages, because of infra- and ultrasonic resonances and indeterminate bandwidth inherent in the system. (Measured in dB at specific frequencies.)

Headphone outputs. The main problem in driving headphones from a power amplifier is avoiding destroying these comparatively delicate transducers with power designed for loudspeakers. Headphone sockets are thus 'padded' with an attenuator, and this also enables the volume control to provide the equivalent degree of loudness which would be obtained in the ordinary course of driving loudspeakers.

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Noise. This should not of course obtrude into the reproduction of music. In respect of random full-frequency ('white') noise, this is one parameter on which amplifiers and receivers can rarely be faulted, since the noise inherent in all current domestic programme sources is rather worse than that produced by most amplifiers. As an indicator of the real dynamic range of equipment, however, this noise figure is somewhat misleading, since musical dynamics are largely contained in transients, and there is some reason to think that transient/dynamic capacities are determined by factors other than level of the 'static' noise floor. Hum is however a form of noise which can be annoying, and is due either to breakthrough into the audio circuitry of the mains frequency and its harmonics (*ie* 50Hz, 100Hz, 150Hz in the UK) or simply mechanical hum from the transformer/mounting (which will not affect the signal directly, but can nevertheless be irritating). Since it occurs at distinct frequencies it can be more disconcerting than random noise, so hum performance is a factor which will receive comment in the reviews.

Power bandwidth. This is the overall band of frequencies over which the receiver can deliver useful amounts of power at low distortion levels. It is actually defined as those frequencies at which the power output is reduced to half (*ie* to −3dB). Preferably it should cover the audio spectrum of 20Hz to 20kHz without difficulty, but extensions into the ultrasonic beyond these extremes is not necessarily a good thing.

DC offset. This is the DC voltage measurable at the power amplifier output terminals in the quiescent ('idling') condition. This should be near to zero, and can also be taken as an indicator of how well the receiver has been set up at the factory! In a different sense, the term 'DC' is also used to refer to Direct-Coupling of the receiver to the speakers, as opposed to capacitor-coupling, which interposes a capacitor at the output terminals. The arguments in favour of capacitorless coupling are a little abstruse to be recited here (and perhaps are not quite conclusive anyway), but most receivers couple the speakers this way, which means that there remains the possibility of a DC voltage at the output.

Crosstalk. Alternatively known as channel separation, this is a measure of the breakthrough of signal from one stereo channel to the other. There are several possible causes of breakthrough in amplifiers and receivers, and good performance here is perhaps indicative of care in design, but these are not likely to be a problem unless the crosstalk is worse than −40dB in the mid-band, since few sources manage better figures, and most are noticeably worse at the frequency extremes.

Damping factor. This is the ratio of the impedance of the loudspeaker load (= 8 ohms) to the impedance of the amplifier output; since these are almost always over 30, we can infer that power-amp impedances are quite low. This ensures that the amp acts as a true voltage source for the loudspeaker, and that the signal will not be affected by variations in the speaker impedance. The name derives from the fact that a large value ought to mean that the back-emf from the loudspeaker (remember that this is simultaneously a motor and an electrical generator) is effectively short-circuited, thus damping and controlling motion of the cone.

As an amplifier 'goodness' indicator, this measurement is perhaps over-rated, and any change in damping factor with frequency is likely to be as significant as the absolute measured value. The amplifier/loudspeaker interface is really much too complicated to be neatly encapsulated in such a simple concept: for example, when the switch was made from valve amplifiers to transistor amplifiers, it was found that much better damping factors could be achieved, since all one had to do was increase the amount of overall negative feedback in the circuit. However, recent investigations suggest that the important factor may not be the output impedance of the amplifier *after* negative feedback has been applied, but the values without feedback, even though the amplifier actually operates with the feedback loop in action. If this is the case, we really need a performance parameter which examines the 'natural' output impedance of the amp, but this would necessitate internal modifications (which are not easy to obtain without entering the innards and physically breaking the feedback loop).

Squarewave performance. Squarewaves are a convenient form of test signal to use because alterations to their shape are readily apparent, and constitute changes in the precisely known frequency components' amplitude and phase relationships. Interpretation of squarewaves is not easy, and because they have a theoretically infinite bandwidth (*ie* extend way up into the ultrasonic regions) they can be criticised as not being fully representative of normal music signals (by the same token they do perhaps go some way towards

meeting Murphy's famous criterion that if something can go wrong it will). Changes in shape of the squarewave are of comparatively little importance provided that they are gradual, and indicate departures from 'flat' in frequency and/or phase response. Potentially more serious is the tendency to overshoot on the leading edges, which most models show to a greater or lesser extent, and this tends to be an indicator of the stability of the design under conditions of bandwidth and loading stress (but at quite modest power nonetheless).

CHOOSING AND USING A RECEIVER

Having read through this Introduction so far, it should be clear that there are good grounds for making a careful, conscious, rational decision when buying a receiver. It is hoped therefore that no-one will be inclined to panic in the face of the full choice that exists, and proceed to buy the first item which catches the eye. The first thing to do then is to prepare a list of priorities, and consider those receivers which best fulfil them. Personally, we think that sound quality should be the first priority, and while accepting that there may be genuine reasons for it not being so, strongly recommend that shortlisted items be auditioned with the help of a competent dealer before making a final decision – after all, music is their prime purpose!

Price will be the major constraint for most people, but there are no simple rules for allocating a specific proportion of the budget towards a receiver, and indeed, one should perhaps remain a little wary of strong opinions on this topic. Some flexibility could pay dividends on the final sound quality of the system as a whole, and attention is again drawn to the particular importance of the turntable in determining this. Lastly, it is also worthwhile comparing equipment in different price brackets, so as to appreciate what one is gaining, or losing, as the case may be.

Power requirements are likely to figure strongly in any choice, but as has been pointed out, there are really no hard and fast rules here either. The odds probably favour the individual who is not especially interested in loudness, since he has the larger choice of suitable equipment (that includes speakers), and is not forced to seek and pay for high-powered units. Remember also that the theoretical loudness difference between 40 and 50W is not worth talking about (and that between 50 and 100W is surprisingly small), whereas a 25W model with good overload characteristics may produce a more satisfactory loud noise than a less stable 100W design. If loudness is required, the dealer should be encouraged to demonstrate that a high-powered receiver actually *will* sound louder than a lower-powered one; the proof of the pudding here can only be in the listening. However it must also be said that an apparent excess of real power capacity is not a waste, since the 'excess' represents a 'headroom' margin which will enable loud transients to be handled with less risk of misbehaviour than would be the case with a low-powered receiver.

Some consideration may also have to be given to the quality of the tuner section in respect of its front-end performance if one lives in an area of fringe reception, in a local 'blank-spot', or in an area with many powerful signals and reflections. A competent dealer should be able to advise on this, and give assistance on choosing a satisfactory aerial to complement both receiver and radio signal conditions.

Specific facilities may be considered essential, but some may be superfluous, and usually have to be paid for. It is rather more important to ensure that the receiver matches one's other equipment in terms of input and output sensitivities and impedance. On the question of cosmetics, it's a case of each one to his own. If there's anything to be said here, it is that equipment tends to be so look-alike for the most part that it's in the nature of Hobson's choice; this is perhaps fortunate, since one is not then distracted from attending to more important differences between products.

Auditioning

Having placed some emphasis on how equipment auditions, some remarks on this aren't amiss. First however two important conditions, which will facilitate direct comparison of what is heard: ancillary equipment should remain the same throughout the comparisons (and should preferably be identical to one's own – if this has already been purchased); care should be taken to match loudness levels as closely as possible and ensure that over-driving does not take place). One should be very cautious of only auditioning equipment *via* switch comparisons, which are felt by many to be instrumental in removing much important, if subtle, musical detail.

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impressive on initial acquaintance. Such feelings of marvel should be put aside: further experience may even give rise to disillusionment and more important, they are likely to interfere with a dispassionate appraisal of what is being heard. A good approach is to listen first to both the cheapest and most expensive receivers stocked by the dealer, to determine the sorts of differences there are, whether there are any, and whether they're worth bothering with! But on the assumption that the answers to these two questions are in the affirmative, it is hoped that the following will assist.

Attention should be focused on two broad areas: the reproduced sound as a reproduction of a group of musicians and the music they are playing; and on the reproduced sound simply as sound. In the first area the musicians should be located in stereo (='solid') space: each one should be heard as occupying a distinct position, not just laterally but depthwise also (although the actual amount of depth will depend on the programme), and this position should remain stable whatever musical events happen. In particular the images should exhibit no tendency to wander or waver, regardless of how many other instruments are being reproduced at the same time. Also the contribution of each performer to the music, the notes and melodies played, how they're played, and the details of playing that particular instrument should be clearly audible, separable, and should not be affected by the entry and presence on the musical stage of other performers. In other words there should be perceived control of everything that's going on. Loss or lack of control can take many forms, be present in differing degrees, and may be more or less noticeable in different frequency areas. In perceptual terms, besides a poorer rendition of the above qualities, problems may be described as an imprecision, muddling, 'furring', loss of detail, and muddying of the musical information (instrumental location, pitch, duration, attack of notes, etc.). In addition, the particular piece of music will to some degree lose its coherence as a whole, *ie* as a continuing unfolding and interplay of musical ideas expressed in phrases and melodies, and the way these are rendered by the performers – and will display loss of the (often subtle) variations of attack, dynamics, and tone-colour used. One key test is voice, either sung or spoken: consonants, and the 'noises' involved in producing them may be reproduced in quite markedly better or worse ways, and if differences are noted here, how they are reflected as differences in the rendition of music should be carefully listened for.

Attention might also usefully be focused on aspects of the sound itself. One of the main sources of difference here is tonal balance, although for amplifiers these tend to be very small indeed. (It should not need to be pointed out that for these sonic comparisons, 'sound-shapers' should be switched out or set to their zero positions). Other differences in the quality of the sound itself can often be noted, describable for example along these lines: 'fizz', 'grit', 'tizz' (at high frequencies); 'clanginess', 'hardness'; and at low frequencies, 'soft', 'full', 'waffly', etc. Again these variations may be more or less pronounced, but more important than their presence is their signposting of how musical information is delivered, with these effects often accompanying degradation in that area. Most equipment has such characteristics, though they may be comparatively subtle. If musical information is in general well presented, it is perhaps churlish to damn the equipment for any residual sonic idiosyncracies, unless they are found personally objectionable.

Aerials

To turn now to aerial requirements, specifically for FM: FM radio waves have a propagation limit of about 60 miles (except during exceptional atmospheric conditions, when their range can be rather greater), and their reception depends very much on the aerial being in the line of sight of the transmitter, and oriented in the right direction. Whenever possible an aerial should be mounted outdoors, since interior locations (*eg* roof-space mounting) can significantly reduce the received signal strength, and be as high up as possible. This last point is to ensure reception of signals directly from the transmitter if possible, since FM radio waves can be absorbed, refracted, and reflected by sizeable obstacles (hills, large buildings, gasometers, etc.), and the aerial signal may in fact comprise both a direct wave and several reflected waves. This phenomenon is known as multipath reception, and causes ghost signals to exist alongside the main one, with attendant risk of distortions.

Orientation of the aerial should be in the optimal direction for reception, which because of the possibility of reflections may not necessarily be towards the transmitter. In some cases it may be advantageous to have a rotating aerial (remotely

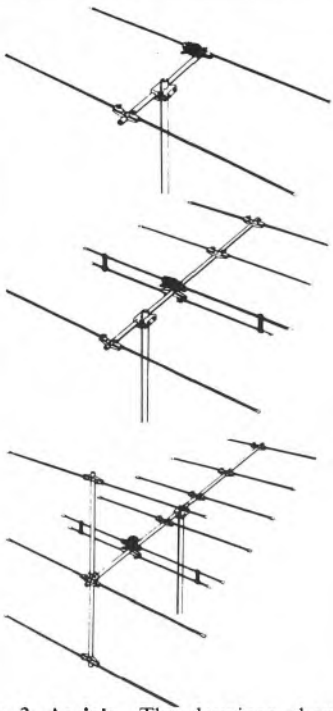
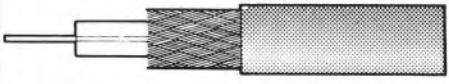


Fig 2 **Aerials** The drawings show three aerial types for outdoor installation, in order of increasing gain or sensitivity (usually good) and directivity (sometimes inconvenient). These are usually fitted with 75ohm co-axial cables/plugs similar to a domestic TV installation, though simple indoor ribbon aerials may use a 300ohm connector of a different type.



75ohm co-axial

300ohm ribbon

controlled from indoors) whose direction can be changed at will. Using a rotator enables aerials which are quite directional in their receiving properties to be used. These offer some protection against multipath distortions, but their main advantage is their extra gain, *ie* their relative amplification factor, over a simple dipole aerial. Aerial gain (useful) and directionality (not always useful) will be increased by increasing the number of elements making up the aerial, *ie* its 'prickliness', with the highest gain aerials being the most complicated-looking ones. Normally something more complex than a dipole will be required, but the highest gain aerials will only be necessary in fringe areas, for DX-ing, and where multipath reception is a bad problem. For specific advice on aerials however, either one's own dealer or a local reputable aerial contractor (who will also erect the aerial if required) should be contacted. It's also worth knowing that assistance can be obtained from both the BBC and IBA and from the Post Office's Radio Interference Branch if troubles are experienced.

Finally some do's and dont's in using a receiver. Don't economise on speaker cable by using lighting flex, and/or grafting short lengths together: use mains cable of 13 amp rating (or at least 5 amp rating). Don't connect or disconnect input or outputs – especially the loudspeaker leads – with the receiver turned on. Don't overdrive the amplifier for extended periods – this could result in damage to the speakers, besides producing generous amounts of distortion. If buying an expensive receiver, consider having it checked by an engineer to ensure it is up to spec., since the bumps and bruises of transportation may have caused some misalignment to occur in the tuner's front end, particularly if it has travelled halfway across the world to be with you.

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MITSUBISHI AUDIO

Technical Introduction

On this occasion the *Technical Introduction* will be largely devoted to describing the test techniques, as the *rationale* behind them and the implications of the results have already been discussed quite adequately in the *Consumer Introduction* and *Conclusions* sections. The final section is a general discussion of AM radio by our consultant Norman McLeod.

FM RADIO

The FM Tuner can be split into a number of sections each of which is tested in various ways:

1. Input section, RFIP or Front-End;
2. Intermediate section, IF;
3. Discriminator or Demodulation;
4. Stereo decoder;
5. De-emphasis.

Signal input to the tuner, from the aerial, is at a high frequency in the region of 88–108MHz.

The high frequency carrier signal containing the wanted information is mixed with a high frequency which is generated by the Oscillator in the "Front-End". The resulting signal, which is the beat frequency or difference frequency, is at the lower frequency of 10.7MHz. The 10.7MHz is shaped and cleaned up by the IF then fed to the demodulator to be converted back to Audio. So, to receive a signal at 90MHz the local Oscillator would be tuned to 79.3MHz giving a difference of 10.7MHz.

The Front-End is asked to perform many differing and exacting tasks. It must be sensitive enough to receive very weak signals and have a large dynamic range to receive very strong signals without overloading. Strong signals close to weak ones must not steal or swamp the wanted one. Strong signals close together in frequency must not be able to generate intermodulation products in the Tuner Front-End which would give rise to distortion products, and the unit should be relatively free from response to multiples of the received signal or the IF signal.

Sensitivity

Sensitivity tests are an attempt to examine how well the tuner will respond to weak signal inputs. The traditional tests measure the unmodulated RF level necessary at the aerial terminals to generate a signal-to-noise (A wtd.) ratio of 30dB or 50dB between the unmodulated RF and a 1mV RF level modulated at 1kHz to 100%. Three similar tests examine this level for 30dB and 50dB in mono and 50dB stereo S/N ratios.

Though these tests have been in widespread use for many years, they have notable limitations. The major problem is that the measurement is taken without the tuner actively processing signal, and gives no information concerning the quality of the low level signal, which can often be very distorted. So while this might appear to be an examination of the intelligibility of a signal ref. noise, in many cases this intelligibility will be marred by severe distortion. (This is partly because the tuner is operating below its limiting level at these very low inputs, and will therefore be open to AM distortions in the circuits.)

It is a great pity that overmuch attention has always been focused on the so-called 'ultimate' (30dB mono) sensitivity measurement, as this not only has limited usefulness but also a number of pitfalls that make accurate measurement at the values available today somewhat uncertain. Theory suggests that values below 0.7uV are unlikely to be valid because of the inherent noise in the system, but even this minimum is derived from functions which include the ambient temperature, the selectivity of the receiver, and precise matching of the correct aerial terminations, and disregard unpredictable slight leakage effects that can be significant at these sort of levels. We would therefore regard measurements below 1uV as somewhat unreliable, placing little credence in 'splitting hairs'; much more interesting is to note the trend of the different sensitivities, which in any case tend to reinforce the unusually low 'ultimate' figure recorded in some cases.

A fourth, and in many ways rather more meaningful sensitivity measurement is made, known as the IHF Useable Sensitivity. This uses the tuner while processing signal, so all the circuits are active, and gives the mono 30dB signal-to-noise-plus-distortion level, which is clearly a more useful measure of intelligibility at low inputs.

Poor sensitivity results may be indicative of poor or compromised designs, but are even more likely to indicate poor alignment in the front-end.

Limiting

Some of the sensitivity tests are not strictly correct, since below a certain RF level, the circuits are no longer able to keep the received amplitude of the signal constant. (This constant amplitude is one of the strong points of FM.) The limiting circuit will clamp the output to a fixed level. This is the level to which we refer all the sensitivity figures. Below the

limiting level, the amplitude of the signal falls, so the 30dB and 50dB points actually measure a slightly smaller ratio if they occur below the limiting level.

Full limiting is a difficult point to define, so what we measure is the point at which the amplitude of the received signal has dropped by 1dB. The better the Tuner, the lower is the limiting point in uV. Normally this has no relevance in stereo, since the switching threshold is well above this point.

Muting

The muting level (when present) is the point at which the interstation noise filter will switch on, in uV sensitivity. It is normally optional (on/off) and on the more elaborate machines may be variable. With a variable mute circuit, it is possible to set the level to ignore weak stations.

RFIM (Radio Frequency Intermodulation)

This is a measure of the susceptibility or otherwise of the tuner front-end to generate distortion sidebands in the presence of two or more strong aerial signals close in frequency. These sidebands may serve to obscure or distort the reception of weaker signals, if they should coincide.

Effectively, though not without complexity, the two unmodulated generators are set to a similar (highish) level at closely-spaced frequencies, and this level is adjusted until the tuner registers a signal equivalent to its 30dB mono sensitivity input when tuned to the IM sidebands (2f1–f2, 2f2–f1). The difference between the high generator level input and the sensitivity datum gives the RFIM in dB; we have examined both sidebands, and have recorded the worst figure.

AM rejection

AM rejection is an important parameter in assessing the tuner's susceptibility to interference (electrical, multipath and broadcasting). Setting a reference level by FM modulating to 100%, 1kHz, for an RF output of about 1mV, the generator is switched to provide 30% AM modulation instead, at the same frequency and output. The difference between the tuner outputs for FM and AM modulation under these conditions is the AM rejection ratio, in dB.

IF rejection

Because the intermediate section of the tuner operates on 10.7MHz, it is worth ensuring that the front-end is unresponsive to such a frequency, to avoid possibilities of interference. Accordingly the RF level required for a 1kHz 100% modulation on 10.7MHz to generate the 30dB mono sensitivity datum level in the tuner is found, and is expressed as the IF rejection ratio in dB when compared to the basic 30dB mono sensitivity.

Image rejection

Like IF rejection, image rejection is a measure of the selectivity of the front-end, in this case at another potentially 'difficult' frequency. The tuner operates by tuning its local oscillator to a frequency 10.7MHz above (or below) the wanted frequency, and then the IF stage, tuned to 10.7MHz, examines the residue of this interaction. The 'image' frequency, which may also lie within the tuning band, is the same 10.7MHz interval the *other* side of the local oscillator, to which the IF strip could respond. To examine this effect one can set the signal generator to 95MHz; when tuned in this implies that the tuner local oscillator is functioning on 105.7MHz. Having found the tuner's 30dB sensitivity datum level ref 1 mV, 50% mod, the generator is then re-set to about 116.4MHz and peaked to give maximum response; the modulation is removed and the RF level reduced until the tuner again gives 30dB mono S/N, this time from the 'image'. The generator level recorded is compared to the basic 30dB mono sensitivity datum to give the image rejection ratio in dB.

Capture ratio

Capture ratio examines the reaction of the tuner to the reception of two signals operating on the same frequency. To avoid interference, it is desirable that the weaker of these is rejected by the tuner front end. The measurement we have taken examines how much stronger the stronger signal must be to maintain a 30dB S/N ratio, so small values such as 2dB or less are expected.

With two generators set to the same frequency, a 0dB 1kHz 100% mod. reference is set, then the unmodulated second signal is increased until the reference level drops 1dB, whereupon the unmodulated RF level is noted, then further increased until the modulated signal is pushed down to the −30dB point. The new unmodulated RF level is noted, and half the difference between the two levels required for the −1dB and −30dB condition is known as the capture ratio.

Selectivity

Moving on from the front-end to the intermediate frequency (IF) 'strip', selectivity is a description of how 'sharp' the filter tuning is. Several measurements can be used in an attempt to describe this essentially geometric function numerically, but the

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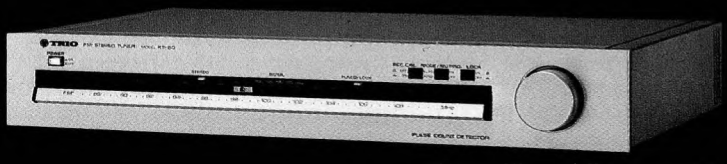

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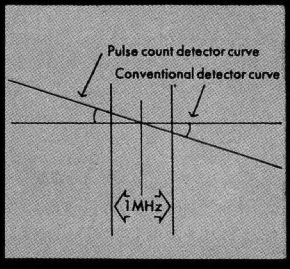

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most useful remains the *alternate channel selectivity,* and this we have quoted (though we also examined the adjacent channel and general symmetry).

Using a reference frequency of 95MHz, 100uV unmodulated RF, a second modulated generator is used to try to 'swamp' this signal from positions ±200kHz (adjacent channel) and ±400kHz. (alternate channel), thus enabling the 'shape' of the IF to be accurately established. Adjacent channel figures are often 5–10dB, while alternate channel figures are around 40–80dB. High values of selectivity on the alternate channel can be useful for trapping weak signals in the vicinity of stronger ones, but may also imply a highish figure on the adjacent channel, which is not ideal for best audio quality.

Signal-to-noise ratio

These measurements are concerned primarily with the audio noise present in the entire tuner, and an A-weighting function was used. A 1mV 100% mod. 1kHz signal was applied to determine the 0dB datum, and for the mono measurement the modulation was switched off and the weighted noise residual measured and compared to the datum. Stereo is a little more complicated, as the pilot tone modulation has to be maintained to preserve the stereo condition. Once again after establishing the reference the modulation was removed apart from the pilot tone, then a 19kHz notch filter was used to remove this at the output (though not any associated harmonic distortion components), and the weighted residual again measured ref. the 0dB datum.

FM in the system: Distortion, pilot tone suppression, frequency response and crosstalk

These were all taken for the tuner as part of the tested system, *ie* measuring from the speaker terminals of the amplifier or receiver, and are shown in the pen charts and spectrograms on the review pages (right hand column). They were obtained by applying RF levels of 1mV to the aerial, with 1kHz mono or stereo, 20% or 100% mod as appropriate. The spectrum analyser and pen chart recorder were connected across the amplifier section's speaker terminals while the amplifier was delivering 1 watt into 8 ohms. The distortion measurements were taken from the published spectrograms, plus others for which space was insufficient.

AMPLIFICATION

The measurement techniques are very similar to those used in *Hi-Fi Choice: Amplifiers,* published May '79.

Noise

Following some of the recent IHF recommendations for standard test procedures, a system of *reference levels* was adopted for noise measurements, and also in determining relative output levels. The noise levels are related to 1 watt output, and are measured with the volume control in such a position as to produce this when driven from 5mV disc and 500mV line input levels (and, where appropriate, 500uV *via* m-c disc input).

Noise measurements were taken with 'A' weighting on the B&K *2010,* the inputs being loaded by 1kohm source; for the m-c inputs the source loading was 10 ohm.

Noise measurements were also taken with the volume control at zero, the level recorded being referenced to the 1 watt figures, which is perhaps not strictly correct, as this measure is traditionally related to the maximum power of the amp. However it is a fairer measurement as it does not give 'unfair' advantage to the more powerful models. It is nevertheless very simple to convert the figure by calculating the maximum output of the amp in dBs ref 1 watt, and then add this figure to our zero volume figure to obtain the signal-to-noise ratio referred to maximum power.

Hum

To examine any hum present, a spectrogram was recorded for frequencies below 200Hz, and the components at 50, 100 and 150Hz were analysed to enable a value judgement to be made.

Power

As before, power was measured at the onset of clipping, defined as the 0.1% distortion point: into 8 ohms at 20Hz, 1kHz and 20kHz with both channels driven, and then at 1kHz into 8, 4 and 2 ohm loads with one channel driven. (The voltage across the amplifier terminals was measured, the known load enabling the power to be calculated.) During these tests checks were also made of the distortion at both high and low frequencies. 'Burst' power was measured as before using a single cycle of 1kHz sinewave, the amplifier driven as hard as possible to clipping/limiting. The readings were noted on a storage oscilloscope and a peak-reading

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meter, being RMS averaged from the latter for the published figures.

Power bandwidth
The bandwidth of the amplifier *via* both disc and aux. inputs was measured at half the rated power, to give the published −3dB power bandwidth on the disc input. This was not carried out on the moving coil inputs fitted to some models.

Inputs and Outputs
These were examined bearing in mind the latest IHF recommendations concerning reference levels. 5mV was applied to the disc inputs and the resulting tape outputs duly noted, into 10kohm parallel to 1000pF for phono outputs (and DINs behaving as phonos), and into 100kohm for DIN outputs.

The headphone output level was measured across an 8 ohm load while the amplifier was providing 1 watt into 8 ohms from the speaker terminals.

Input sensitivities were the levels necessary at the inputs to produce the 0.1% distortion rated power at 1kHz with the volume control set at maximum.

The disc input was examined rather more thoroughly, checking both sensitivities and overload levels at three frequencies (20Hz, 1kHz, 20kHz), the same treatment being applied to the moving-coil cartridge options (though all these gave satisfactory overload results which have therefore not been quoted).

Input impedances were measured and capacitances were measured on all disc inputs where possible. We did find a number of models that did not respond to our technique, and the appropriate results have been left as a question mark. We remain rather mystified by the problems that occurred in these instances, and despite double-checking the results and the meter (an EPI digital impedance meter), and searching for other potential snags such as hum loops, etc., the fact remains that with certain units it was not possible to achieve a stable reading for the impedance and/or capacitance. Where only the capacitance measurement has been omitted, this was sometimes due to the use of semiconductor cable on the input.

Input impedances for high level sources may vary according to the setting of the volume control, so they were always measured at the reference level volume.

Damping factors were calculated by comparing on- and off-load voltages, measured at 1kHz and close to maximum power at the output terminals.

Harmonic distortion (and noise)
Measurements were made at three power levels (max., 10W, 1W) to enable a value judgement to be made.

IM distortion, frequency response and crosstalk
These were all derived from the spectrograms and pen charts published in the right hand column of each review. As with the tuner measurements, the spectrum analyser and pen recorder were connected across the speaker terminals while the amplifier delivered 1 watt into 8 ohms.

The IM spectrum was obtained by passing 19 and 20kHz signals through the auxiliary inputs, from which the distortion products could be clearly seen. The accompanying frequency response spectrogram on the line input is a cross-correlation of input and output using white noise bandlimited to 25kHz, again at 1 watt output.

The disc frequency response and crosstalk signals were fed from the B&K *2010 via* an inverse RIAA network into the disc input, the pen chart made from a 1 watt 8 ohm amplifier output at the terminals. The inverse network was to the British Standards 1% tolerance, and we believe it is accurate to ±0.5dB, the 'low' region a broad valley centred on 200Hz, and the 'high' area a plateau centred on 10kHz.

LISTENING/SUBJECTIVE TESTS

Our efforts in the listening tests were directed towards carrying out several different tests on the units under varying conditions and locations, though the ancillaries naturally had to be of a high enough standard to ensure that their effects upon the results would be minimal. There were of course some inconsistencies, which we have been quite prepared to admit, though happily there was also quite close correlation in many of the findings, which we feel adds credence and confidence. Repeat inserts provided a random check on consistency, again with usually encouraging correlations.

Listening was carried out *via* the disc input, using Linn Sondek/Ittok with Supex 901 cartridge (a low impedance high output device which should have a stable frequency response irrespective of likely load), with some models checked with an ADC *XLM III.* Loudspeakers used included Linn

Isobarik DMS, Linn *Sara,* KEF *105,* KEF *105 II* and Mission *770.* FM was assessed off-air (with particular attention to the 'live' studio announcers), both in the system with the accompanying amplifier and also from the tape or pre-amp output into a high quality reference system (Naim/Linn PMS). A further series of sessions made direct comparisons with the disc input performance by taking the signal from the turntable *via* a high quality pre-amp into an FM signal encoder, and thence directly to the RF aerial inputs of the tuners/receivers.

The majority of the sessions were carried out 'blind' with varied program material, though to assist familiarisation some 'hands-on' testing was also included. AM was included in some blind sessions, and a separate series of subjective evaluations were carried out by an acknowledged expert in the field, who also reported upon the operation of the tuners from a 'radio enthusiast' point of view.

Room sizes at both sites were quite generous: 32ft x 20ft x 9ft and 24ft x 14(ave)ft x 9ft, so particular care was taken to avoid clipping even the lowest powered amplifiers, auditioning taking place fairly near the loudspeakers. All the usual precautions to maintain levels and prevent listener fatigue were taken.

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KEF Electronics
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Brighton Hi-Fi
And to the following individuals who gave up their time to help: Roy, John, Mike, Alan, Martin, Jerry, Janis, Bill, Marcus, Adrian and Norman (to name but a few).

AM RADIO (by Norman McLeod)
With space in the radio spectrum becoming increasingly scarce, it is likely that future broadcasting in Europe will follow trends established in the United States, of treating FM and AM services as programme options in their own right. And that the wasteful practice of 'simulcasting' – that is, broadcasting an identical programme simultaneously on both AM and FM transmitters – will become less frequent.

Already most of Radio 1, much of Radio 4 and programmes from the other BBC networks are confined to medium or long wave. AM reception also offers listeners in some parts of the UK the opportunity to hear foreign programmes more consistently than *via* tropospheric FM reception. The continuing importance of AM is reflected in the fact that most of the tuners reviewed in this book offer at least medium-wave reception, and the recent removal of Radio 4 to the long waveband (a band not used for broadcasting outside Europe and the USSR) has meant that this band is now frequently appearing on new tuners on sale in this country.

AM receiver design has not received the assiduous attention lavished on the FM section; indeed many AM sections rank as little more than a token gesture. However, the development of low-cost ceramic filters for reliable and consistent selectivity has made an impact in this area, as has the recent development of frequency synthesiser packages, and the ubiquitous integrated circuit has resulted in some improvements over earlier discrete designs. Nevertheless, the basic style and most of the techniques used in current AM receiver sections are the same as those employed in the first generation of transistor radios spawned in the late fifties and early sixties.

Aerials for AM reception
As Mrs. Beeton might have said, "First trap your signal . . .". While many proud owners of FM equipment have roofs decorated with complex arrays of aluminium tubing, the most generous aerial devoted to the other two bands is usually a ferrite rod round the back of the receiver. This is hopefully (though not always) mounted on a flexible pivot, to enable the rod to be rotated for optimum reception. A ferrite rod has a figure-of-eight pickup pattern: if the rod is placed broadside on to the incoming field, it will pick up maximum signal; if it pointed end-on to the station, it will pick

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THE LIGHT FANTASTIC.

For some years, it has been widely held by electro-acoustic engineers that low mass design represented the future of advanced cartridge technology.

Now Ortofon have conceived an ultra low mass cartridge: the Concorde 30.

It's a cartridge so light, so compact, it probably weighs less than your present headshell alone.

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Ultra low mass means ultra low inertia.

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As a result, this is one of the world's few cartridges truly capable of handling even the highest frequencies found on today's hi-fi ultimate: the direct cut disc.

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up little or nothing. This has the advantage of being able to discriminate against unwanted sources of interference, but BBC and IBA transmitters are not sited in the same place, so the optimum position for receiving each service may be different, and adjusting the aerial placed round the back of the receiver can be awkward.

Although the ferrite rod is a quite sensitive aerial when accurately tuned, and certainly adequate for local-station reception in most areas, there may be locations where more signal is required, and all tuners provide a terminal to which an external AM aerial may be connected if desired. Some (unwisely) also arrange for AM signals picked up by the FM aerial downlead to be coupled into the AM section of the tuner. The main problem is that the interference field in domestic environments, arising from television receivers, fluorescent lights, electrical machinery and so on, does not begin to diminish until roof level. This means that an unscreened wire, even if it does run up to the relatively 'clean' environment on the roof, will pick up lots of interference on the way.

The best arrangement for quality AM reception is to use a vertical rod on the roof, with a matching transformer coupling into a screened coaxial cable, and a step-up transformer at the receiver end to match the cable to the aerial input impedance of the set. However, in areas with strong local transmissions this may give rise to a multitude of spurious responses from the tuner, resulting from the design of the "front-end".

The 'front-end'

The 'front-end' collectively describes the first stage of the receiver prior to the intermediate frequency amplifier, comprising the RF amplifier – if fitted – the local oscillator, and the mixer. An RF amplifier is still quite uncommon in 'hi-fi' AM sections, although a tuned RF amplifier would considerably improve the performance. Its function is to boost the incoming signal before it reaches the mixer, which will improve both the sensitivity and the signal-to-noise ratio of the receiver. An additional tuned circuit resonating at the incoming signal frequency at the output of the RF amplifier will also vastly reduce the image, IF and other spurious responses from the tuner. Unfortunately, the budget assigned to most AM sections does not run to this refinement.

The mixer and local oscillator perform the function of converting all the incoming signals to one standard frequency, known as the intermediate frequency or IF. The incoming signal is mixed with the output from the local oscillator, which runs at a frequency exactly 450–480kHz higher than the incoming signal, and the non-linear action of the mixer produces the difference between the two signals as the IF, still carrying the modulation of the original aerial signal.

With an IF of 460kHz, the oscillator will run at 1460kHz to receive a signal at 1000kHz, at 1560kHz to pick up 1100kHz, and so on. This means that the bulk of the gain and selectivity of the receiver can be concentrated at one frequency in the region 450–480kHz, instead of having to tune all the selectivity circuits up and down every time you change station.

Although this principle, known as a 'superheterodyne' or 'superhet', is universally used in modern receivers, it is not without its own pitfalls. An unwanted signal twice the IF higher in frequency than the wanted one will also produce an output at the IF frequency from the mixer. This is known as the 'image' response, and in the case of the hypothetical tuner mentioned above, receiving 1000kHz, the image response will lie 460kHz on the other side of the oscillator frequency, *ie* at 1920kHz. Unless the mixer input circuit severely attenuates signals at this frequency, while passing signals at 1000kHz unimpeded, the receiver will respond to unwanted signals at the image frequency. The more tuned RF circuits there are prior to the mixer, the better will be the image rejection, and although four or even more are commonplace in FM sections, the AM receiver frequently has to make do with only one.

The IF amplifier

The IF amplifier in an AM receiver takes the output from the mixer, and amplifies it up to a level suitable for driving the detector. It is invariably voltage-controlled by a signal from the detector, in order to reduce the gain when a strong signal is received. Unlike an FM IF strip, where limiting is desirable, the AM IF section must pass the signal linearly at all input levels, or the modulation will emerge distorted.

Until fairly recently the selectivity incorporated in the IF amplifier was provided by a number of tuned circuits (usually between four and six) in the interstage coupling. Nowadays, these have generally been replaced by a fixed ceramic filter block, which offers a more consistent, reliable and drift-

free performance. The selectivity of this block has a profound effect on the frequency response of the audio emerging from the detector, since on AM the recovered frequency response is exactly determined by the IF passband. If the IF has a passband of 6kHz at −3dB points, then the audio will be −3dB at 3kHz, exactly half the bandwidth of the IF response.

Because the bandwidth of an AM transmission is exactly twice the highest audio frequency transmitted, most European broadcasters now steeply filter the audio input to their high-power transmitters above 5kHz, in order to reduce interference to users of the adjacent channels 9kHz away on either side of the transmission. So there is little point in having an IF passband wider than 10kHz. However, an IF passband narrower than 10kHz will mean that the higher audio frequencies transmitted by the broadcasters will not be reproduced at their full level by the receiver.

If the response of the IF amplifier to signals on the adjacent channel (±9kHz) from the wanted one is too great, it will be impossible to receive a station without interference where such a situation exists. The adjacent channel station will give rise to a whistle at 9kHz, arising from the beat between the two carriers, plus 'chirping' and 'monkey chatter' arising from interference between its sidebands and the wanted carrier.

Because low-cost ceramic filters do not have a perfect rectangular response, the designer is faced with a compromise. Either he passes the whole 10kHz bandwidth radiated by the transmitter with minimal attenuation, which achieves maximum fidelity but runs the risk of adjacent-channel interference, or he fits a narrower IF filter which will cut out adjacent channel interference quite thoroughly, but will also severely attenuate the high-frequency response recovered by the detector from the unwanted transmission.

Unfortunately, most of the receivers inspected have chosen the second option, with the result that the recovered audio response starts to fall very rapidly, often from as low as 2kHz. This makes AM reception on most tuners sound much more muffled than it need be. The option of two selectivities (available all those years ago on the Quad AM tuner) – one (wide) for maximum fidelity during the day, when adjacent-channel is rarely a problem, and another (narrow) for night-time reception – is one which has yet to make an appearance, although it would be most welcome.

The detector

Traditionally, AM receivers have relied on one semiconductor diode to detect the signal, in exactly the same manner as the 'cat's whisker' of the early days. The diode detector has a number of disadvantages, however. In particular, it produces a lot of distortion, sometimes as much as 5–10% on full modulation, and it is inefficient at low signal levels. Modern integrated circuits use a variety of improved detectors which give much lower distortion figures, which are clearly superior in any casual comparison, particularly on weak signals.

Synthesisers

Finally, a word on synthesisers in the AM context. All a frequency synthesiser can do is to generate a very accurate local oscillator frequency, which will ensure that the receiver is accurately tuned to the incoming broadcast. The European medium waveband is divided into 120 channels, each 9kHz apart, with carrier frequencies ranging from 531 to 1602kHz. Long wave carriers extend from 155 to 281 kHz, a total of 15 channels again 9kHz apart. The frequencies of the carriers on medium wave are all exact multiples of nine, and in the late eighties all long wave channels will follow suit, by shifting down by 2kHz. This will make synthesised receivers more straightforward.

Those receivers which use frequency synthesis to generate the local oscillator frequency, and thus to define the received channels, usually opt for 9kHz spacing on medium wave, but shift to 1kHz increments on long wave, in order to accommodate both present and future long wave carrier frequencies. All frequency-synthesised receivers have a digital readout, but the converse is not always the case. The unique feature of a proper synthesised receiver is its ability to tune, not continuously, but in discrete steps.

BEST BUY

Small Wonder

The A&R integrated amplifier and its matching T21 stereo f.m. tuner are tangible proof that biggest isn't always best.

Numerous reviews have shown the modestly priced A60 to be amongst the best available, regardless of cost. The A60's sound quality is outstanding and its reliability legendary. The T21 has been equally well received; and all this from units only 2 3/8 inches (60mm) high!

We've designed the A60 and T21 to be used in the home, not the dealer's showroom. The controls are simple and straight-forward to use. The satin black facias are smart and straight-forward to use. The satin black facias are smart but unobtrusive. Interchangeable wood sleeves (with a choice of teak, walnut, rosewood and black) enable them to be matched with almost any furniture scheme.

Small wonder Hi-Fi Choice has awarded them the accolade of 'Best Buy'.

If you are thinking of buying an amplifier, tuner or receiver you must audition A&R equipment. Write or phone today for full details and the names of dealers near you.

Please send me A60 and T21 details, plus reviews and your dealer list.

Name .....

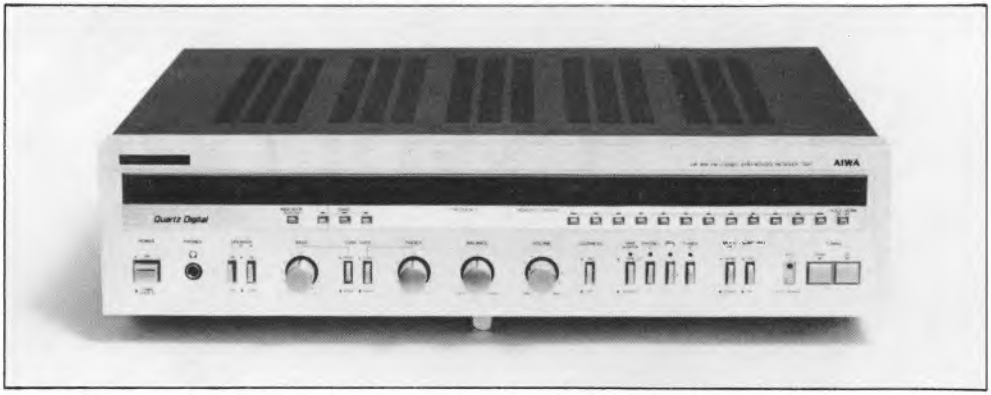
Address .....

A&R
CAMBRIDGE
Amplification and Recording
(Cambridge) Ltd
French's Mill, French's Road
Cambridge. Tel (0223) 354507

HFCh.
8/80

Aiwa AR7800

Aiwa Sales and Service, Aiwa Centre, 56–58 Brunswick Centre, Marchmont Street, London WC1. Tel: (01) 278 2081



Presentation, facilities, etc.

This large, solid, though comparatively slim receiver is ergonomically rather daunting, with rows of near-identical push-buttons, four identical knobs, and an imposing full-width multi-coloured display. Aiwa's top receiver, the unit features no less than four kinds of tuning, including manual, automatic, and preset forms, all being accomplished electronically, with the frequencies displayed digitally; the operations are over-elaborate, to say the least.

Tuning FM and long and medium wave AM, with ten preset positions and the above-mentioned alternatives, the aerial signals are provided *via* 75 and 300 ohm sockets, with an external AM socket supplementing the properly pivoted ferrite fitted. A signal strength meter also doubles to read 'power', while a stereo beacon and a variety of other lights to indicate engaged switches are provided. The tuning 'hardware' is supplemented by mono/stereo and muting switching. The amplification section offers two turnover positions of bass and treble tone controls, loudness, speaker switching, and a headphone jack, while inputs are phono on disc and aux., DIN on tape (and indeed one set of speaker terminals). In summary, a comprehensively specified receiver, whose elaborate tuning functions may take a little learning.

Lab performance

The power output is reasonable for the price is well maintained into low impedances, but with some discrepancy between single and dual channel drive. Disc input bandwidth was a little wide, and the frequency response rose somewhat in the treble. Inputs and outputs are fairly typical, though the disc input capacitance when combined with that from some arm leads may be on the high side for a few cartridges. Performance results were reasonable, but IM distortion was only average and hum below average.

The tuner section gave generally good or excellent measurements throughout, marred only slightly perhaps by the distortion increase noted between stereo and mono, which is greater than it could perhaps have been.

Subjective impressions

Unhappily an intermittent tuner section fault had become permanent before auditioning and 'hands on' examination had taken place. The amplifier section had a mixed reception resulting in a slightly below average result, with a common criticism of some 'brightness' and 'harshness', and a certain degree of muddling.

Conclusions

Unable in practice to confirm or deny the good tuner measurements, our conclusions must return a somewhat open verdict, but some reservations on listening tests and ergonomic grounds, plus the rather brash appearance, do serve to mute our enthusiasm somewhat.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	5Hz–97kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	60/64/64 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	76/106/102 Watts
Burst power 1kHz, 8/4/2 ohms	90/143/157 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.6	47k	216pF
Disc MC	—	—	—	
Tuner/aux	Phono	160	40k	
Tape	DIN	160	1M	
Disc overload 1kHz				39dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	DIN	35	80k
Headphones (8 ohms)	Jack	80	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−88dB
Aux ref volume	−75dB
Disc ref volume	−77dB

Other

Damping factor	49
THD performance	good
IMD performance	average
Hum performance	below average

TUNER

RF Performance

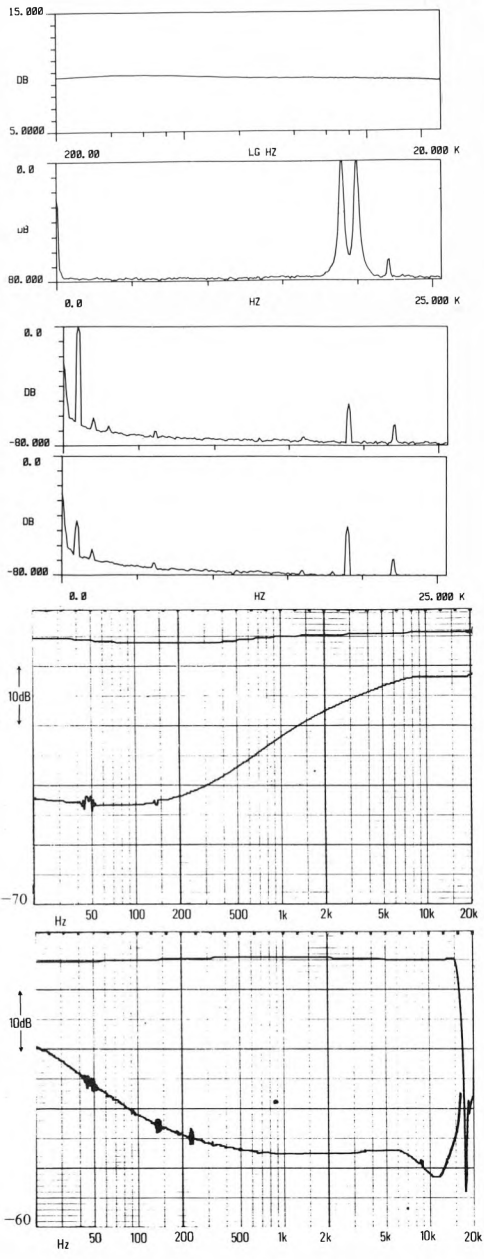
30dB S/N Ratio, mono sensitivity	1.25uV
50dB S/N Ratio, mono/stereo sensitivity	2.00/22uV
IHF 30dB S/N Ratio, mono	1.30uV
Muting level	18.0uV
Limiting level, −1dB	2.2uV
RFIM	60dB
Capture ratio	2.5dB
Selectivity	65dB
IF rejection	101dB
AM suppression	58dB
Image rejection	101dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	74/71dB
Distortion, mono 20%/100% modulation	0.07/0.08%
Distortion, stereo 20%/100% modulation	0.18/0.30%
Pilot tone suppression	−53dB
Crosstalk, 1kHz	−48dB

GENERAL

Total size (W x D x H)	19¾(50) x 17½(44) x 4¾(12) in(cm)
Approximate weight	22lb
Typical retail price	£280



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Aiwa AA8700/AT9700

Aiwa Sales and Service, Aiwa Centre, 56–58 Brunswick Centre, Marchmont Street, London WC1. Tel: (01) 278 2081

Presentation, facilities, etc.

These large and solid-looking separates represent the top models from Aiwa. Not surprisingly they are heavy, bulky, and packed with facilities, sufficient perhaps to make them a little confusing to use for the inexperienced, though one is unlikely to lack anything (apart from presets, unfortunately).

The FM only tuner has quartz control on tune and mpx, auto or manual selectivity switching between sharp and normal, switching between mono, stereo, two degrees of 'hi-blend', and a full deviation signal for setting tape level; complex tuning indicators include signal strength, 'quality', centre-tune, stereo/mono and quartz-locking. The tuned frequency is displayed in both digital and analogue formats, though only manual tuning is provided. Aerial sockets are fitted for both 75 and 300 ohm matching, and an (optional) output level control is fitted on the front. The amplifier is similarly complex, with curious-looking piano-type keys incorporating indicator lights to select the inputs. One of the disc inputs is controlled by a three-way switch, selecting two choices of capacitance for m-m cartridges, or m-c cartridge matching. Tone controls have two turnover frequencies each plus an 'off' position; loudness, high and low filters and muting are all available. Further switching encompasses complex tape monitoring and dubbing and speaker selection, and 'power' meters are fitted. Phono socketry includes pre/power break, with DIN-duplication on Tape 1, and a DIN-only 'Tape 3' on the front panel. 'Nuff said! These are complex, beautifully finished and impressive rather than elegant pieces of electronic hardware, though with the plethora of features provided, it is a pity that no presetting tuning mechanism was included.

Lab performance

The generous power delivery is only to be expected at the price, but is well maintained under various conditions, and should therefore cope well with low impedance loading. The inputs and outputs should pose no problems, the variable disc capacitance assisting m-m cartridge matching, though the m-c input is a little insensitive for some such models. Although harmonic distortion was fine, IM distortion was well below average and hum only average.

The tuner measurements were literally superb (the ultimate sensitivity perhaps unrealistically so!), and there is no doubt that this model should be well suited to DX fans. Some pilot tone filter misalignment was noted.

Subjective impressions

Listening tests placed this combination at or just above average overall, with praise for 'solidity', 'liveliness', and an impression of power, but criticism of harshness and 'edginess'. The FM was described as a little 'bassy' and 'bright'. In use it showed signs of some assymetry in the 'sharp' selectivity mode, though the 'normal' position was fine. It was also felt that the stereo threshold was set too high, particularly as mono and two 'high blend' states were available, though in other respects the tuner was liked a great deal.

Conclusions

Though in many ways a very impressive combination, particularly in terms of the tuner's potential,

there were enough aspects of mild concern to prevent recommendation at this price level.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 2Hz–50kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) .. 92/84/80 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ... 100/112/60 Watts
Burst power 1kHz, 8/4/2 ohms ..... 133/189/179 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.5	51k	Var
Disc MC	Phono	0.2	52k	
Tuner/aux	Phono	170	36k	
Tape	Phono	170	50k	
Tape	DIN	170	60k	

Disc overload 1kHz 41dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	250	2k
Tape	DIN	30	80k
Headphones (8 ohms)	Jack	35	—

Noise (ref 1 Watt, 8 ohms)
Zero volume ..... −99dB
Aux ref volume ..... −89dB
Disc ref volume ..... −99dB

Other
Damping factor 73
THD performance ..... good
IMD performance ..... well below average
Hum performance ..... average

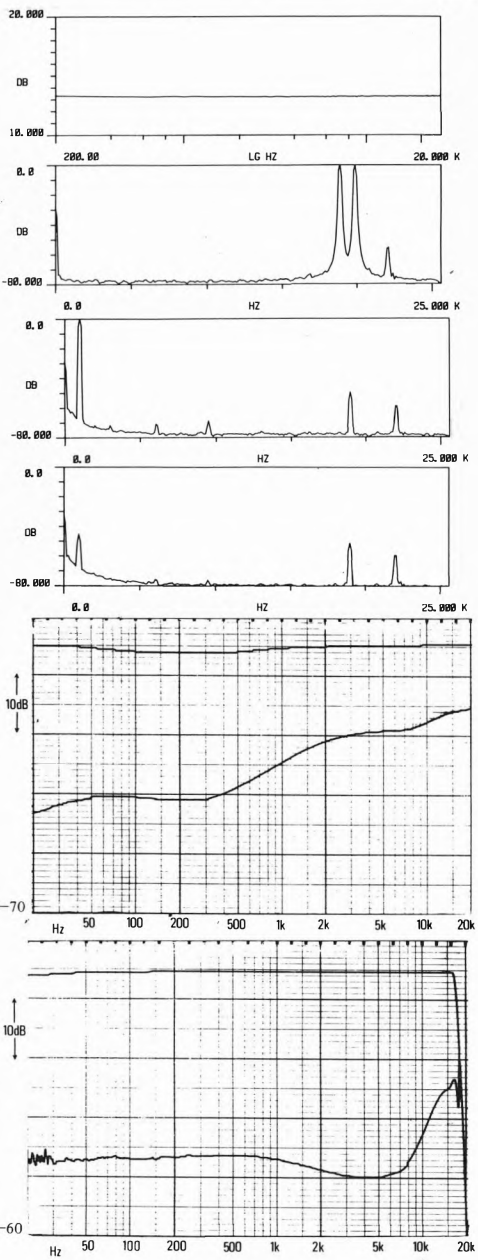
TUNER

RF Performance
30dB S/N Ratio, mono sensitivity 0.50uV
50dB S/N Ratio, mono/stereo sensitivity 1.25/25uV
IHF 30dB S/N Ratio, mono 0.80uV
Muting level 3.6uV
Limiting level, −1dB 3.6uV
RFIM 83dB
Capture ratio 1.2dB
Selectivity 83dB
IF rejection 75dB
AM suppression 62dB
Image rejection 110dB

Audio Section
S/N ratio 1mV i/p, mono/stereo 74/72dB
Distortion, mono 20%/100% modulation 0.13/0.40%
Distortion, stereo 20%/100% modulation 0.13/0.40%
Pilot tone suppression ..... −50dB
Crosstalk, 1kHz ..... −40dB

GENERAL

Total size (W x D x H) ..... 17½(45) x 15½(39) x 12(30) in(cm)
Approximate weight 52lb
Typical retail price ..... £275+£250



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

BEST BUY

A&R A60E/T21

A&R (Cambridge) Ltd., French's Mills, French's Road, Cambridge CB4 3NP
Tel: (0223) 354507

Presentation, facilities, etc.
A&R's *A21* amplifier has been fundamentally unchanged for some years, though the company policy is one of continuous detail improvement. It has acquired a good reputation for sound quality at its price, which tended to be confirmed in the recent Choice: *Amplifiers* book. The *T21* tuner is a more recent introduction, and uses A&R's expertise in designing LED displays for the professional market. These are amongst the slimmest units in the book – stacked together they would still be dwarfed by some of the single units in this survey – and are attractively discrete, with black faces and wooden cases.

The tuner has five presets on the back panel in addition to the normal tuning knob on the fascia, and all may be selected by front pushbuttons which also switch mono and AFC. Centre-tune, stereo and signal strength are displayed; the back panel accepts both aerial types, and also offers variable signal output. The amplifier offers fairly basic traditional facilities, but in addition one or two which are less common. These include alternative speaker terminals which allow direct or *via* headphone connection, so switching in the output signal path may be avoided by those who so desire; comprehensive alternative components are available from the manufacturer to optimise cartridge matching; the DIN disc input uses a spare pin to power A&R's head amp, an optional extra for those using moving-coil cartridges. Overall an attractively finished unusual design with particular appeal to the enthusiast.

Lab performance
A little on the expensive side for the measured power, this was nevertheless well maintained under the various measurement conditions, and is probably limited by the size of power supply that can be fitted into the very slim case. The disc input bandwidth is nicely limited, and cartridge loading flexible, while the crosstalk shows a welcome 20dB improvement over that measured in *Choice: Amplifiers*. Though using DIN sockets, the equipment should interface without problems with either standard. Performance characteristics were generally fine, but with hum performance below average.

The tuner absolute sensitivity measurement was not exceptional, but the more important 50dB stereo figure was well above average, as were all the measurements apart from distortion.

Subjective impressions
In a repeat of our *Amplifiers* findings, the A&Rs consistently appeared in the top group in audition, being described as coherent, integrated, smooth and quite 'lively' on disc and FM. The LED tuning scale did not hold much appeal for our radio enthusiast, who found it irritatingly imprecise, but he also rated the performance highly.

Conclusions
Our familiarity with these models makes dispassionate evaluation difficult, but our findings still indicate that by dint of well balanced design compromise without fancy aspirations they simply deliver the goods, and may therefore be confidently recommended as offering good value in the medium price class.

A&R A60E/T21

BEST BUY

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	11 Hz–43kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	30/36/30 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	43/74/28 Watts
Burst power 1kHz, 8/4/2 ohms	57/92/29 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	DIN	2.0	48k	240pF
Disc MC		head amp optional extra		
Tuner/aux	DIN	100	100k	
Tape	DIN	100	48k	

Disc overload 1kHz	37dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	DIN	165	50k
Headphones (8 ohms)	Jack	70	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−81dB
Aux ref volume	−75dB
Disc ref volume	−82dB

Other

Damping factor	44
THD performance	good
IMD performance	average
Hum performance	below average

TUNER

RF Performance

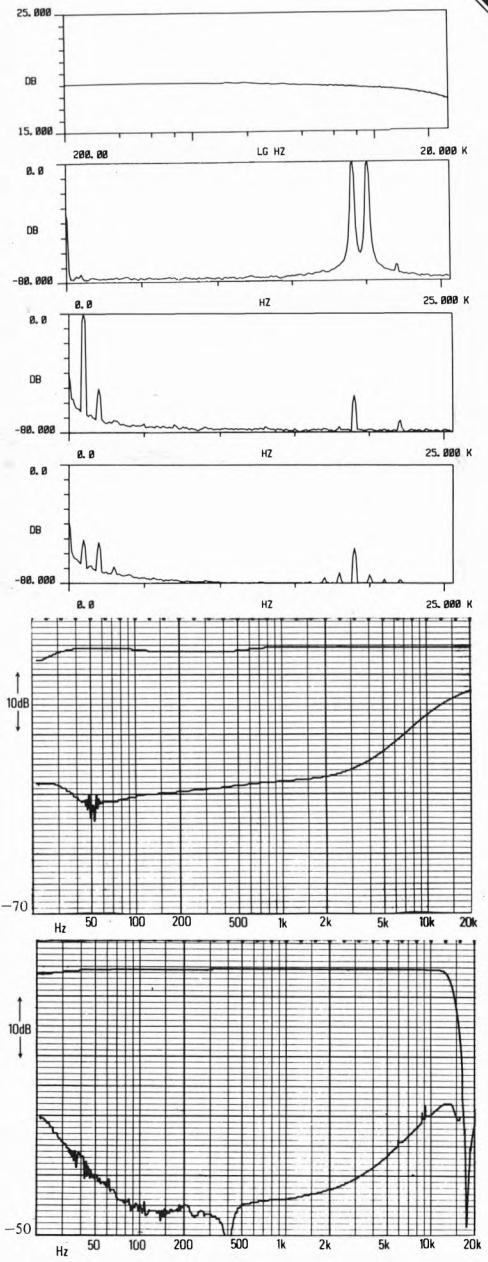
30dB S/N Ratio, mono sensitivity	2.00uV
50dB S/N Ratio, mono/stereo sensitivity	3.50/25uV
IHF 30dB S/N Ratio, mono	2.00uV
Muting level	3.00uV
Limiting level, −1dB	2.00uV
RFIM	79dB
Capture ratio	1.5dB
Selectivity	48dB
IF rejection	107dB
AM suppression	61dB
Image rejection	78dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	75/71dB
Distortion, mono 20%/100% modulation	0.30/0.45%
Distortion, stereo 20%/100% modulation	0.55/1.00%
Pilot tone suppression	−55dB
Crosstalk, 1kHz	−42dB

GENERAL

Total size (W x D x H)	17¾(45) x 10(25) x 4¾(12) in(cm)
Approximate weight	19lb
Typical retail price	£190+£173



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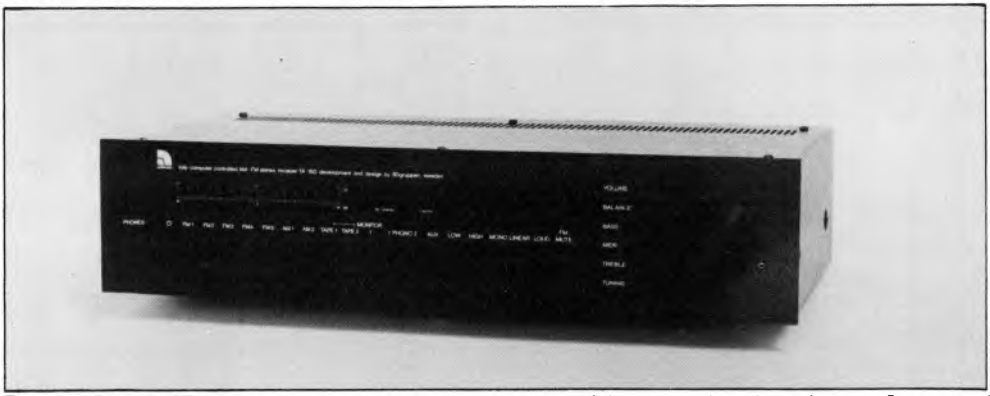
Audio Pro TD150

Audio Pro (Hi-Fi) Ltd., Sandy Lane, Moston Road, Sandbach, Cheshire
Tel: (09367) 7520



Presentation, facilities, etc.

This unusual microprocessor-controlled receiver originates from 3D-Gruppen in Sweden, and is marketed in the UK by the Audio Pro organisation. Wide and very solidly constructed, it has a single knob and no less than 26 push-buttons, which may seem a little daunting, but does incorporate some intriguing ergonomics. It is a little difficult to explain these fully and simply, but essentially the knob performs all increasing/decreasing functions (volume, tone, etc.) according to the push-button selected, the levels of these functions being displayed on a thermometer-type LED display.

The tuner operates on FM and medium wave AM, with five and two presets respectively. Aerial sockets for 75 and 300 ohm FM are provided, and a hinged but not pivoted AM ferrite is fitted (which suggests some limitations in this area, in view of the weight and size of this model). The digital frequency display doubles as a clock, while other indicators include centre-tune and stereo; switchable FM muting is also fitted. The amplifier section uses DIN inputs and speaker outputs (switchable), though the normal headphone jack is fitted. The facilities include tone-defeat, loudness, stereo/mono, high and low filters, and bass, middle and treble tone controls. Though the ergonomics may take a little learning, they seem well thought out, particularly the large multi-function knob (which acts on volume except when other functions are selected), and go to make this an interesting if elaborate design.

Lab performance

Quite powerful, but also quite expensive, the power delivery pattern is fairly typical, and is rather restricted into very low impedances. Inputs and outputs should be perfectly satisfactory, the m-m disc being able to be matched to any cartridge, and the m-c (a replacement PCB) having about the right sensitivity, though the disc bandwidth is rather wide. Performance characteristics were average or better than average.

Excellent sensitivity figures can be seen, though the tuner was less impressive on AM rejection and pilot tone suppression. In general the results were above average or better.

Subjective impressions

Rather inconsistent listening tests were recorded, resulting in an overall rating slightly below average. The powerful sound was liked, but consistent criticism was also made of added slight high frequency exaggeration except on FM (see frequency responses?) It was also felt that the sound deteriorated sharply when overdriven. The idea of tuning precisely with a detent action knob remains slightly bizarre, and frequently prevented accurate tuning on AM, while tuning ease was further impeded by a 'slow' electronics/manual linking. AM performance nevertheless had promise, marred by pickup from the display.

Conclusions

Though by no means a poor performer, this model is on the expensive side, and the ergonomics, though quite clever, were not unanimously liked and did not seem entirely practical.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	12Hz–102kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	71/77/73 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	86/130/17 Watts
Burst power 1kHz, 8/4/2 ohms	101/154/19 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	DIN	3.4	47k	67pF
Disc MC	DIN	.09	—	-
Tuner/aux	DIN	200	43k	
Tape	DIN	200	43k	

Disc overload 1kHz	34dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	DIN	150	850
Tape	—	—	—
Headphones (8 ohms)	Jack	80	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−80dB
Aux ref volume	−77dB
Disc ref volume	−77dB

Other

Damping factor	146
THD performance	good
IMD performance	average
Hum performance	above average

TUNER

RF Performance

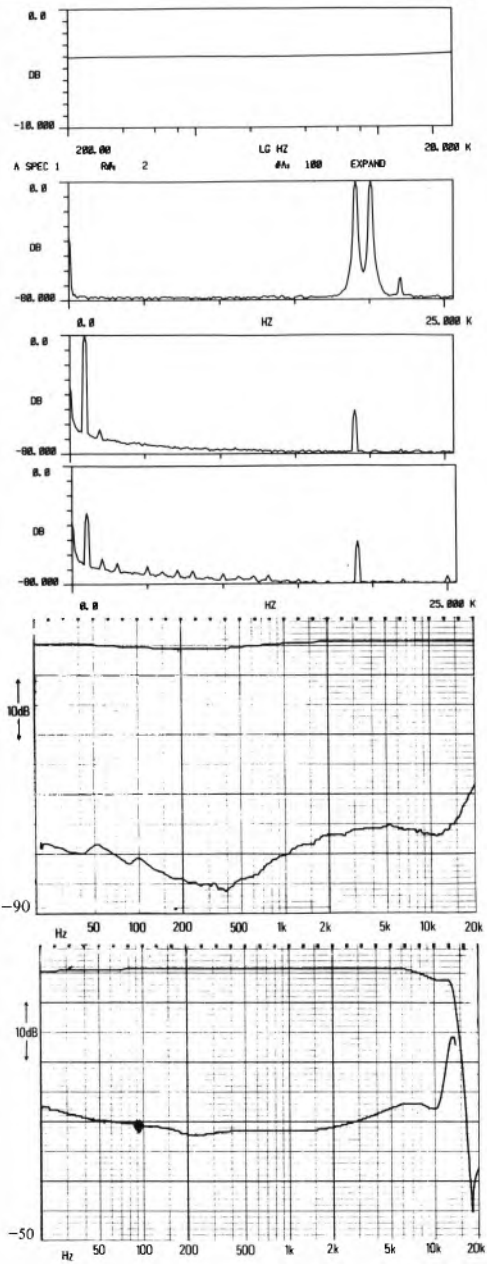
30dB S/N Ratio, mono sensitivity	1.00uV
50dB S/N Ratio, mono/stereo sensitivity	2.20/10uV
IHF 30dB S/N Ratio, mono	1.50uV
Muting level	2.0uV
Limiting level, −1dB	1.3uV
RFIM	72dB
Capture ratio	0.7dB
Selectivity	64dB
IF rejection	87dB
AM suppression	45dB
Image rejection	70dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	70/67dB
Distortion, mono 20%/100% modulation	0.06/0.30%
Distortion, stereo 20%/100% modulation	0.12/0.70%
Pilot tone suppression	−50dB
Crosstalk, 1kHz	−30dB

GENERAL

Total size (W x D x H)	19½(50) x 13(33) x 4½(11) in(cm)
Approximate weight	26lb
Typical retail price	£600



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Aurex SB-A10/ST-T10L

Toshiba (UK) Ltd., Toshiba House, Frimley Road, Frimley, Camberley, Surrey GU15 5JJ. Tel: (0276) 62222

Presentation, facilities, etc.

Toshiba created quite a stir with the release of their original Aurex micro-components *system 15,* and now there are the cheaper *10* and *12 series;* the models we have tried have had a good run of success with *Choice* testers too. Few people can resist the styling appeal of these delightfully well-finished tiny products, which seem to give little or nothing away to their more portentious rivals.

The tuner operates manually on FM and medium and long wave AM, with 75 ohm and external AM screw terminals supplementing the hinged but not pivoted AM ferrite, which may of course offer slight siting problems. Indicators for stereo, signal strength and tune, and switches between stereo-plus-mute and mono-without are fitted. Phono socketry is used throughout apart from a front panel mike jack with mixing control on the integrated amplifier, which is equipped to drive headphones or one set of speakers. Concentric volume/balance and conventional tone controls are fitted, plus switching for loudness and tape monitor. Although the features provided are fairly basic, this does help to facilitate operation and ensures that the excellent miniaturised styling does not become cluttered, while at the same time satisfying the vast majority of needs.

Lab performance

With limited power at a fairly high price, largely a by product of the compactness, delivery was reasonably maintained into low impedances, at least under 'burst' conditions, but shows a significant single/dual channel drive difference. The disc input has sensibly restricted bandwidth and very low capacitance that can match anything, though frequency response showed a 2dB 'bright' shelf. Other inputs/outputs should present no problems. Like its 'big brother', hum was well below average and IM distortion below average, with plenty of harmonics.

The tuner had good sensitivity but was difficult to hold on tune with weak signals. Other measurements were above average or better, apart from AM and image rejection, and there was some intermodulation with the pilot tone.

Subjective impressions

Rated slightly below average, partly because the limited power tended to be a bit of an embarrassment, the sound quality was a bit bright and became too harsh too easily for comfort, though it was quite liked and considered quite informative at low levels. FM was considered significantly better than average, relaxing to listen to but a touch 'bassy'. In use it had good thresholds, though the signal strength meter saturated easily. AM showed some problems with a 'sticky' AFC reducing apparent sensitivity, IF producing strong 909kHz whistles, and poor 'skirt' and 'nose' selectivity. OK on strong inputs, weak signals were distorted, and as usual the bandwidth was very tight.

Conclusions

Capable of quite good results within its limited power capabilities, this combination should be used with sensitive speakers, and will appeal where the style and compactness warrants a slight price premium.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 14Hz–53kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 17/19/19 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 24/21/13 Watts
Burst power 1kHz, 8/4/2 ohms ..... 29/45/51 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.0	47k	20pF
Disc MC	—	—	—	
Tuner/aux	Phono	175	14k	
Tape	Phono	160	27k	

Disc overload 1kHz 34dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	250	5k
Headphones (8 ohms)	Jack	100	—

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −81dB
Aux ref volume ..... −78dB
Disc ref volume ..... −80dB

Other

Damping factor 56
THD performance ..... good
IMD performance ..... below average
Hum performance ..... well below average

TUNER

RF Performance

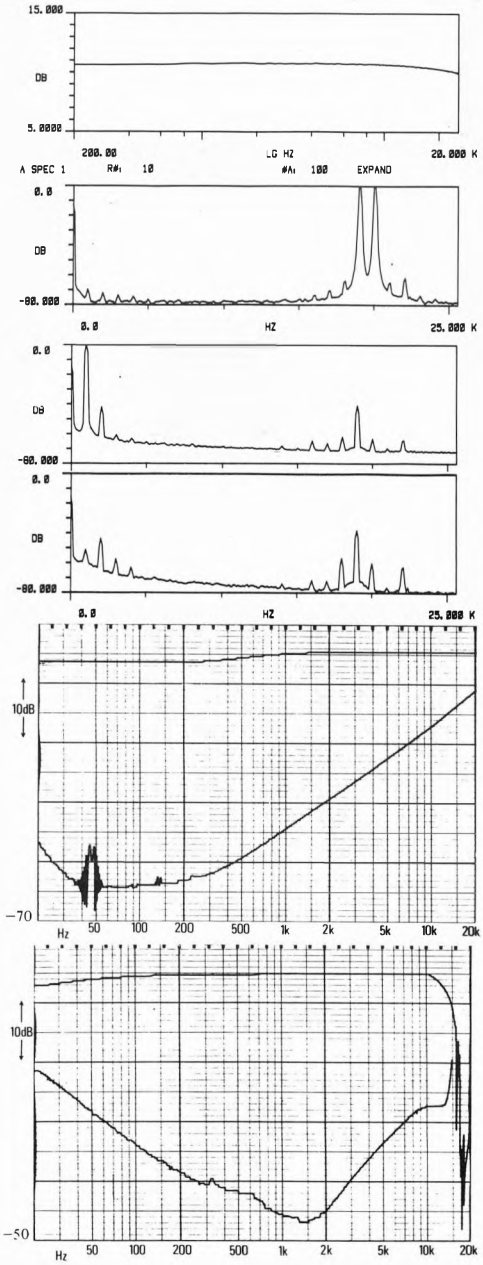
30dB S/N Ratio, mono sensitivity 0.90uV
50dB S/N Ratio, mono/stereo sensitivity 1.50/30uV
IHF 30dB S/N Ratio, mono 3.00uV
Muting level 2.5uV
Limiting level, −1dB 1.0uV
RFIM 66dB
Capture ratio 3.7dB
Selectivity 62dB
IF rejection 73dB
AM suppression 47dB
Image rejection 35dB

Audio Section

S/N ratio 1mV i/p, mono/stereo 73/65dB
Distortion, mono 20%/100% modulation 0.20/0.30%
Distortion, stereo 20%/100% modulation 0.56/0.30%
Pilot tone suppression ..... −45dB
Crosstalk, 1kHz ..... −42dB

GENERAL

Total size (W x D x H) ..... 10¼(26) x 10(26) x 4¼(11) in(cm)
Approximate weight 10lb
Typical retail price ..... £146+£115



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk 6) Tuner frequency response/crosstalk

Aurex SC-M12/SY-C12/ST-T10L

Toshiba (UK) Ltd., Toshiba House, Frimley Road, Frimley, Camberley, Surrey GU15 5JJ. Tel: (0276) 62222

Presentation, facilities, etc.

This is effectively the middle combination in the Aurex/Toshiba micro-component range, and shares the tuner of the cheaper set (also reviewed), but combines it with separate pre- and power amplifiers; this enables greater heat dissipation, and consequently higher power levels. Higher priced and more sophisticated components also exist in a similar format, allowing a variety of permutations, and including cassette decks. The elegant ultra-compact styling and 'jewellery' finish invariably draws favourable comment.

The tuner covers FM and medium and long wave AM manually, with 75 ohm FM and external AM terminals, in addition to a hinged but not pivoted AM ferrite, which may require some re-orientation of the set for optimum results. Indicators for signal strength, stereo and tune are fitted, plus switching between stereo-plus-muting and mono-without. The pre-amplifier has phono socketry throughout apart from a mixable mike jack on the front panel; concentric volume and balance, traditional tone controls, switchable loudness and tape monitoring for two machines complete the list. The power amplifier includes a headphone socket and permits switching between two sets of speakers. Although fairly basic in terms of facilities, the simplicity prevents clutter and will satisfy most people. In our opinion this delightful-looking combination deserves better than relegation to the bedroom or second-system role that some marketing people have implied should be its place.

Lab performance

The fairly modest power output came quite expensive, showing modest single/dual channel difference, but restricted availability into low impedances. Disc input bandwidth was fairly well controlled, but had rather high capacitance for matching some cartridge/arm combinations, while frequency response showed some variation from flat, though disc overload margin was exceptional. Other inputs/outputs seemed fine, while IM distortion was below average and hum and damping factor well below average.

The tuner gave good sensitivity measurements, but it was difficult to hold tune at low RF levels. Generally competent results found AM and image rejection on the low side, and some intermodulation with the pilot tone.

Subjective impressions

Sound quality was encouraging, with comfortably above average results, liked for good detail, information and integrity, but with criticism of bright (but nice) high frequencies and some 'untidiness'. FM also received praise, though a little 'hissy' and 'bassy'. In use the tuner was quite liked, with good thresholds, though the signal strength meter saturated easily. AM was less well received, the AGC not operating readily and obscuring the sensitivity, the IF producing strong whistles on 909kHz, and poor skirt and nose selectivity. Generally OK on strong signals, weak signals were distorted and the bandwidth was limited.

Conclusions

On the very borderline of recommendation, we

decided to rate this model 'highly commended' because power is a little restricted and there are one or two 'worries' (*eg* disc input capacitance), though the general technical and listening results remain encouraging.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	12Hz–46kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	32/35/33 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	40/39/33 Watts
Burst power 1kHz, 8/4/2 ohms	45/59/42 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	1.8	46k	300pF
Disc MC	—	—	—	
Tuner/aux	Phono	130	35k	
Tape	Phono	120	39k	

Disc overload 1kHz	45dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	215	5k
Headphones (8 ohms)	Jack	75	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−81dB
Aux ref volume	−75dB
Disc ref volume	−77dB

Other

Damping factor	24
THD performance	good
IMD performance	below average
Hum performance	well below average

TUNER

RF Performance

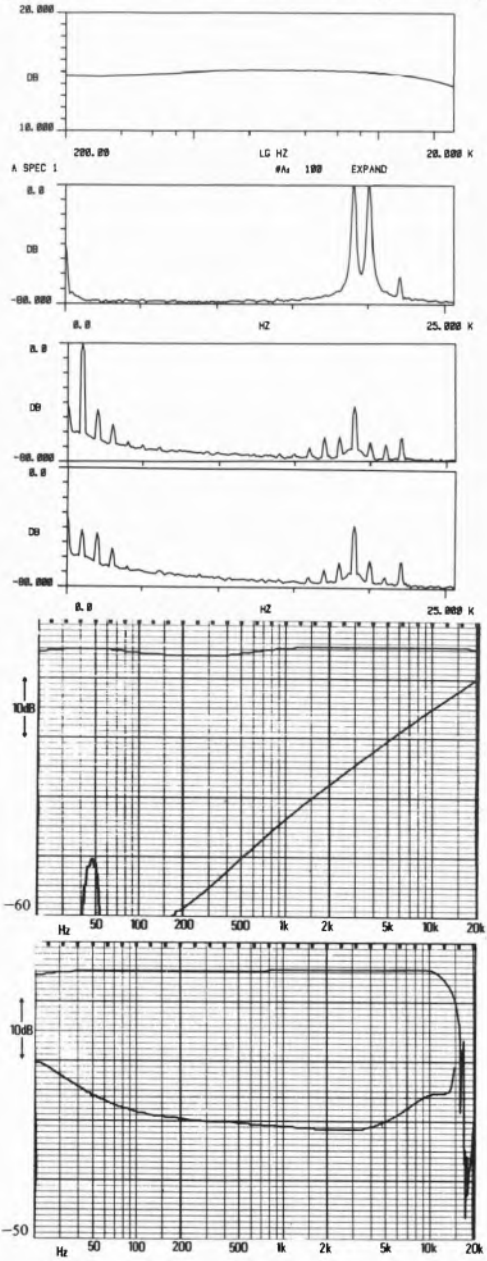
30dB S/N Ratio, mono sensitivity	0.90uV
50dB S/N Ratio, mono/stereo sensitivity	1.50/30uV
IHF 30dB S/N Ratio, mono	3.00uV
Muting level	2.5uV
Limiting level, −1dB	1.0uV
RFIM	66dB
Capture ratio	3.7dB
Selectivity	62dB
IF rejection	73dB
AM suppression	47dB
Image rejection	35dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	73/65dB
Distortion, mono 20%/100% modulation	0.20/0.30%
Distortion, stereo 20%/100% modulation	0.56/0.30%
Pilot tone suppression	−45dB
Crosstalk, 1kHz	−42dB

GENERAL

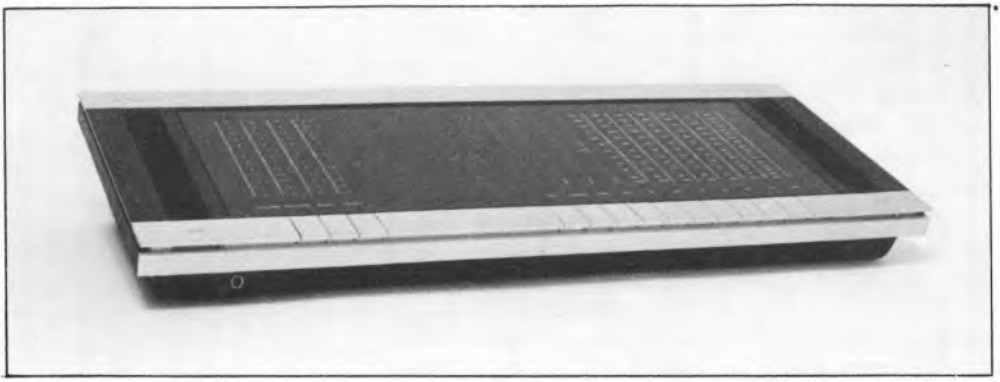
Total size (W x D x H)	10¼(26) x 10(26) x 8¼(21) in(cm)
Approximate weight	19lb
Typical retail price	£110+£136+£115



CAPTIONS *(1–6 tcp to bottom rt. hand column, all at 1 watt/8 ohms)*
1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

B&O 1700

Bang and Olufsen (UK) Ltd., Eastbrook Road, Gloucester GL4 7DE
Tel: (0452) 21591



Presentation, facilities, etc.
The cheaper of the two B&O receivers reviewed, styling and ergonomics are as radical as one would expect from the company that put hi-fi equipment into the New York Museum of Modern Art. Unusually long, though low and sleek, all the controls are on the top surface, which is tilted forward at a slight angle; this layout prevents stacking of course, but is the easiest to use from both seated and standing positions when mounted on the low shelving that is the Danish trademark.

The machine is operated by two 'caterpillar track' rollers, one at each end. The one on the left operates the volume, but three pushbuttons switch it to adjusting balance and tone. The other operates preset tuning on any of five FM, one AM and one LW good-sized tuning scales; further pushbuttons select disc and tape DIN inputs and AFC. Additional functions include a centre-tuning meter system, and facilities for connecting headphones (jack) and (unswitchable) second speakers (DIN); three aerial inputs cover 300 ohm and 75 ohm FM, plus external AM. In summary, a simple and elegant machine with few frills but intelligent ergonomics, if a trifle bulky.

Lab performance
Although modestly powered in relation to its price, the delivery was quite well maintained into different loads. Interconnection impedance measurement data remained elusive, though presumably it is likely to be used with, and will therefore match, B&O equipment in any case. The disc input conforms to the new IEC recommendations for LF rolloff, and is extended to an unnecessarily high frequency. Performance characteristics were good or above average.

The tuner section gave good results on every parameter measured.

Subjective impressions
The main criticisms consistently directed against this model on the listening tests related to the bass quality, which unsettled most listeners, and was described as 'woolly' and poorly defined. A slight interface problem may have prejudiced results, and it is likely that the higher LF rolloff of a Beogram would have improved matters. Mid and high frequencies and FM (with one dissenter) were considered clear and pleasant. The full-scale preset analogue presentation was liked, though the roller tuning mechanism was less easy and precise than a good flywheel. AM sound quality was not particularly liked, and though the sensitivity was high, it deteriorated above 1200kHz (misalignment?)

Conclusions
The value of this receiver will depend on the value to the purchaser of the ergonomics and presentation, and the acceptability of the limited power. It has a fine tuner section, and if the limited power is sufficient it is worth considering, and it will probably perform well with a Beogram turntable.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	20Hz–130kHz
Bothchannels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	17/20/18 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	22/32/24 Watts
Burst power 1kHz, 8/4/2 ohms	24/39/42 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	DIN	2.6	47k	?
Disc MC	—	—	—	—
Tape	DIN	250	?	

Disc overload 1kHz 29dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	DIN	48	?
Headphones (8 ohms)	Jack	100	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−89dB
Aux ref volume	−85dB
Disc ref volume	−86dB

Other

Damping factor	65
THD performance	good
IMD performance	good
Hum performance	above average

TUNER

RF Performance

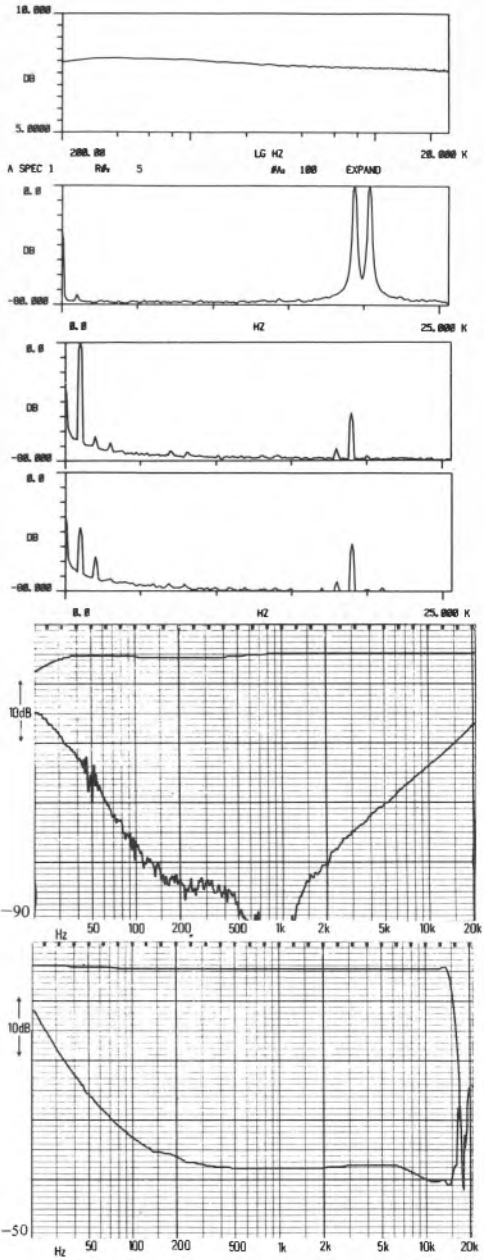
30dB S/N Ratio, mono sensitivity	1.50uV
50dB S/N Ratio, mono/stereo sensitivity	2.50/18uV
IHF 30dB S/N Ratio, mono	2.25uV
RFIM	60dB
Capture ratio	3.0dB
Selectivity	45dB
IF rejection	75dB
AM suppression	60dB
Image rejection	93dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	79/77dB
Distortion, stereo 20% modulation	0.07%
Pilot tone suppression	−48dB
Crosstalk, 1kHz	−40dB

GENERAL

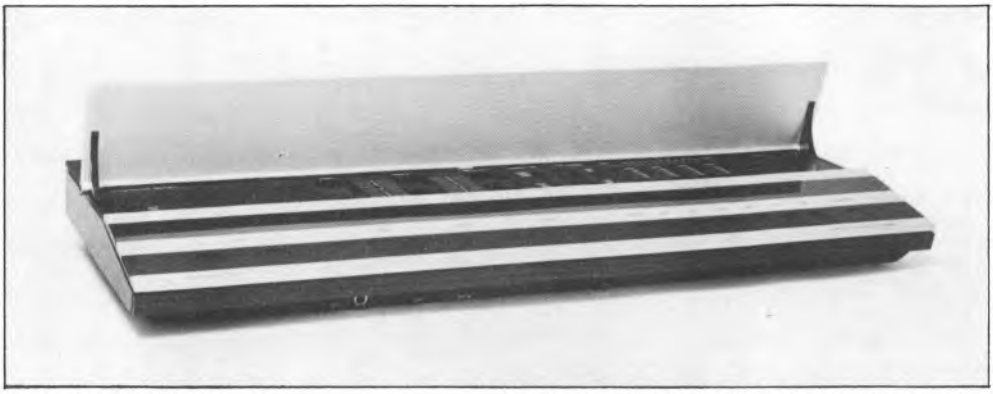
Total size (W x D x H)	23¾(60) x 10(25) x 3½(9) in(cm)
Approximate weight	17lb
Typical retail price	£198



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

B&O 1900-2

Bang and Olufsen (UK) Ltd., Eastbrook Road, Gloucester GL4 7DE
Tel: (0452) 21591



Presentation, facilities, etc.

Typically unconventional in styling and presentation, this FM-only receiver follows B&O traditions of being slim, low and rather long, with the 'essential' controls plus illuminated display on an angled panel, and hence is easy to operate seated or standing. The less commonly used functions are under a damped, hinged top plate. The major controls are entirely electronic, finger indents responding to touch for input selection (five FM presets), and volume up and down; the latter can be set to come in at low, medium or high levels on switch on, and has an illuminated display of the level.

Lifting the cover exposes conventional tone and balance controls for the five FM presetting mechanisms (four of which use knurled wheels, the fifth a larger disc, though all scales are on the short side). Switching is provided for FM stereo, AFC, and loudness, and to mute the second speaker sockets. The light display panel, in addition to indicating the volume, shows the source selected, the tone control settings, and includes centre-tune and stereo beacon. DIN inputs for tape and disc are fitted, with 75 and 300 aerial sockets, plus provision for headphones. This is definitely a receiver with the accent on ergonomics and styling, though all the basic facilities are provided in an elegant if rather wide package.

Lab performance

Offering more power than the *1700,* the watts still come expensive, but the power behaviour is again generally good, though with a 'tighter' low-impedance cutoff than the cheaper model. It would appear advisable to use a tape deck with DIN standard connections. The disc input is sensibly bandwidth limited on this model, though the frequency response is clearly anomalous, and is almost certainly a fault on our early production sample. Performance parameters were good, particularly crosstalk, though IM distortion was only just average.

Tuner measurements were generally quite good, though not up to those for the cheaper *1700,* and with some odd anomalies like the high limiting threshold and capture ratio, while pilot tone suppression and noise were somewhat below average; further evidence of a sample problem perhaps?

Subjective impressions

Despite general comments on a lack of bass 'weight' affecting results, and clearly attributable to the frequency response anomaly, favourable comments on mid and high frequencies and FM in general (despite noise) still resulted in an average ranking, which indicates some potential. Ergonomically the tuner was liked, though the volume control was fussier to use than a conventional knob, the tuning dial was slightly mis-calibrated, and the stereo threshold was set rather too low.

Conclusions

Even ignoring any value placed on the aesthetics and ergonomics, this model performed creditably for the price. Had the anomalies been corrected in time for the auditioning it could well have been recommended, and remains worth considering assuming that the problems noted were sample ones only.

AMPLIFIER

Power

Bandwidth (−3 dB ref max power, disc) 46Hz–82kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)... 24/27/24 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 30/46/19 Watts
Burst power 1kHz, 8/4/2 ohms ..... 36/57/19 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	DIN	2.6	47k	?
Disc MC	—	—	—	
Tuner/aux	None	—	—	
Tape	DIN	250	89k	

Disc overload 1kHz ..... 23 dB

Outputs (5 mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	DIN	30	?
Headphones (8 ohms)	Jack	90	—

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −91 dB
Aux ref volume ..... −86 dB
Disc ref volume ..... −87 dB

Other

Damping factor 118
THD performance ..... good
IMD performance ..... average
Hum performance ..... good

TUNER

RF Performance

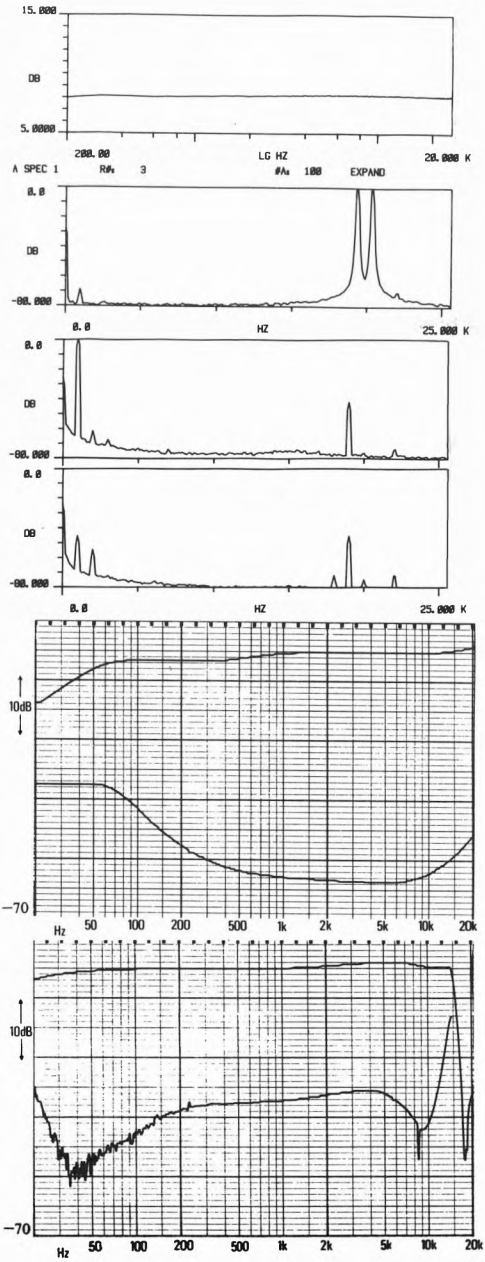
30dB S/N Ratio, mono sensitivity 1.80uV
50dB S/N Ratio, mono/stereo sensitivity 3.50/20uV
IHF 30dB S/N Ratio, mono 14.00uV
Limiting level, −1dB 10.0uV
RFIM ..... 59 dB
Capture ratio 11.0dB
Selectivity ..... 47 dB
IF rejection ..... 88 dB
AM suppression ..... 52 dB
Image rejection ..... 70 dB

Audio Section

S/N ratio 1mV i/p, mono/stereo ..... 69/68 dB
Distortion, stereo 20% modulation 0.07%
Pilot tone suppression ..... −40dB
Crosstalk, 1kHz ..... −45 dB

GENERAL

Total size (W x D x H) ..... 24¼(62) x 9½(24) x 2¼(6) in(cm)
Approximate weight 18lb
Typical retail price £279



CAPTIONS *(L–6 top to bottom rt. hand column, all at 1 watt/8 ohms)*
1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Dual CR1780

Hayden Laboratories Ltd., Hayden House, Churchfield Road, Chalfont St. Peter, SL9 9EW. Tel: (02813) 88447

Presentation, facilities, etc.

This German heavyweight is solidly engineered with a dark brown metallic finish fascia, liberally sprinkled with shiny silver knobs, giving a rather aggressive appearance. The digital tuning scale doubles as a clock, the bright green lettering contrasting a multiplicity of red and green indicator lights; no specific timing functions are included.

The tuner operates electronically on FM and medium wave AM in three modes; *via* six presets for each band; by manual push-button scanning; and by automatic scanning, pausing at received stations. Indicators are provided for signal strength, centre-tune and stereo, and switching for stereo/mono and muting. A socket and terminals are provided for 75 and 300 ohm FM and external AM; a properly pivoted AM ferrite is fitted, or alternatively the AM section can take its signal from the FM downlead. The amplifier has normal tone controls, with switches operating loudness (contour), high and low filters, speaker selection, tape monitoring and cross-dubbing. Inputs are predominantly phono, DIN-duplicated on Disc, and Tape 1, the latter also having overriding jack sockets on the front panel, where a headphone jack is also situated. In summary, this is a handsome 'heavyweight', which is not too difficult to use, despite the plethora of functions with which it is provided.

Lab performance

High power levels in excess of 100 watts are available, but a significant difference is noted between single and both channels driven figures, and the 4 and 2 ohm values suggest rather severe current limiting, so 'true' 8 ohm speakers should be used to exploit the power to the full. Disc input bandwidth and capacitance are both sensible, and other inputs and outputs should pose no problems. Performance parameters were generally good, with hum average and FM crosstalk below average. IM distortion was excellent.

The tuner was quite sensitive with above average or good figures on all measurements apart from the aforementioned crosstalk.

Subjective impressions

Reasonably well received, the *1780* was scored consistently a little above average, and described as quite powerful and dynamic, though a little brash, especially when driven hard. FM was described as sounding a little emphasised at both bass and treble frequencies. The tuning section was ergonomically well-liked, and perhaps was the easiest of the digitals to use, while AM was much better than most, with good sensitivity, low distortion, and reasonable sound quality, marred by some interference from the tuning display.

Conclusions

This powerful receiver has few weaknesses and generally good performance, though a little care may be needed in choice of loudspeakers. Though good, the subjective and objective performance was not exceptional enough to warrant recommendation at the fairly high price.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	7Hz–66kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	106/109/102 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	129/67/24 Watts
Burst power 1kHz, 8/4/2 ohms	168/78/37 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Both	2.0	50k	170pF
Disc MC	—	—	—	
Tuner/aux	Phono	215	460k	
Tape	Phono	215	460k	
Tape	DIN	215	400k	
Disc overload 1kHz				37dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	400	3k
Tape	DIN	50	80k
Headphones (8 ohms)	Jack	40	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−82dB
Aux ref volume	−75dB
Disc ref volume	−79dB

Other

Damping factor	78
THD performance	good
IMD performance	excellent
Hum performance	average

TUNER

RF Performance

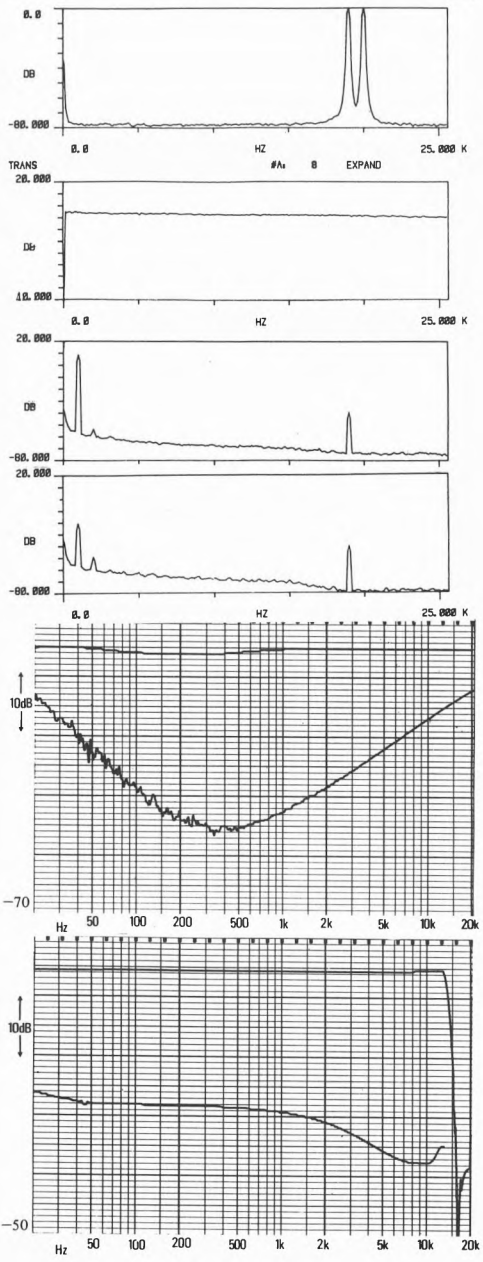
30dB S/N Ratio, mono sensitivity	1.40uV
50dB S/N Ratio, mono/stereo sensitivity	2.50/35uV
IHF 30dB S/N Ratio, mono	1.90uV
Muting level	7.0uV
Limiting level, −1dB	1.5uV
RFIM	60dB
Capture ratio	2.0dB
Selectivity	78dB
IF rejection	80dB
AM suppression	49dB
Image rejection	110dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	71/70dB
Distortion, mono 20%/100% modulation	0.21/0.17%
Distortion, stereo 20%/100% modulation	0.30/0.17%
Pilot tone suppression	−50dB
Crosstalk, 1kHz	−30dB

GENERAL

Total size (W x D x H)	17¼(44) x 16½(42) x 5¾(15) in(cm)
Approximate weight	32lb
Typical retail price	£530

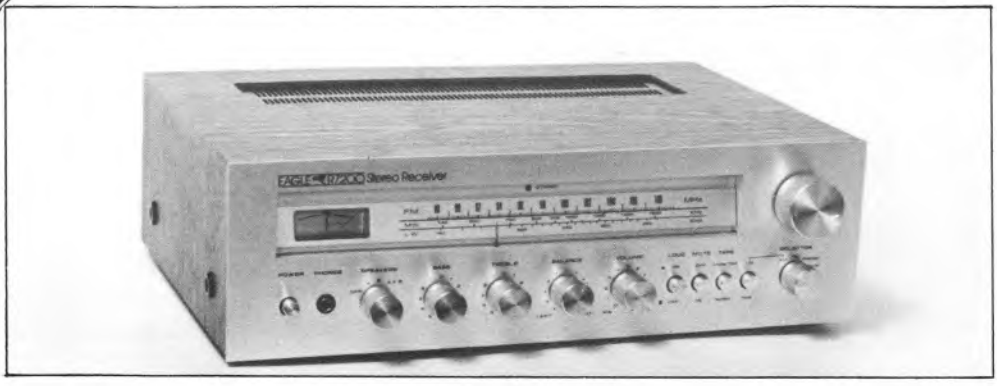


CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)*
1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

BEST BUY

Eagle R7200

Eagle International, Precision Centre, Heather Park Drive, Wembley HA0 1SU
Tel: (01) 902 8832



Presentation, facilities, etc.
This conventionally styled receiver combines the elements of Eagle's 'budget' *7200* series separates in a single competitively priced package. The standard brushed aluminium fascia is offset by a simulated veneer wooden case.

The unit tunes FM and long and medium AM bands without any presets. For AM a ferrite rod aerial is fitted on the back panel; this is unfortunately of fixed direction with respect to the receiver, so for the best signal strength for some AM stations, it may be necessary to move the whole unit slightly. Features include centre-tune on FM, doubling as AM signal strength, and switchable muting and 25/50us de-emphasis. External 75 and 300 ohm FM and AM aerials are all catered for, but only *via* screw terminals. The amplifier section has the usual simple tone controls, balance and volume, plus loudness and speaker switching; a headphone socket is provided. This receiver is attractive enough, and is well finished if a trifle undistinguished; features provided are fairly limited, but this only reflects the modest price, and is unlikely to prove any hardship to the prospective user.

Lab performance
Not surprisingly in view of this unit's low price, the power was somewhat limited, showing early distortion rises at low and high frequencies, and a significant difference between single and dual channel drive; nevertheless, current delivery was quite well maintained into low impedances. The disc input bandwidth was sensibly constrained, though the highish capacitance suggests some care need be taken when choosing accompanying turntables and cartridges. Other inputs/outputs are quite typical, and performance parameters were average or better.

Despite its humble pretensions, the FM section gave very good performance results, the distortion being slightly worse than average, but the pilot tone rejection, crosstalk, and crosstalk distortion were very good.

Subjective impressions
Rating above average overall, with little dissent, this is a very creditable result for such a modestly priced unit. Points of consistent criticism included a 'thick' and rather 'lumpy' bass sound, and some brightness or 'splash' tending to emphasise sibillants. FM was considered a little 'gritty' at HF, and a bit noisy, but generally well balanced. In use, the tuner had a rather cramped scale, and the lack of mono/stereo switching (or high blend) was missed, there being no option but to accept noisy stereo when received. The tuning indicator could also have been more energetic! AM performance was very indifferent, the reasonable sound quality marred by the pickup of considerable spurii, while there was significant distortion and poor skirt selectivity.

Conclusions
Offering a generally good and well-balanced performance at a reasonable price, the *7200* clearly merits strong recommendation for value for money.

Eagle R7200

BEST BUY

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	16Hz–45kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	21/26/24 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	34/44/27 Watts
Burst power 1kHz, 8/4/2 ohms	41/61/29 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	3.3	47k	240pF
Disc MC	—	—	—	
Tuner/aux	Phono	200	46k	
Tape	Phono	220	73k	
Tape	DIN	220	73k	
Disc overload 1kHz				33dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	240	8k
Tape	DIN	45	23k
Headphones (8 ohms)	Jack	83	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−89dB
Aux ref volume	−84dB
Disc ref volume	−86dB

Other

Damping factor	58
THD performance	good
IMD performance	average
Hum performance	average

TUNER

RF Performance

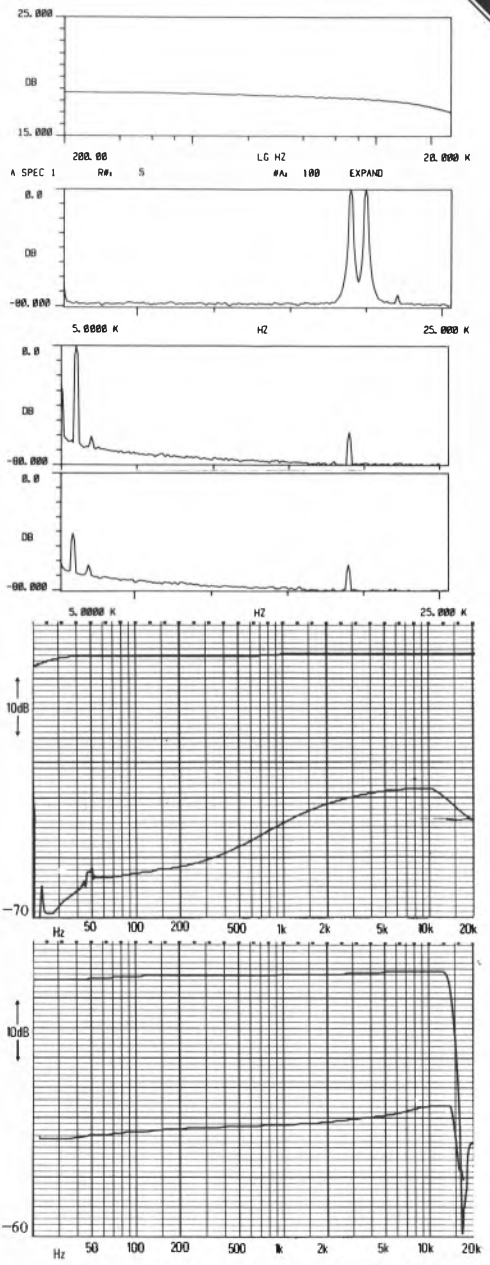
30dB S/N Ratio, mono sensitivity	1.40uV
50dB S/N Ratio, mono/stereo sensitivity	3.0/45uV
IHF 30dB S/N Ratio, mono	2.25uV
Muting level	8.0uV
Limiting level, −1dB	1.8uV
RFIM	60dB
Capture ratio	1.2dB
Selectivity	48dB
IF rejection	87dB
AM suppression	60dB
Image rejection	60dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	72/69dB
Distortion, mono 20%/100% modulation	0.40/0.15%
Distortion, stereo 20%/100% modulation	0.10/1.00%
Pilot tone suppression	−60dB
Crosstalk, 1kHz	−40dB

GENERAL

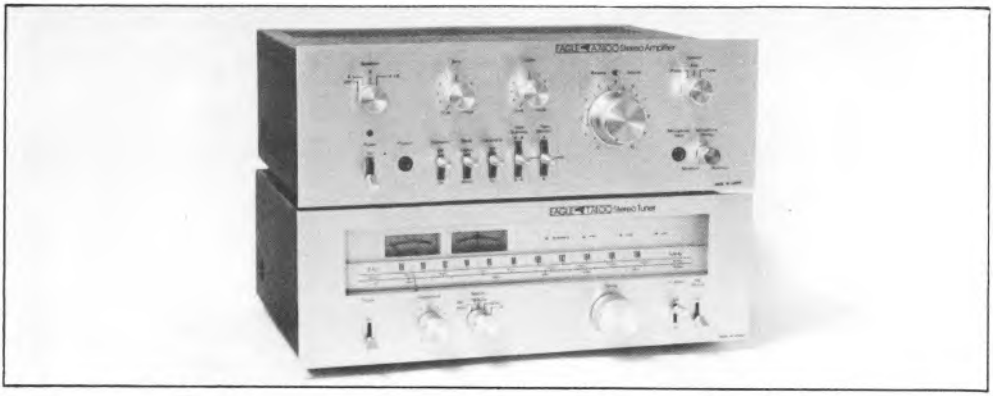
Total size (W x D x H)	17(44) x 14½(37) x 5½(14) in(cm)
Approximate weight	18lb
Typical retail price	£137



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Eagle A7400/T7400

Eagle International, Precision Centre, Heather Park Drive, Wembley HA0 1SU
Tel: (01) 902 8832



Presentation, facilities, etc.

These traditionally styled separates from Eagle have been available for some time now (at the time of writing), and the amplifier was (just) good enough for recommendation in our book last year, on the basis of a generous power delivery and copious facilities for the price. Though quite bulky, the control layout is logical and easily used, and the units well-finished.

The tuner operates on FM and medium and long wave AM without presetting. Screw terminals are provided for connection of 75 and 300 ohm FM leads and external AM to supplement the back panel ferrite, which is hinged but cannot be swivelled (so the unit may need to be moved slightly to obtain the best AM reception). Facilities include signal strength and centre-tune metering, stereo and waveband indicators, with switching for stereo/mono/AM, 50/75us de-emphasis, muting, 'hi-blend', and an output level control. The plentiful amplifier facilities include normal tone controls and concentric volume/balance, tape monitoring and cross-dubbing, stereo/mono, subsonic filter, loudness, speaker switching, and headphone socket. An unusual provision, albeit one of minimal value one suspects, is the inclusion of a mike jack input on the front, together with a mixing control. Phono sockets are used throughout (apart from the aforementioned mike input), Tape B being DIN-duplicated, and a pre/power break included. In all, then, these are well finished designs of traditional appearance, with many facilities.

Lab performance

Offering a significant increase in power over the *7200*, the amplifier showed nearly a 20% power increase in single over both channel driven modes, and was rather more strongly limited into low impedances. The disc input showed a commendably restricted bandwidth and usefully low capacitance, with other inputs/outputs quite satisfactory. Performance parameters were average, with hum below average and crosstalk quite good.

The tuner measurements were generally good, AM suppression being fractionally below average, but pilot tone rejection and crosstalk particularly good.

Subjective impressions

Rather inconsistent listening test results gave an overall ranking about average, with common descriptions of a 'thickened' midrange and unexceptional bass performance. FM was considered generally good, if a bit on the bright side and slightly noisy. Generally liked in use, the tuning meter could have been more energetic, but calibration and weak signal performance was good. In contrast the AM performance approached the nadir, being insensitive (poor alignment), with a peaked IF response resulting in bass emphasis, and with poor bandwidth.

Conclusions

Generally a quite respectable design with few faults (AM excepted), but which is not quite as well-balanced nor offers quite the same value as the cheaper Eagle receiver. Nevertheless these units are still worth considering.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 18Hz–40kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 34/41/41 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 50/36/18 Watts
Burst power 1kHz, 8/4/2 ohms ..... 72/69/36 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.5	54k	90pF
Disc MC	—	—	—	
Tuner/aux	Phono	170	68k	
Tape	Phono	170	85k	
Tape	DIN	170	80k	

Disc overload 1kHz 33dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	200	6k
Tape	DIN	32	80k
Headphones (8 ohms)	Jack	82	—

Noise (ref 1 Watt, 8 ohms)
Zero volume ..... −83dB
Aux ref volume ..... −74dB
Disc ref volume ..... −76dB

Other
Damping factor 37
THD performance ..... average
IMD performance ..... average
Hum performance ..... below average

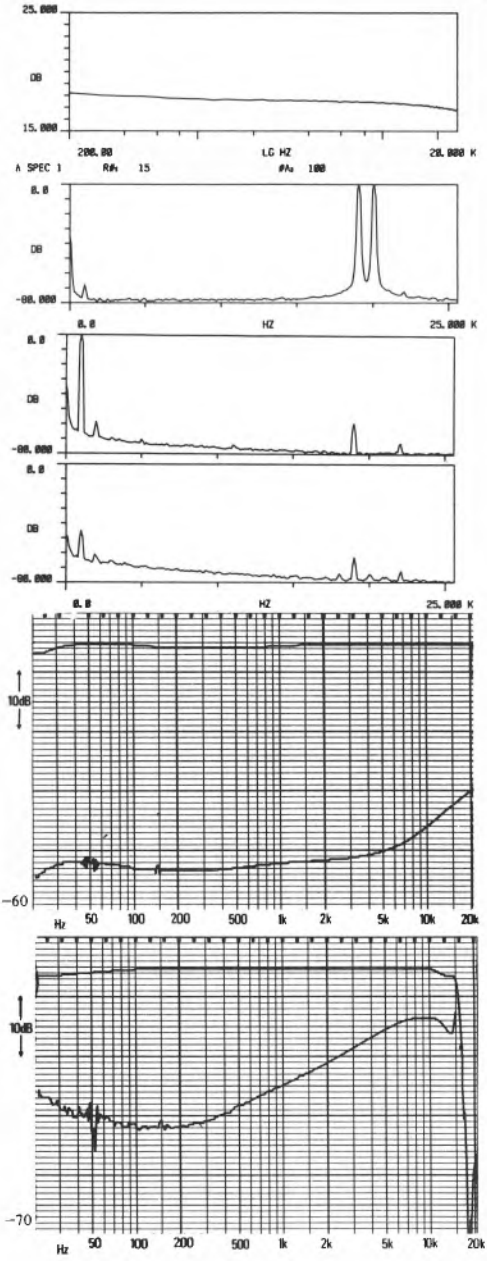
TUNER

RF Performance
30dB S/N Ratio, mono sensitivity 1.50uV
50dB S/N Ratio, mono/stereo sensitivity 2.50/30uV
IHF 30dB S/N Ratio, mono 2.00uV
Muting level 3.5uV
Limiting level, −1dB 3.0uV
RFIM 70dB
Capture ratio 1.0dB
Selectivity 55dB
IF rejection 66dB
AM suppression 51dB
Image rejection 63dB

Audio Section
S/N ratio 1mV i/p, mono/stereo 73/70dB
Distortion, mono 20%/100% modulation 0.30/0.17%
Distortion, stereo 20%/100% modulation 0.12/0.30%
Pilot tone suppression ..... −60dB
Crosstalk, 1kHz ..... −45dB

GENERAL

Total size (W x D x H) ..... 15¾(40) x 15½(39) x 11(28) in(cm)
Approximate weight 33lb
Typical retail price ..... £123+£137

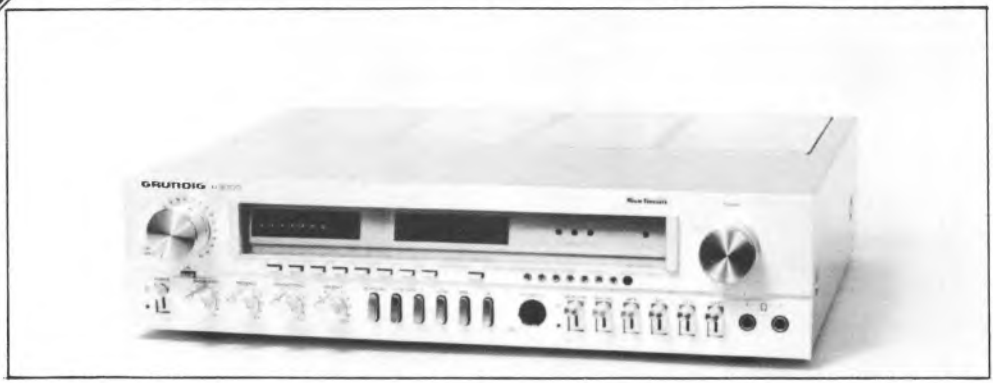


CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)*
1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

BEST BUY

Grundig R3000

Grundig International Ltd., 40/42 Newlands Park, Sydenham, London SE26 5NQ
Tel: (01) 659 2468



Presentation, facilities, etc.

This is the larger of two receivers in Grundig's new 'international style' range, which together with a 'mini system' represents this major European manufacturer's response to the growing strength of Japanese competition in its home market. It is a substantial, heavy unit, though quite compact, and uses digital frequency display to enable the many facilities to be fitted on a nevertheless crowded fascia without undue confusion.

The tuner operates manually or *via* (seven) presets on FM, and manually on long and medium wave AM, with signal strength, stereo and centre-tune ('tunoscope') indicators, and switching for AFC, muting and mono/stereo. Aerial socketry matches 75 and 300 ohm FM and external AM, and provision is made to use the FM downlead as a compromise AM antenna. The amplifier has tone controls for bass, presence and treble, and the volume control may be switched to operate as a variable loudness control. Socketry is DIN throughout, apart from the two headphone jacks on the front panel, and permits complex interswitching of tape functions, with the added usefulness of a duplicate front panel Tape socket; a rear panel switch changes sensitivity on Disc. In summary this is a compact, comprehensively specified receiver, with some useful facilities, which remains reasonably simple to operate.

Lab performance

This medium powered model may not be offering the cheapest watts around, but their general stability under different loading conditions was quite reassuring, and the disc input bandwidth was sensibly restrained (the impedance however defied our measurement). Frequency response was reasonably flat, and crosstalk very good. Inputs and outputs are to DIN standards, and these should be used for interconnections to avoid problems. Performance parameters were generally good, with IM distortion excellent.

Tuner measurements were generally very good, but with crosstalk and capture ratio below average; though quite low, distortion showed significant rises in stereo and with 100% modulation.

Subjective impressions

This unit scored consistently good marks and received some praise in the listening tests. Information and detail was considered better than usual, with a clear open midrange, though rather 'boomy' in the bass nonetheless. FM was also well received, though again some bass heaviness was criticised. Certain aspects of the tuner ergonomics were considered mildly irritating, though there was nothing serious and FM performance was considered very satisfactory. AM sensitivity was quite good, but the usual flat, dull sound was produced.

Conclusions

The well-balanced performance and well-received sound quality dictate strong recommendation for this model amongst the products in this price class.

Grundig R3000

BEST BUY

AMPLIFIER

Power

Bandwidth (−3 dB ref max power, disc)	24Hz–45kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	36/36/36 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	40/56/67 Watts
Burst power 1kHz, 8/4/2 ohms	42/72/98 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	DIN	2.0	47k	?
Disc MC	—	—	—	
Tuner/aux	DIN	140	480k	
Tape	DIN	140	420k	

Disc overload 1kHz	31dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	100	9k
Tape	DIN	20	1M
Headphones (8 ohms)	Jack	140	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−89dB
Aux ref volume	−81dB
Disc ref volume	−87dB

Other

Damping factor	134
THD performance	good
IMD performance	excellent
Hum performance	good

TUNER

RF Performance

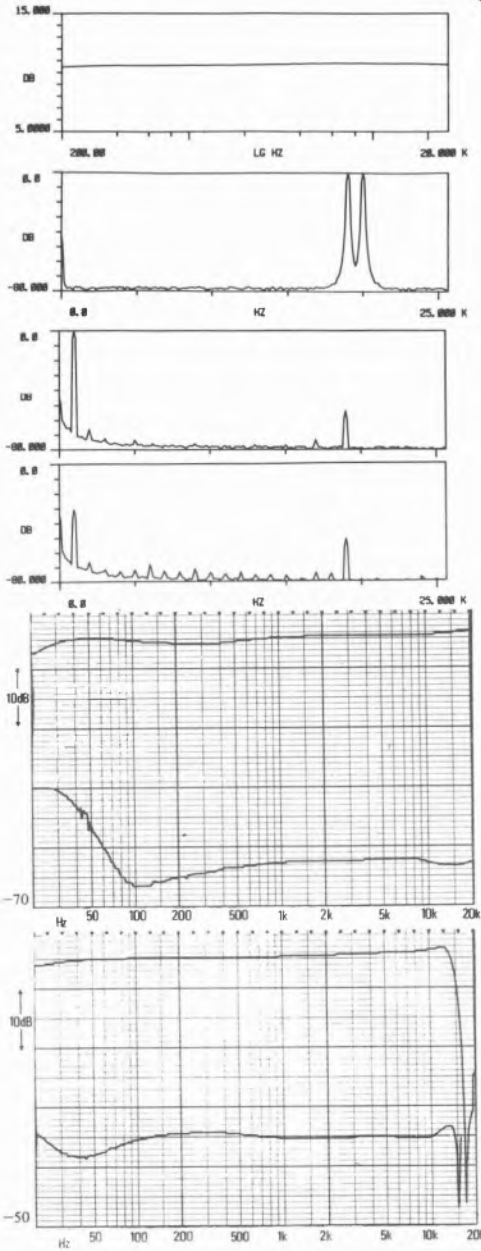
30dB S/N Ratio, mono sensitivity	0.50uV
50dB S/N Ratio, mono/stereo sensitivity	0.60/13uV
IHF 30dB S/N Ratio, mono	1.25uV
Muting level	5.0uV
Limiting level, −1dB	0.8uV
RFIM	64dB
Capture ratio	6.0dB
Selectivity	69dB
IF rejection	115dB
AM suppression	59dB
Image rejection	88dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	74/74dB
Distortion, mono 20%/100% modulation	0.08/0.45%
Distortion, stereo 20%/100% modulation	0.30/0.63%
Pilot tone suppression	−55dB
Crosstalk, 1kHz	−30dB

GENERAL

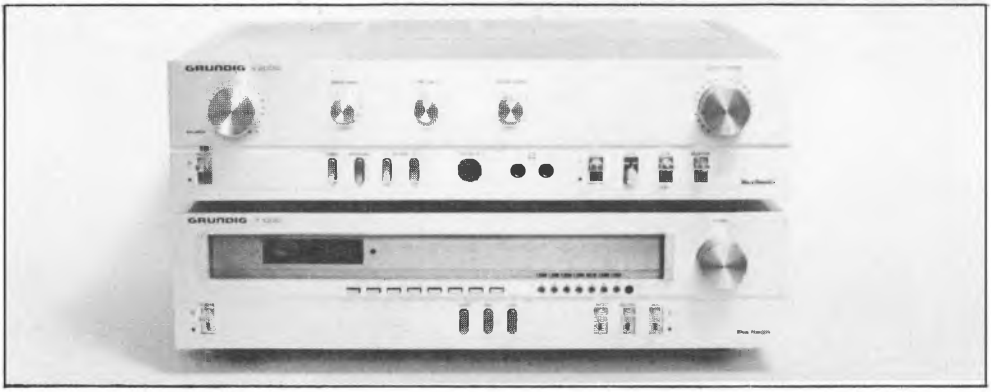
Total size (W x D x H)	17¾(45) x 15¼(39) x 4½(11) in(cm)
Approximate weight	27lb
Typical retail price	£226



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Grundig V2000/T1000

Grundig International Ltd., 40/42 Newlands Park, Sydenham, London SE26 5NQ
Tel: (01) 659 2468



Presentation, facilities, etc.
Like Philips, Grundig are a European giant who are currently working very hard to brush up their 'hi-fi' image, and these separates come from a new range of 'international style' components, which comprise some twelve full width slimline models and also a mini system range. The *T1000* is the cheaper of two tuners, its companion having complex electronic functions and digital quartz frequency synthesis, while the *V2000* is the middle model in a range of three amplifiers.

The tuner operates manually or *via* seven presets on FM, and manually on medium and long wave AM; there is provision for 75 and 300 ohm and external AM aerials, a movable link enabling the FM downlead to serve as a rudimentary AM aerial. Indicators are provided for signal strength and stereo, and switching for muting, AFC and stereo/mono. The substantial and quite heavy amplifier has DIN inputs, plus phonos for one Tape connection, DIN switchable speaker outputs, two headphone jacks, and a front panel duplicate DIN tape connector. Tone controls cover bass, treble and presence, and the volume control can be switched to operate as a variable loudness control. Complex tape interconnections may be selected. In summary, these are quite conventional, rather shiny-looking units with useful preset provision, if a trifle confusing on the amplifier functions.

Lab performance
Marginally more powerful than the Grundig receiver tested, the load characteristics again indicate well balanced delivery with no low impedance problems. The disc input bandwidth was reasonably restrained, capacitance well chosen, crosstalk quite good, but frequency response unacceptably uneven. Duplicated DIN and phono standard socketry should pose no interconnection problems. Performance parameters were generally good, with IM distortion excellent, though there was a faint suggestion of some slewing problems at high frequencies/powers.

Tuner measurements were rather disappointing, and certainly not as good as those for the receiver, with poorer (though still satisfactory) sensitivity, below average AM and image rejections, capture ratio, pilot tone suppression, and fairly high distortions, increasing in stereo and at high mod levels. Furthermore the frequency response was marred by an HF 'bump'.

Subjective impressions
An interface problem with our low impedance cartridges made assessment difficult, and may perhaps have prejudiced the findings somewhat, overall results being below average, with descriptions of a 'hard edge' recorded. FM was generally quite liked, though with treble exaggeration noted, and the high level inputs suggested that the amplifier has few problems, and is characterised by slight bass and treble exaggeration. In use the ergonomics were considered slightly irritating in a number of areas, with dial calibration in error and sensitivity uninspiring. AM was reasonable, but not in any way exceptional.

Conclusions
Generally below average tuner measurements and listening tests results, which are inevitably contrasted with the much better findings on the

similarly priced receiver, mean that we cannot really recommend this combination.

AMPLIFIER

Power

Bandwidth (−3 dB ref max power, disc) 18Hz–77kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 39/39/39 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 45/69/87 Watts
Burst power 1kHz, 8/4/2 ohms ..... 49/78/116 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.2	47k	100pF
Disc MC	—	—	—	
Tuner/aux	DIN	230	157k	
Tape	DIN	230	180k	
Tape	Phono	230	450k	

Disc overload 1kHz 29dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	300	8k
Tape	DIN	14	1M
Headphones (8 ohms)	Jack	135	—

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −92dB
Aux ref volume ..... −78dB
Disc ref volume ..... −85dB

Other

Damping factor 105
THD performance ..... good
IMD performance ..... excellent
Hum performance ..... above average

TUNER

RF Performance

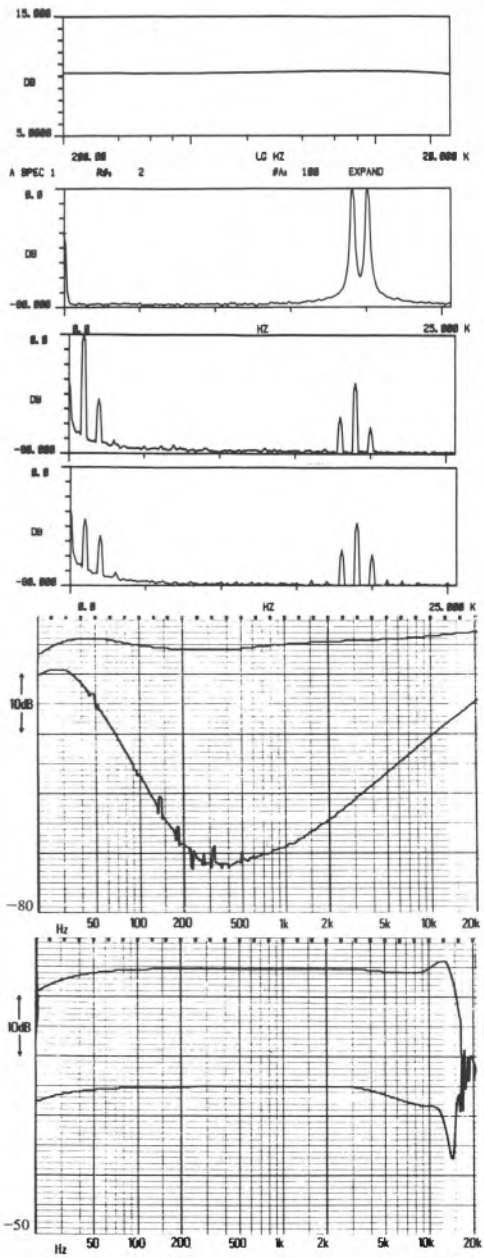
30dB S/N Ratio, mono sensitivity 1.00uV
50dB S/N Ratio, mono/stereo sensitivity 2.25/35uV
IHF 30dB S/N Ratio, mono 2.50uV
Muting level 10.0uV
Limiting level, −1dB 2.0uV
RFIM 70dB
Capture ratio 6.0dB
Selectivity 41dB
IF rejection 110dB
AM suppression 40dB
Image rejection 41dB

Audio Section

S/N ratio 1mV i/p, mono/stereo 75/72dB
Distortion, mono 20%/100% modulation 0.30/1.70%
Distortion, stereo 20%/100% modulation 0.80/3.00%
Pilot tone suppression ..... −28dB
Crosstalk, 1kHz ..... −35dB

GENERAL

Total size (W x D x H) ..... 17¾(45) x 15½(39) x 9(23) in(cm)
Approximate weight 38lb
Typical retail price ..... £115+£105

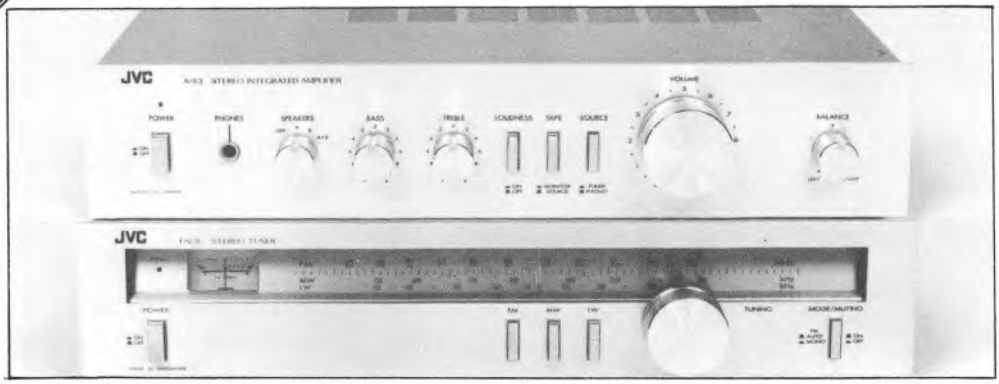


CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

RECOMMENDED

JVC AS3/TV3L

JVC UK Ltd., Eldonwall Trading Estate, Staples Corner, 6–8 Priestley Way, London NW2. Tel: (01) 450 2621



Presentation, facilities, etc.
These two smart, slightly shiny, slimline separates represent the 'budget' models in JVC's extensive range, an area where they have had conspicuous success over the years, with sensibly specified no-frills models with the emphasis on honest-to-goodness performance (*eg* KD720).

Operating on FM and medium and long wave AM, the manual-only tuner has a 75 ohm socket and provision for external AM aerial to supplement the hinged ferrite provided (which is of the type that may require the tuner to be re-oriented for best results). Centre-tune and stereo indicators are provided, with switching between stereo-with-muting/mono-without. The amplifier has normal tone controls, loudness, speaker switching, and a headphone jack. Inputs are phono, DIN-duplicated on Tape. Refreshingly simple, and consequently easier to use than many, this is undoubtedly a neat and attractive design.

Lab performance
The amplifier power is fairly modest for the combination price, but power is delivered well under most load conditions, albeit slightly restricted into low impedances. The disc bandwidth is reasonably restrained, with sensible capacitance loading, though crosstalk was below average. Other input and output parameters were sensible. Performance parameters were generally reasonable, with IM distortion and hum below average, however.

Tuner measurements showed good sensitivity and generally respectable results apart from the very low pilot tone suppression, which could give rise to unwelcome spurii or interference with tape recorders (though most have their own filters in any case).

Subjective impressions
Some inconsistency in listening test findings nevertheless gave an overall result slightly above average, with comments concerning a generally smooth sound, slightly 'soft' but quite detailed, albeit becoming more aggressive when loud, and showing signs of sibillance exaggeration on FM. Ergonomically the only comment concerned meaningless scale divisions and higher than necessary muting threshold. AM was regarded as poor overall, with restricted bandwidth, indifferent sensitivity, and tendency to spurii reception.

Conclusions
The only real areas of criticism on these neat budget separates concern the AM performance and pilot rejection, so if these parameters are not considered too important, the combination may be recommended with some confidence.

JVC AS3/TV3L

RECOMMEN

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 9Hz–79kHz
Bothchannels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) .. 25/26/25 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 30/39/24 Watts
Burst power 1kHz, 8/4/2 ohms ..... 36/45/37 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.4	50k	140pF
Disc MC	—	—	—	
Tuner/aux	Phono	150	35k	
Tape	Phono	160	46k	
Tape	DIN	350	100k	

Disc overload 1kHz 34dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	310	450
Tape	DIN	74	53k
Headphones (8 ohms)	Jack	100	—

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −77dB
Aux ref volume ..... −69dB
Disc ref volume ..... −70dB

Other

Damping factor 49
THD performance ..... good
IMD performance ..... below average
Hum performance ..... below average

TUNER

RF Performance

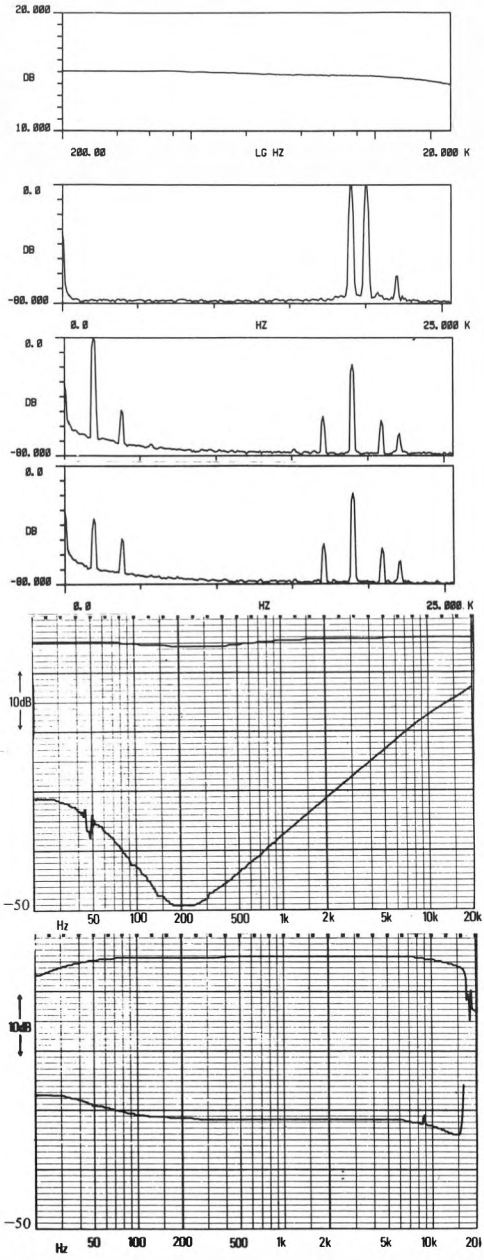
30dB S/N Ratio, mono sensitivity 1.30uV
50dB S/N Ratio, mono/stereo sensitivity 3.40/4uV
IHF 30dB S/N Ratio, mono 1.40uV
Muting level 3.5uV
Limiting level, −1dB 2.0uV
RFIM 60dB
Capture ratio 2.0dB
Selectivity 46dB
IF rejection 78dB
AM suppression 54dB

Audio Section

S/N ratio 1mV i/p, mono/stereo 78/*dB
Distortion, mono 20%/100% modulation 0.30/1.00%
Distortion, stereo 20%/100% modulation 0.30/1.00%
Pilot tone suppression ..... −20dB
Crosstalk, 1kHz ..... −35dB

GENERAL

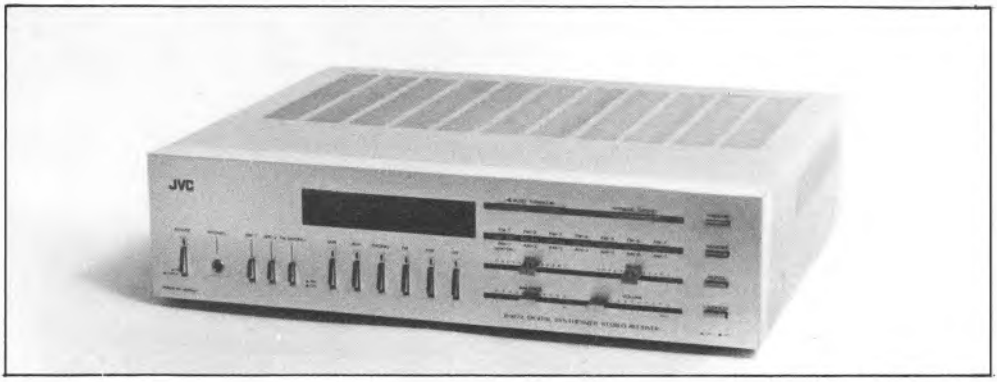
Total size (W x D x H) ..... 16½(42) x 12½(32) x 6¾(17) in(cm)
Approximate weight 18lb
Typical retail price ..... £85+£90



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

JVC RS55L

JVC UK Ltd., Eldonwall Trading Estate, Staples Corner, 6–8 Priestley Way, London NW2. Tel: (01) 450 2621



Presentation, facilities, etc.

This large modern AM/FM receiver has a very clean 'sculptured' appearance, with the 'deepened' fascia divided into three sections according to function (a typical JVC technique). The digital electronic tuning technique operates on FM and long and medium wave AM bands, and can store electronically seven AM and seven FM preset stations in its memory. A front panel switch turns the machine off to a 'stand by' state, to preserve this memory store; there is an additional power-off switch at the rear panel on UK models, though the preset memory will be lost after a couple of days.

The tuned frequency is naturally digitally displayed, and the range may be scanned electronically by 'up' and 'down' pushbuttons, whereupon it stops automatically at each station, or manually *via* an edge-set wheel. Aerial socketry accepts a 75 ohm co-axial plug only for FM, as well as an external AM aerial where required to supplement the properly pivoted ferrite rod fitted on the rear panel. The phono inputs are DIN-duplicated on Tape, while two sets of speaker terminals may be switched and a headphone socket is fitted. Features include signal strength and stereo indication and switchable muting, mono and loudness, while horizontal sliders control tone, balance and volume (the latter control being none too distinctive for its relative importance). In summary, this is an unusual design with useful presets, clever ergonomics, and a very contemporary appearance.

Lab performance

Offering good power output for the price, this was reasonably well delivered under differing conditions. The disc bandwidth was excessively extended, while the input capacitance was very high, which will restrict the number of m-m cartridges that can be used satisfactorily. Frequency responses show sufficient variations to cause some coloration. Inputs and outputs should cause no other compatibility problems. Performance parameters were not very promising, with very good THD offset by well below average IM distortion and below average hum.

Tuner measurements were generally pretty good, though like other JVC models the pilot tone rejection was very modest, and we consider that this could have undesirable side-effects.

Subjective impressions

With some inconsistency, listening test findings gave an overall result slightly below average, criticism relating to some 'muddling' and a slightly 'constricted' sound with some VHF 'fizz', while FM was described as a little 'steely'. Ergonomically there was little to criticise, though the digital display system *vis-à-vis* analogue does have the same disadvantages in use as one finds with watches. AM performance was poor, with a 'lumped' IF response.

Conclusions

Though interesting in terms of appearance and facilities, and with a healthy power output, there were sufficient oddities that this design failed to fully win our confidence, though it is by no means inadequate.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	12Hz–115kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	41/46/43 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	54/75/74 Watts
Burst power 1kHz, 8/4/2 ohms	63/96/126 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	3.0	52k	400pF
Disc MC	—	—	—	
Tuner/aux	Phono	170	37k	
Tape	Phono	170	40k	
Tape	DIN	170	40k	

Disc overload 1kHz 30dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	280	47
Tape	DIN	200	76k
Headphones (8 ohms)	Jack	100	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−85dB
Aux ref volume	−75db
Disc ref volume	−76dB

Other

Damping factor	51
THD performance	excellent
IMD performance	well below average
Hum performance	average

TUNER

RF Performance

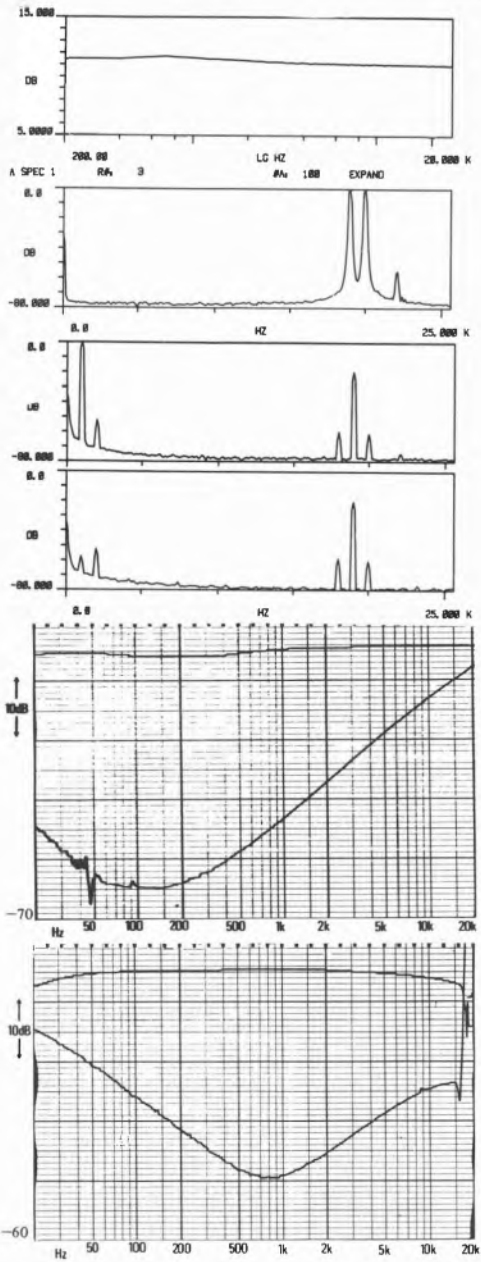
30dB S/N Ratio, mono sensitivity	1.10uV
50dB S/N Ratio, mono/stereo sensitivity	4.40/23uV
IHF 30dB S/N Ratio, mono	2.90uV
Muting level	3.0uV
Limiting level, −1dB	1.4uV
RFIM	62dB
Capture ratio	2.0dB
Selectivity	57dB
IF rejection	80dB
AM suppression	55dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	73/65dB
Distortion, mono 20%/100% modulation	0.24/0.63%
Distortion, stereo 20%/100% modulation	0.24/0.63%
Pilot tone suppression	−20dB
Crosstalk, 1kHz	−57dB

GENERAL

Total size (W x D x H)	16½(42) x 15½(40) x 4¼(11) in(cm)
Approximate weight	18lb
Typical retail price	£160



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

COMMENDED

JVC RS-7

JVC UK Ltd., Eldonwall Trading Estate, Staples Corner, 6–8 Priestley Way, London NW2. Tel: (01) 450 2621

Presentation, facilities, etc.

This large conventionally styled receiver lacks the distinctive styling we have become accustomed to from JVC, but is nevertheless smartly finished and attractively presented, with optional wooden side-panels provided.

Tuning FM and medium wave AM, without presetting, facilities include switched muting and mono, with stereo beacon, centre-tune and signal strength metering. Aerial connections match a 75 ohm downlead or 300 ohm for FM, and the normal AM external. The plastic rear panel enables the usual ferrite rod AM aerial to be mounted internally, but this has the disadvantage that the strength of signals will depend to some extent upon the orientation of the receiver, and this is a fair-sized box to swivel around! The amplifier section has the usual tone controls, plus switching for loudness and speaker selection (two sets), and a headphone socket. Input socketry is phono, with DIN duplication on tape. Overall this is a large, smart receiver with fairly basic facilities, but a useful power output.

Lab performance

With a generous output for the price, power delivery was reasonable (the 2 ohm steady state measurement being prevented by protection circuitry, which should be irrelevant in practice). The disc input bandwidth is excessively extended, and capacitance too high to be used with a number of cartridge/turntable combinations, though other inputs pose no potential problems. Performance parameters were generally fine, with IM distortion performance very good indeed.

Tuner measurements were consistently good apart from the poor pilot tone rejection common to nearly all the JVC models tested, which could cause problems under some circumstances; stereo distortion showed a significant increase over mono, though both were satisfactory nonetheless.

Subjective impressions

Though not entirely consistent, listening test results were above average overall, which is encouraging for the price. Comments described an 'open' clean sound, a little on the bright side, with similar comments on the FM section. Ergonomically the tuner was liked, though the muting threshold was a little high and the tuning meter lacked *brio.* On AM our consultant waxed lyrical: '. . . the only tuner which gives output on AM sounding remotely like the input signal.' Distortion here was low, but the interior aerial fitted gave poor sensitivity.

Conclusions

Good subjective reactions, respectable AM sound quality, generous power delivery, and respectable performance parameters are sufficient to ensure this unit's recommendation, though the absence of long wave and awkward disc input capacitance remain disincentives.

RECOMMENDED

AMPLIFIER

Power

Bandwidth (−3 dB ref max power, disc)	8Hz–154kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	61/66/63 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	75/102/— Watts
Burst power 1kHz, 8/4/2 ohms	87/135/168 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.5	53k	350pF
Disc MC	—	—	—	
Tuner/aux	Phono	180	59k	
Tape	Phono	180	68k	
Tape	DIN	180	68k	

Disc overload 1kHz 35dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	350	75
Tape	DIN	45	76k
Headphones (8 ohms)	Jack	100	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−86dB
Aux ref volume	−75dB
Disc ref volume	−76dB

Other

Damping factor	83
THD performance	good
IMD performance	excellent
Hum performance	average

TUNER

RF Performance

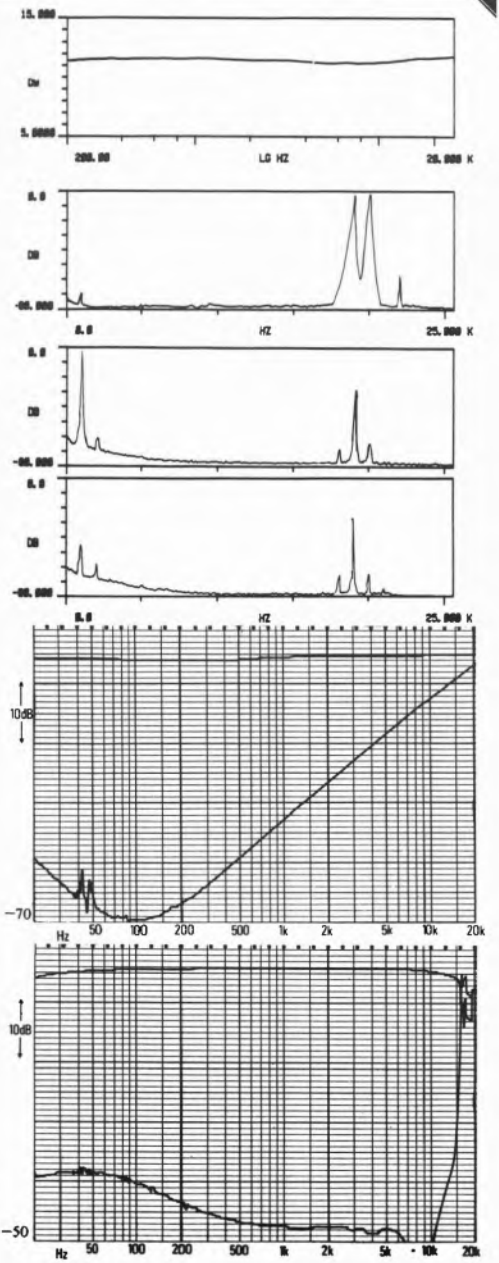
30dB S/N Ratio, mono sensitivity	1.00uV
50dB S/N Ratio, mono/stereo sensitivity	1.50/*uV
IHF 30dB S/N Ratio, mono	1.50uV
Muting level	7.0uV
Limiting level, −1dB	1.2uV
RFIM	62dB
Capture ratio	2.0dB
Selectivity	52dB
IF rejection	96dB
AM suppression	60dB
Image rejection	71dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	73/70dB
Distortion, mono 20%/100% modulation	0.08/0.15%
Distortion, stereo 20%/100% modulation	0.19/0.45%
Pilot tone suppression	−17dB
Crosstalk, 1kHz	−45dB

GENERAL

Total size (W x D x H)	17¾(45) x 14(36) x 6 (15) in(cm)
Approximate weight	20lb
Typical retail price	£180



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

JVC JRS201L

JVC UK Ltd., Eldonwall Trading Estate, Staples Corner, 6–8 Priestley Way, London NW2. Tel: (01) 450 2621

Presentation, facilities, etc.

This very large unit traces its styling ancestry back to JVC's successful 'blue period' range, which came as something of a breath of fresh air some years ago. It is not perhaps as heavy as one might expect (or fear?), due to the use of plastics panels. The fascia is divided into four sections, which helps to prevent the unit from looking *too* large, but also gives a rather 'bitty' appearance, though the grouping of the control functions is unusually logical.

The glass-covered panel on the left houses the tuning, signal strength, centre-tune and stereo indicators. To the right of centre is a brushed aluminium panel which selects between disc, FM and long and medium wave AM, and also switches the FM muting; no presets are provided. The right hand panel is a sophisticated tone control system, which is in effect a mini-graphic equaliser, offering control over five broad frequency bands, and affecting both channels equally; at the bottom of this panel is the balance control. The fourth panel is set forward, offering an angled control surface along the length of the unit, with slider volume, edge-wheel tune, loudness, mono, tape monitor and 1–2 dub, graphic equaliser on record, subsonic filter and speakers (two sets). Input socketry is phono with DIN duplication on Tape 1, and all normal FM and AM aerial sockets/connectors are provided, though the fitted ferrite rod for AM cannot be swivelled for best signal, and moving such a large unit is unlikely to be practical. In all, this is a curious and unconventional design, with many facilities and a welcome degree of distinctiveness.

Lab performance

The power ratings for this model are very close to those for the much cheaper *55L*, and rather less than for JVC's *RS-7* model, which is partly indicative of recent trends in price/power (the *201L* being a couple of years old now), and also emphasises that elaborate facilities like the equaliser must be paid for. Power delivery was reasonable, but the disc bandwidth was unnecessarily wide. Disc input capacitance should pose no matching problems, and the other inputs/outputs should be fine. Performance parameters were generally good, but with the IM distortion performance below average.

Tuner measurements generally gave rather average results, the sensitivity not really suiting this model to DX work, and capture ratio and RFIM were rather below average. Pilot tone suppression was quite good, and a significant improvement over the other JVC models.

Subjective impressions

Not entirely unanimous, the listening tests placed this model a little below average overall, with consistent criticism of an 'edge' to the sound, making it a little aggressive, though the bass was considered better than most. FM was quite neutral, though again slightly bright. In use, the machine was described as 'fun to play with', though the muting level was high and there was a small scale calibration error. AM was distinctly unimpressive, being insensitive and with a narrow bandwidth, though distortion was acceptable.

Conclusions

The value of this receiver will depend on the value

that is placed on the unusual appearance and graphic equaliser facility. Without allowing for these, the unit is clearly less good value for money than the other JVCs tested.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 5Hz–150kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 40/45/43 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 52/67/58 Watts
Burst power 1kHz, 8/4/2 ohms ..... 59/84/74 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.7	50k	180pF
Disc MC	—	—	—	
Tape	Phono	170	56k	
Tape	DIN	170	56k	

Disc overload 1kHz 37dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	320	450
Tape	DIN	40	76k
Headphones (8 ohms)	Jack	100	—

Noise (ref 1 Watt, 8 ohms)
Zero volume ..... −85dB
Aux ref volume ..... −77dB
Disc ref volume ..... −79dB

Other
Damping factor 100
THD performance ..... good
IMD performance ..... below average
Hum performance ..... above average

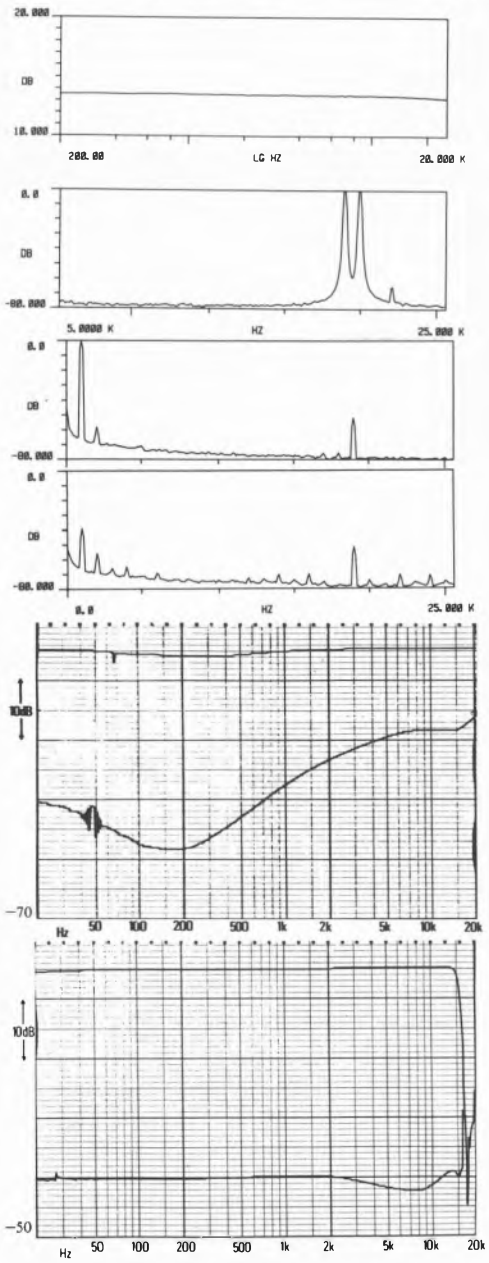
TUNER

RF Performance
30dB S/N Ratio, mono sensitivity 1.75dB
50dB S/N Ratio, mono/stereo sensitivity 3.50/50uV
IHF 30dB S/N Ratio, mono 3.50uV
Muting level 5.0uV
Limiting level, −1dB 2.0uV
RFIM 49dB
Capture ratio 3.5dB
Selectivity 63dB
IF rejection 98dB
AM suppression 60dB
Image rejection 70dB

Audio Section
S/N ratio 1mV i/p, mono/stereo 74/68dB
Distortion, mono 20%/100% modulation 0.03/0.10%
Distortion, stereo 20%/100% modulation 0.12/0.17%
Pilot tone suppression ..... −50dB
Crosstalk, 1kHz ..... −40dB

GENERAL

Total size (W x D x H) ..... 20(51) x 16½(42) x 6½(16) in(cm)
Approximate weight 24lb
Typical retail price £270

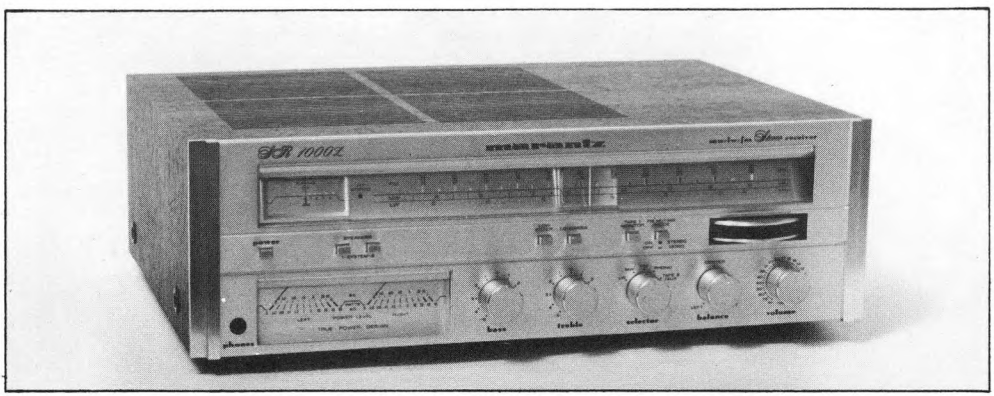


CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

COMMENDED

Marantz SR1000L

Marantz Audio UK Ltd., 193 London Road, Staines, Middlesex
Tel: (0784) 50132



Presentation, facilities, etc.
Sharing the same casework as more expensive models in the range, this modestly priced receiver seems bulky for its weight. In the distinctive Marantz tradition, it loudly proclaims its features from a variety of (to me irritating) typefaces; more importantly however it does offer some variety amongst a depressing market uniformity, with a handsome 'walnut' case and 'bronzed' fascia, with commendably discrete lighting.

Tuning FM and medium and long wave AM without presetting, screw terminals are provided for 300 and 75 ohm FM and external aerials, the latter supplementing an internal ferrite rod whose reorientation would require that the whole receiver was moved. Sadly, compared to the *4000,* signal strength indication has been sacrificed instead of the largely irrelevant 'power' indicators, though centre-tune and stereo beacon, plus switching from stereo with mute to mono without are provided. The amplifier is fitted with phono inputs throughout, features the aforementioned 'power' meters and conventional tone controls, and also has switching for speaker selection, loudness, low filter and tape monitor. To summarise, this unit has distinctiveness and a certain charm, though the choice of facilities could perhaps have been better.

Lab performance
Good power levels for the modest price, delivery nevertheless showed a big difference between single and both channel drive, though performance was quite well maintained into low impedances. The disc input bandwidth was rather excessive, and impedance and sensitivity a little low, though unlikely to cause problems (the capacitance measure, however, resisted our meter). Other inputs and outputs should pose no problems. Performance measurements showed a significant gradual rise in frequency response, and though harmonic distortion was fine, intermodulation distortion was well below average and hum below average.

The tuner measurements were generally good, with sensitivity excellent (unrealistically so, perhaps, in the case of the 30dB mono figure!) Image rejection and RFIM were slightly below average.

Subjective impressions
Auditioning placed this unit a little below average, with some inconsistencies, but general criticism of a 'loose', 'flabby' bass, with some midrange muddling. FM was considered rather 'thick', and tended to exaggerate sibillants. No particular criticisms were made of the tuner in use, apart from the muting threshold as usual being rather higher than necessary, but FM weak signal performance was excellent, and calibration accurate. AM on the other hand was generally poor, in terms of bandwidth, sensitivity and weak signal distortions.

Conclusions
Although the listening tests were a little inconclusive, and gave some cause for concern, there is no gainsaying the excellent tuner parameters and generous power at a very modest price. While there remain some areas of reservation, the unit clearly deserves recommendation.

Marantz SR1000L

RECOMMENDED

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 7Hz–108kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 30/31/31 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 40/47/21 Watts
Burst power 1kHz, 8/4/2 ohms ..... 52/78/86 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*
Disc MM	Phono	4.0	40k
Disc MC	—	—	—
Tuner/aux	Phono	250	20k
Tape	Tape	250	20k

Disc overload 1kHz 29dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	300	470
Headphones (8 ohms)	Jack	70	—

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −85dB
Aux ref volume ..... −79dB
Disc ref volume ..... −83dB

Other

Damping factor 40
THD performance ..... good
IMD performance ..... well below average
Hum performance ..... below average

TUNER

RF Performance

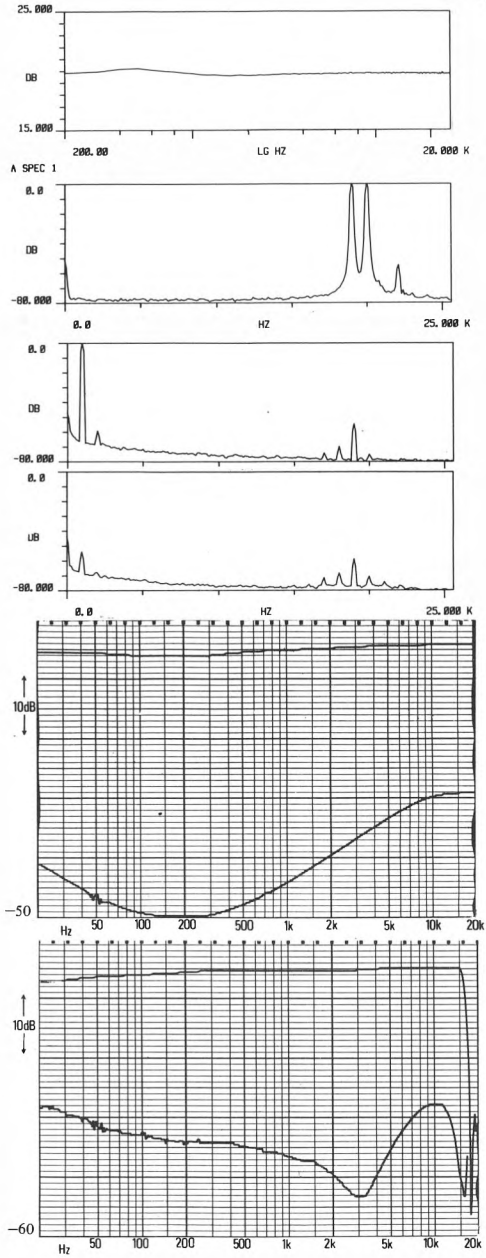
30dB S/N Ratio, mono sensitivity 0.50uV
50dB S/N Ratio, mono/stereo sensitivity 1.50/17uV
IHF 30dB S/N Ratio, mono 1.00uV
RFIM 53dB
Capture ratio 1.7dB
Selectivity 83dB
IF rejection 92dB
AM suppression 56dB
Image rejection 54dB

Audio Section

S/N ratio 1mV i/p, mono/stereo 74/70dB
Distortion, stereo 20% modulation 0.10%
Pilot tone suppression ..... −52dB
Crosstalk, 1kHz ..... −52dB

GENERAL

Total size (W x D x H) ..... 18½(47) x 14½(37) x 6(15) in(cm)
Approximate weight 17lb
Typical retail price £125



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Marantz SR4000L

Marantz Audio UK Ltd., 193 London Road, Staines, Middlesex
Tel: (0784) 50132

Presentation, facilities, etc.

Typically distinctive in the Marantz tradition, this large receiver has a handsome 'walnut' case and a 'bronze'-tinged fascia, which has copious propaganda concerning its features in a variety of clashing typefaces (guaranteed to offend the sensitive journalist!) A similar general format and case size is adopted for all the latest receivers, and one can certainly welcome its departure from the increasing conformity of other products.

Operating on FM and medium and long wave AM, screw terminals are provided for 300 and 75 ohm FM, plus external AM to supplement the ferrite rod, which is internal and consequently fixed in position unless the whole receiver is moved. Indicators cover signal strength, centre-tune and stereo beacon, and switching combines stereo with muting, mono without; no presetting is provided. The amplifier offers tone controls for bass, treble and middle, plus concentric balance/volume, while switches cover speaker selection, loudness, low filter, and tape monitor with 1–2 dub. Light emitting 'power' meters are fitted and cannot be defeated, though they are reasonably restrained. Inputs are phono throughout. In summary, a well finished model of unusual appearance and colour, which may well be more domestically acceptable than the standard 'silver' fare.

Lab performance

Offering quite good power for the money, delivery was somewhat restricted into very low impedances even under 'burst' conditions, and showed significant change between single and dual channel drive. Disc input bandwidth was excessively extended, with capacitance perhaps a little high for a few arm/cartridge combinations; disc sensitivity was on the low side, as was the overload margin, though neither should prove troublesome. Other inputs and outputs were reasonably typical. Frequency responses showed some mild aberrations, and IM distortion performance was below average, but the other parameters were good.

Tuner measurements were consistently above average, and many of them were very good.

Subjective impressions

Generally not well received, the *4000L* scored significantly below average overall, with consistent complaints of an over-heavy 'thudding' bass and an extreme high frequency brightness, which was felt rather fatiguing, while FM was found rather 'chesty' and 'spitty', though better than the *1000* in this respect. Practical and easy to use, calibration was accurate and the good sensitivity was appreciated, though muting and stereo thresholds were a little high. AM performance was predictably disappointing, with poor sensitivity at the upper end of the medium wave band, plus the usual narrow bandwidth and low level input distortions.

Conclusions

Though not without virtue, the *4000L* suffers somewhat in comparison to the much cheaper *1000L*, to which it is surprisingly similar in many respects. Furthermore, the listening test results were not as good overall, so recommendation is hardly appropriate.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	8Hz–100kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	59/64/61 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	73/103/16 Watts
Burst power 1kHz, 8/4/2 ohms	83/123/15 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	3.4	47k	185pF
Disc MC	—	—	—	
Tuner/aux	Phono	200	12k	
Tape	Phono	200	12k	

Disc overload 1kHz	30dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	290	470
Headphones (8 ohms)	Jack	68	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−81dB
Aux ref volume	−75dB
Disc ref volume	−79dB

Other

Damping factor	71
THD performance	good
IMD performance	below average
Hum performance	good

TUNER

RF Performance

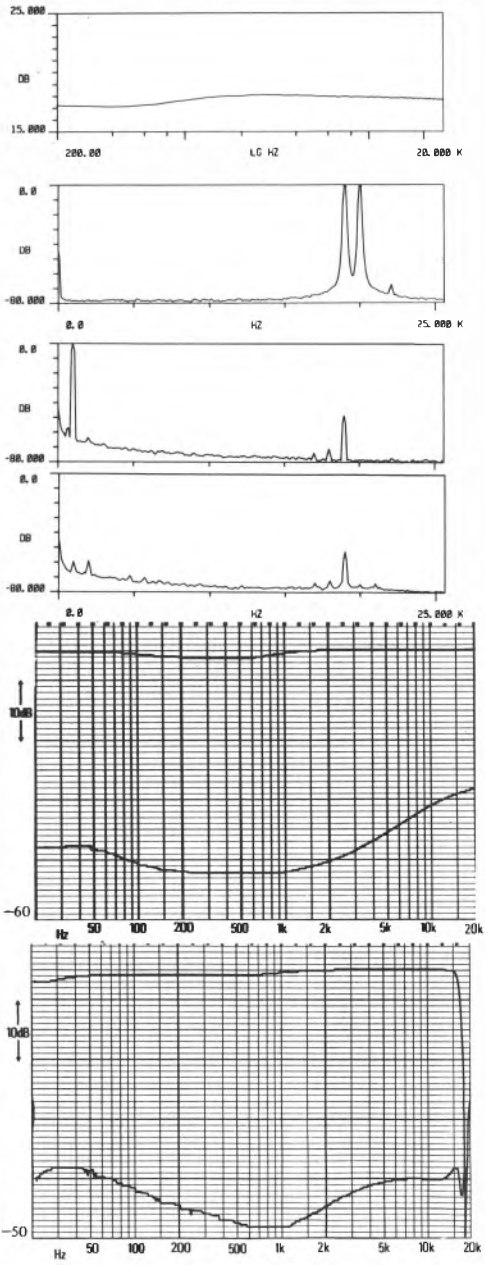
30dB S/N Ratio, mono sensitivity	0.80uV
50dB S/N Ratio, mono/stereo sensitivity	1.00/17uV
IHF 30dB S/N Ratio, mono	1.50uV
RFIM	65dB
Capture ratio	2.0dB
Selectivity	86dB
IF rejection	92dB
AM suppression	54dB
Image rejection	58dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	75/71dB
Distortion, stereo 20% modulation	0.12%
Pilot tone suppression	−48dB
Crosstalk, 1kHz	−59dB

GENERAL

Total size (W x D x H)	18½(47) x 15½(39) x 6(15) in(cm)
Approximate weight	22lb
Typical retail price	£210



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

RECOMMENDED

Marantz PM700/ST600

Marantz Audio UK Ltd., 193 London Road, Staines, Middlesex
Tel: (0784) 50132

Presentation, facilities, etc.

This large heavyweight combination is very much in the Marantz tradition, with the slightly 'bronzed' fascias liberally sprinkled with facilities, identified by quite a variety of typefaces. Though lavishly specified, with unusual features like a graphic equaliser and tuning oscilloscope, these units may be considered 'upper-middle' models in Marantz' extensive range.

The manual tuning operates on FM and medium wave AM, with aerial terminals for 75 and 300 ohm and external AM matching, and a properly pivoted ferrite rod. A stereo beacon is fitted, and the oscilloscope performs a number of tuning indications, which provide signal strength, centre-tune and multi-path information; it may also be switched to audio, and is therefore provided with external connections, which may be useful, for example, when aligning a cartridge by looking for minimum crosstalk. Switching is provided for muting and mono/stereo. The amplifier bristles with most imaginable facilities, including an equaliser operating separately on the two channels, over five frequency bands, and happily provided with a 'defeat' position. Others provided include loudness and high and low filters, 'power' meters, separate input and 'record out' selection, and tape cross-dubbing. The disc input includes a head-amp for m-c cartridges, and socketry is phono, DIN-duplicated on Tape; outputs include a headphone socket and switchable loudspeakers. In summary, a large and perhaps rather garish combination, but with extensive features, of which at least some should prove useful (*eg* head-amp, 'scope).

Lab performance

The powerful output of the amplifier helps to justify the cost of this combination, the power delivery being particularly 'solid', with no difference between single and dual channel drive, and good performance into low impedances (the reduced value into 2 ohm steady state being caused by protection circuitry that should not interfere on short transients). The disc input bandwidth was rather excessive, and the capacitance may require some care in cartridge matching, prohibiting certain combinations. The moving-coil input was rather insensitive, and may not have sufficient gain for all models.

In view of the other Marantz tuner results, and in the light of the manufacturer's specification, the poor sensitivity is almost certainly a sample alignment problem, but as this was a late submission there was not unfortunately time to check a second sample. The results were disappointing, but it is most unlikely that they are typical.

Subjective impressions

These were generally positive, with an overall result above average, and descriptions of a firm, solid sound with quite good detail, integration and perspective, if a little 'gentle', though it was felt to become less pleasant when driven loud. FM was felt to be quite similar, but a little edgy at high frequencies. In use the 'scope offered only slightly more information than conventional twin meters, the calibration was slightly out, and the tuning was rather 'flabby'. AM sensitivity was average with the usual 'light' bandwidth, but an IF harmonic on 909kHz might mar Radio 2 reception in many areas.

RECOMMENDED

Conclusions

It seems only fair to assume that the tuner problems were purely due to a rogue sample, in which case the good auditioning and amplifier results, with good power and facilities at a quite reasonable price, suggest recommendation to those for whom the styling and unusual features have appeal.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 3.0Hz–100kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 88/88/80 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) .... 88/122/53 Watts
Burst power 1kHz, 8/4/2 ohms ..... 97/154/168 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	3.2	46k	325pF
Disc MC	Phono	.225	—	
Tuner/aux	Phono	175	26k	
Tape	Phono	175	32k	
Tape	DIN	175	32k	

Disc overload 1kHz 38dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	250	463
Tape	DIN	65	59k
Headphones (8 ohms)	Jack	65	—

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −83dB
Aux ref volume ..... −74dB
Disc ref volume ..... −76dB

Other

Damping factor 71
THD performance ..... excellent
IMD performance ..... average
Hum performance ..... below average

TUNER

RF Performance

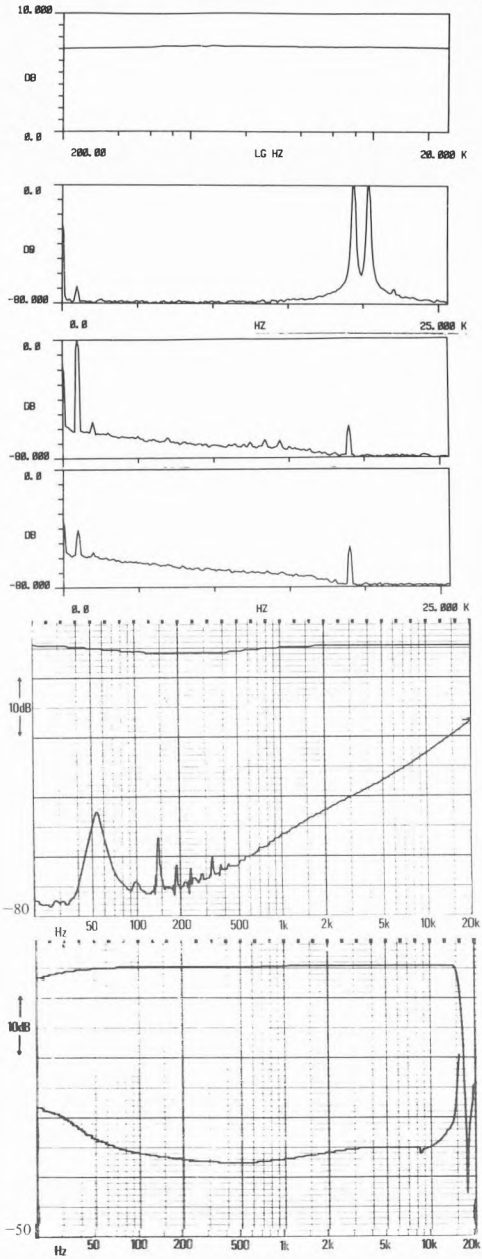
30dB S/N Ratio, mono sensitivity 2.50uV
50dB S/N Ratio, mono/stereo sensitivity 8.00/170uV
IHF 30dB S/N Ratio, mono 25.00uV
Muting level 10.0uV
Limiting level, −1dB 3.5uV
RFIM 58dB
Capture ratio 2.7dB
Selectivity 67dB
IF rejection 85dB
AM suppression 59dB
Image rejection 60dB

Audio Section

S/N ratio 1mV i/p, mono/stereo 72/60dB
Distortion, mono 20%/100% modulation 0.17/1.00%
Distortion, stereo 20%/100% modulation 0.17/1.70%
Pilot tone suppression ..... −58dB
Crosstalk, 1kHz ..... −40dB

GENERAL

Total size (W x D x H) ..... 16½(42) x 15(38) x 12¼(31) in(cm)
Approximate weight 37lb
Typical retail price ..... £190+£240



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk 6) Tuner frequency response/crosstalk

Meridian 101/103/104

Boothroyd Stuart Ltd., 13 Clifton Road, Huntingdon, Cambridgeshire PE18 7EJ
Tel: (0480) 57339

Presentation, facilities, etc.

Compactness, simplicity, and style are three of the obvious visual attributes of this unusual British modular system. This particular version combines the 101 pre-amp module and 104 tuner module with the 103 amplifier, which itself comprises separate modules for the amplifier circuitry and the power supply. This makes a total of four of these tiny 'chocolate box' slabs, and they may be arranged in any configuration with no fear of hum problems. The modules are deliberately quite deep compared to their frontal area, as they are expected to be sited next to a record deck, and rear overhang enables interconnecting wiring to be well concealed. Internally the units also use a module design system to permit future upgrading and provide matching for all cartridge types without full replacement being necessary.

The tuner operates on FM only by means of six screwdriver-set presets only, the selected frequency being displayed on a rather cramped scale which may be switched to operate as a centre-tune. A stereo beacon is fitted plus stereo-and-muting/mono-without switching. Aerial feed is *via* 75 ohm socket, signal output *via* DIN, and switch-on is controlled from the pre-amp, to which the tuner is connected using a compact three-pin mains plug/socket; a similar arrangement connects and operates the power supply module. The pre-amp is utterly simple, with only concentric volume/balance and input selection, plus mono/stereo switching; inputs/outputs are *via* DIN sockets. This 'anti-complication' approach is popular amongst British audiophiles, amongst whom the series has won a good reputation for sound quality. Once the initial set-up and interconnection has taken place, the unit is absurdly easy to use and very unobtrusive in the home.

Lab performance

With a rather limited power output in terms of its fairly high price, comparison with the *103D* shows the advantages of the latter's twin power supply, though the delivery performance is respectable nonetheless. The disc input has a sensibly constrained bandwidth, a slightly bright frequency response with LF to the new IEC recommendations, and a sensibly chosen capacitance (which is in any case infinitely flexible). The DIN socketry in fact conforms to phono standards. Performance parameters were reasonably good apart from the IM distortion, which gave a sufficiently poor result for us to question either the interface with our test equipment or whether the tested sample was representative.

Tuner measurements were generally pretty good, with very good sensitivity and pilot tone suppression, about average results for noise, AM rejection and RFIM, and lower selectivity than most.

Subjective impressions

While still scoring significantly better than average, the *103* did not match the more expensive Meridians; although considered to have plenty of 'punch' and detail, the 'focus', clarity and coherence were not the equal of the *D*. FM was a trifle bright and 'bassy', though clear and detailed. In use the tuner's vestigial scale and lack of manual scanning will not suit some, but muting and stereo thresholds were well chosen, the centre-tune meter was very useful, and weak stereo reception was

liked apart from a slight tendency to suffer multipath distortions.

Conclusions

As it stands the *103* system was a little expensive for what it offered, though it is good nonetheless, and clearly makes a sensible starting point for those with aspirations further up the Meridian range.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	20Hz–50kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	38/43/42 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	51/75/80 Watts
Burst power 1kHz, 8/4/2 ohms	59/102/60 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	DIN	2.7	47k	125pF
Disc MC		various modules available		
Tuner/aux	DIN	190	32k	
Tape	DIN	950	32k	
Disc overload 1kHz				34dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	DIN	205	6k

Noise (ref 1 Watt, 8 ohms)

Zero volume	−89dB
Aux ref volume	−79dB
Disc ref volume	−84dB

Other

Damping factor	84
THD performance	average
IMD performance	see text
Hum performance	excellent

TUNER

RF Performance

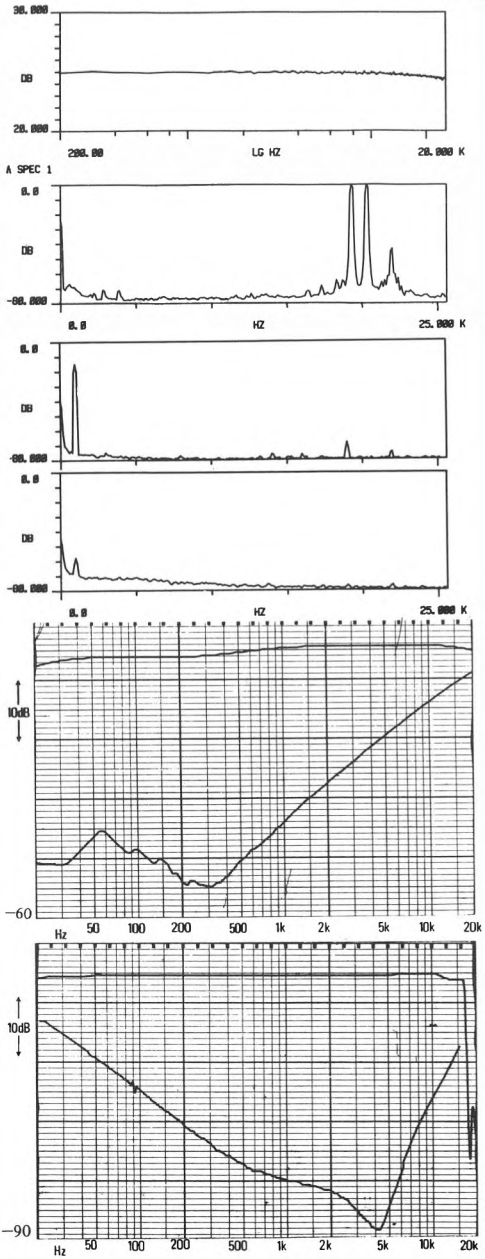
30dB S/N Ratio, mono sensitivity	0.90uV
50dB S/N Ratio, mono/stereo sensitivity	1.50/23uV
IHF 30dB S/N Ratio, mono	1.10uV
Muting level	1.3uV
Limiting level, −1dB	0.9uV
RFIM	54dB
Capture ratio	1.6dB
Selectivity	35dB
IF rejection	98dB
AM suppression	54dB
Image rejection	74dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	69/67dB
Distortion, mono 20%/100% modulation	0.08/0.10%
Distortion, stereo 20%/100% modulation	0.10/0.24%
Pilot tone suppression	−53dB
Crosstalk, 1kHz	−43dB

GENERAL

Total size (W x D x H)	5½(14) x 13(33) x 8½(22) in(cm)
Approximate weight	20lb
Typical retail price	£390+£225



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Meridian 101/103D/104

Boothroyd Stuart Ltd., 13 Clifton Road, Huntingdon, Cambridgeshire PE18 7EJ
Tel: (0480) 57339

Presentation, facilities, etc.
The only difference between this combination and that reviewed on the previous page is the addition of an extra power amplifier power supply module, which increases the power slightly and is claimed to improve the quality significantly, the two supplies operating on each of the stereo channels. A total of five modules makes up the set, and these are available in matt black or brown finish. The *103D* is therefore a simple add-on conversion from the basic *103*, though one or two complaints have been heard about some problems in maintaining the exact finish over a period of time, which could cause some frustration here.

These Boothroyd-Stuart designed modules are connected together so that the entire system is switched on when turning the volume control. Facilities throughout are at an absolute minimum, with the emphasis on compactness, discretion and ease of use. The FM tuner has only screwdriver-set presets (six), indicated on a cramped scale which doubles for centre-tune; stereo beacon, stereo/mono, and stereo-plus-mute/mono-without switch are fitted, and the connections are 75 ohm aerial socket and DIN signal output. The pre-amp again uses DIN connectors, and apart from concentric volume/balance and input selection has only stereo/mono switching. Only one set of speaker sockets is (deliberately) provided, and no headphones, to avoid switching in the output circuitry. In summary this is a deliberately simple, self-effacing unit that has won wide respect amongst enthusiasts for its reputed good sound quality.

Lab performance
Although rather expensive, this amplifier delivers a decent amount of power under most conditions, with only minor reductions into very low impedances. The disc input bandwidth is well constrained, and the slightly bright frequency response also conforms to the new IEC bass rolloff recommendation; capacitance is well chosen, though flexible in any case. Other DIN socketry is to phono standards, and should be used as such. Performance parameters were reasonable apart from IM distortion which was well below average; a surprising result that may not be representative, and could be due to an interface problem with the test equipment.

The tuner measurements were generally pretty good, with very good sensitivity and pilot tone suppression, about average results for noise, AM rejection and RFIM, and lower selectivity than most.

Subjective impressions
Though not quite attaining the ranking of the *105*, the *103D* still came near the very top on audition, with comments concerning fine bass performance and general clarity, coherence and detail, with slight criticism of a treble 'edge'; basically the sound was considered 'tidier' but less 'exuberant' than with the *105*. FM was again described as clean and likeable, with slightly 'brittle' and 'bassy' characteristics. In use the absence of 'proper' scale and scanning will not suit some users, but the centre-tune meter was excellent, thresholds well chosen, and good weak signal performance marred slightly by some multipath susceptibility.

Conclusions
Though the quite unfavourable power/price ratio

makes us reluctant to accord full recommendation, there is no doubt that the *103D*-based system does deliver the goods, and is well worth considering for those for whom quality is more important than power.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	20Hz–50kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	50/52/50 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	52/75/80 Watts
Burst power 1kHz, 8/4/2 ohms	63/102/60 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	DIN	2.7	47k	125pF
Disc MC		various modules available		
Tuner/aux	DIN	190	32k	
Tape	DIN	950	32k	

Disc overload 1kHz	34dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	DIN	205	6k

Noise (ref 1 Watt, 8 ohms)

Zero volume	−89dB
Aux ref volume	−79dB
Disc ref volume	−84dB

Other

Damping factor	84
THD performance	average
IMD performance	see text
Hum performance	excellent

TUNER

RF Performance

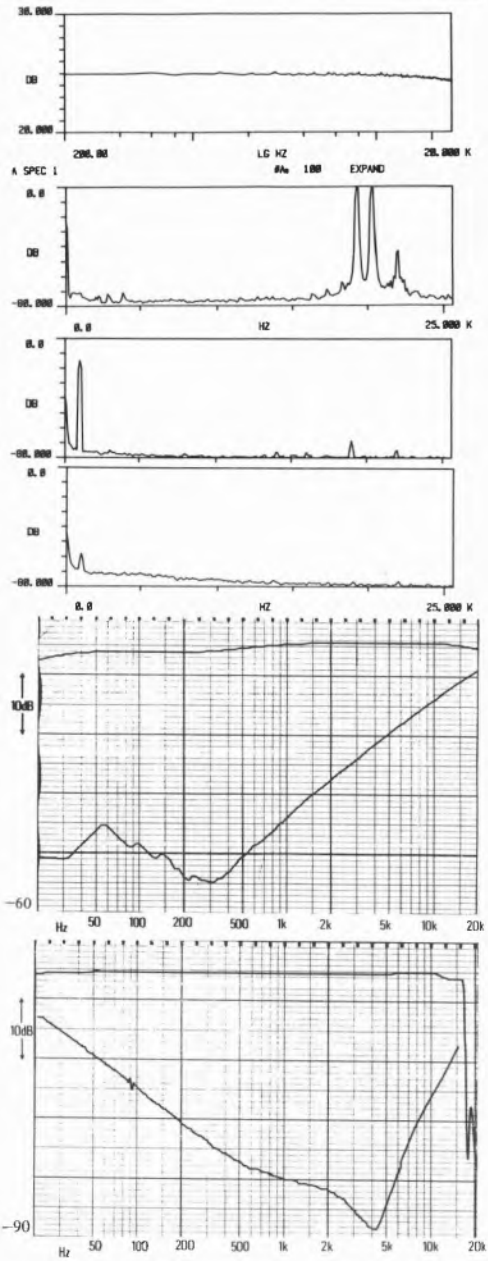
30dB S/N Ratio, mono sensitivity	0.90uV
50dB S/N Ratio, mono/stereo sensitivity	1.50/23uV
IHF 30dB S/N Ratio, mono	1.10uV
Muting level	1.3uV
Limiting level, −1dB	0.9uV
RFIM	54dB
Capture ratio	1.6dB
Selectivity	35dB
IF rejection	98dB
AM suppression	54dB
Image rejection	74dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	69/67dB
Distortion, mono 20%/100% modulation	0.08/0.10%
Distortion, stereo 20%/100% modulation	0.10/0.24%
Pilot tone suppression	−53dB
Crosstalk, 1kHz	−43dB

GENERAL

Total size (W x D x H)	5½(14) x 13(33) x 10¾(27) in(cm)
Approximate weight	27lb
Typical retail price	£490+£225



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Meridian 101/105/104

Boothroyd Stuart Ltd., 13 Clifton Road, Huntingdon, Cambridgeshire PE18 7EJ
Tel: (0480) 57339

Presentation, facilities, etc.

The largest of the Boothroyd-Stuart designed module systems, this uses the same pre-amp and tuner as the other two systems reviewed on the previous pages, but this time with two entirely separate and much more powerful 'double module' mono power amplifiers (one for each channel). In all, this is the equivalent of six small modules, but the power amplifiers' doubled width precludes straightforward vertical stacking, though the system remains flexible.

To re-iterate, the tuner operates *via* six screwdriver-set presets on FM only, the rather cramped tuning scale doubling as centre-tune meter. Aerial signal is supplied *via* a 75 ohm socket, and stereo beacon and stereo-plus-mute/mono-without switch are also fitted. The system signal interconnections are *via* DIN socketry, and European-style mains plugs link the items so all are switched on from the 'master' pre-amp volume/balance/on-off potentiometer. Internal circuitry is based on module systems to permit upgrading without full replacement in case of future technical improvements, and enables precise matching to a variety of pickup cartridges, including m-c and m-m models. To avoid signal path switching and processing, tone controls and alternative speaker and headphone outputs are omitted. In summary, an audiophile system of extreme elegance which is very simple to use, and which has achieved something of a 'cult' reputation for good sound quality.

Lab performance

The very generous power output to some extent justifies the very high price, while the power delivery is superb into low impedances and under 'burst' conditions, the separate modules ensuring that there are no inter-channel effects. The disc input bandwidth is sensibly restrained, with the tested module offering sensible capacitance (alternatives available), while the frequency response conforms to the new IEC bass rolloff recommendations and suggests a slightly bright character. The DIN inputs and outputs do in fact match phono standards, and should be used accordingly. Performance parameters were generally good, with IM distortion performance rating average.

The tuner measurements were generally pretty good, with very good sensitivity and pilot tone suppression, about average results for noise, AM rejection and RFIM, and lower selectivity than most.

Subjective impressions

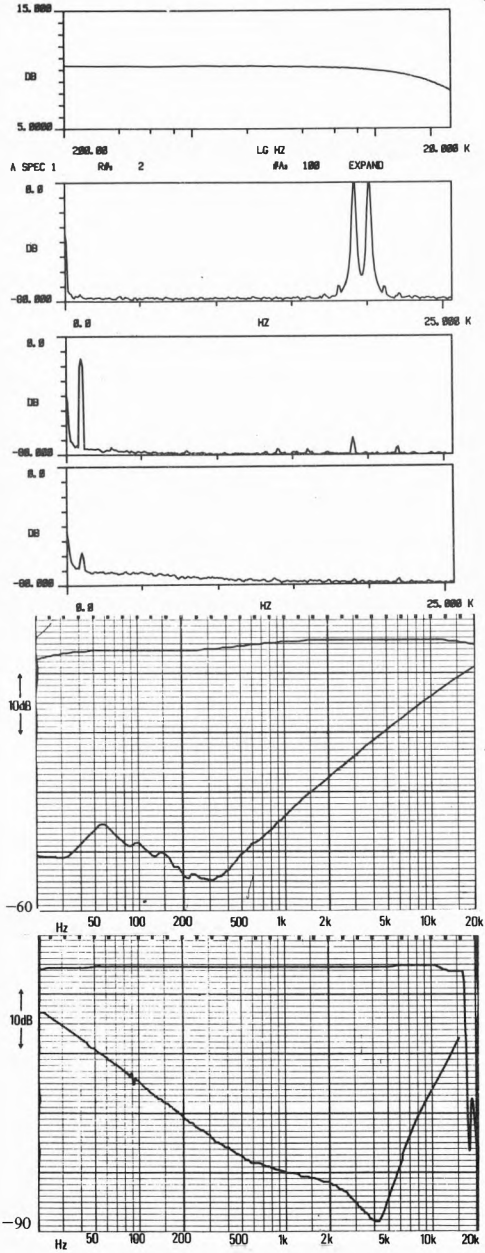
Consistently superior listening test results were only really to be expected, the overall marks being the best of the lot, with particular praise for the bass performance, general integration, and power, but also with mild criticism of slightly fatiguing high frequencies; FM was also considered well above average. Though hardly a dial-twiddler's delight, the tuner was quite liked in use in spite of the tiny meter, with good tune indication and muting and stereo thresholds, plus good response to weak stereo signals, albeit with some sensitivity to multipath distortions.

Conclusions

Although expensive, the consistently good subjective results and excellent power delivery dictate

RECOMMENDED

recommendation to those with the aspirations and good enough ancillaries to feel the benefit.



AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)..... 20Hz–50kHz
Both channels 20Hz/1kHz/20kHz(8 ohms, 0.1% dist)... 100/106/100 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)..... 106/169/212 Watts
Burst power 1kHz, 8/4/2 ohms..... 160/289/475 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM.....	DIN	2.7	47k	125pF
Disc MC		various modules available		
Tuner/aux.....	DIN	190	32k	
Tape	DIN	950	32k	

Disc overload 1kHz..... 34dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	DIN	205	6k

Noise (ref 1 Watt, 8 ohms)

Zero volume..... −89dB
Aux ref volume..... −79dB
Disc ref volume..... −84dB

Other

Damping factor..... 141
THD performance..... good
IMD performance..... average
Hum performance..... excellent

TUNER

RF Performance

30dB S/N Ratio, mono sensitivity..... 0.90uV
50dB S/N Ratio, mono/stereo sensitivity..... 1.50/23uV
IHF 30dB S/N Ratio, mono 1.10uV
Muting level..... 1.3uV
Limiting level, −1dB 0.9uV
RFIM..... 54dB
Capture ratio 1.6dB
Selectivity 35dB
IF rejection 98dB
AM suppression..... 54dB
Image rejection 74dB

Audio Section

S/N ratio 1mV i/p, mono/stereo..... 69/67dB
Distortion, mono 20%/100% modulation 0.08/0.10%
Distortion, stereo 20%/100% modulation 0.10/0.24%
Pilot tone suppression ..... −53dB
Crosstalk, 1kHz..... −43dB

GENERAL

Total size (W x D x H) ..... 11(28) x 13(33) x 6(15) in(cm)
Approximate weight..... 36lb
Typical retail price..... £600+£225

CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)*
1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Mitsubishi DA-R430

Mitsubishi Electric UK Ltd., Otterspool Way, Watford,
Hertfordshire WD2 8LD. Tel: (0923) 40566

Presentation, facilities, etc.

This conventionally-styled yet smart receiver from Mitsubishi's new range features an unusual scale illumination colour change, indicating tuned and stereo conditions, though the slight delay as the lights change is a trifle disconcerting when scanning quickly. Extensive plastics in the case help to keep the weight within reasonable bounds.

The tuner operates on FM and long and medium band AM, with aerial socketry and terminals for 75 and 300 ohm FM and external AM. A hinged but not pivoted AM ferrite rod is also fitted, though this means that the receiver may need to be re-orientated for best results when using this. In addition to the unusual mono/stereo/tune panel lighting, indicators for signal strength and tune are also fitted, plus switching between stereo-with-muting and mono-without. The amplifier has a concentric balance/volume control, the centre section of which is pulled out to switch in the loudness function. Headphone and microphone jacks are fitted to the front panel, the latter in association with a mixing control, while conventional tone controls and speaker switching is also provided. In summary this is a neat and uncluttered design, with sensible grouping of facilities ensuring simplicity in operation.

Lab performance

Offering reasonable power delivery for the price, the delivery pattern under different conditions was reasonable, and low impedances should pose little problem. The disc input showed a frequency characteristic that will cause a degree of coloration, but had sensible bandwidth and capacitance. Other inputs and outputs were fine. The other performance parameters were average, with IM distortion performance below average.

The tuner showed adequate sensitivity, with most parameters average or a little below. RFIM was particularly good, but pilot tone suppression (and in consequence stereo noise) and crosstalk were below average. The frequency response peaked slightly before an early rolloff.

Subjective impressions

The frequency response anomalies may have accounted for a degree of confusion and inconsistency in the listening results, though the overall verdict was certainly below average, and it was felt that favourable initial impressions were not maintained, with the amp becoming a little fatiguing, and being described as 'muddled' and lacking 'liveliness'. FM was considered a bit bright, but not unpleasant. In use the limited sensitivity was noted, but quality seemed quite good. The tuning scale calibration was slightly out, the unusual light show was interesting if a bit foxy, and the lack of 'steering' on the tuning indicator was irritating. AM local signals were reasonably reproduced, but sensitivity was poor, and the 'lumpy' IF produced interference at harmonic frequencies of 470kHz.

Conclusions

Though this is quite a well-balanced design, there were sufficient aspects of both subjective and objective performance to keep this model from firm recommendation despite the modest price.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	8Hz–47kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	24/27/23 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	32/39/32 Watts
Burst power 1kHz, 8/4/2 ohms	39/62/67 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	3.0	46k	150pF
Disc MC	—	—	—	
Tuner/aux	Phono	160	80k	
Tape	Phono	160	80k	
Tape	DIN	160	80k	

Disc overload 1kHz 36dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	240	800
Tape	DIN	130	105k
Headphones (8 ohms)	Jack	68	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−79dB
Aux ref volume	−77dB
Disc ref volume	−79dB

Other

Damping factor	32
THD performance	average
IMD performance	below average
Hum performance	average

TUNER

RF Performance

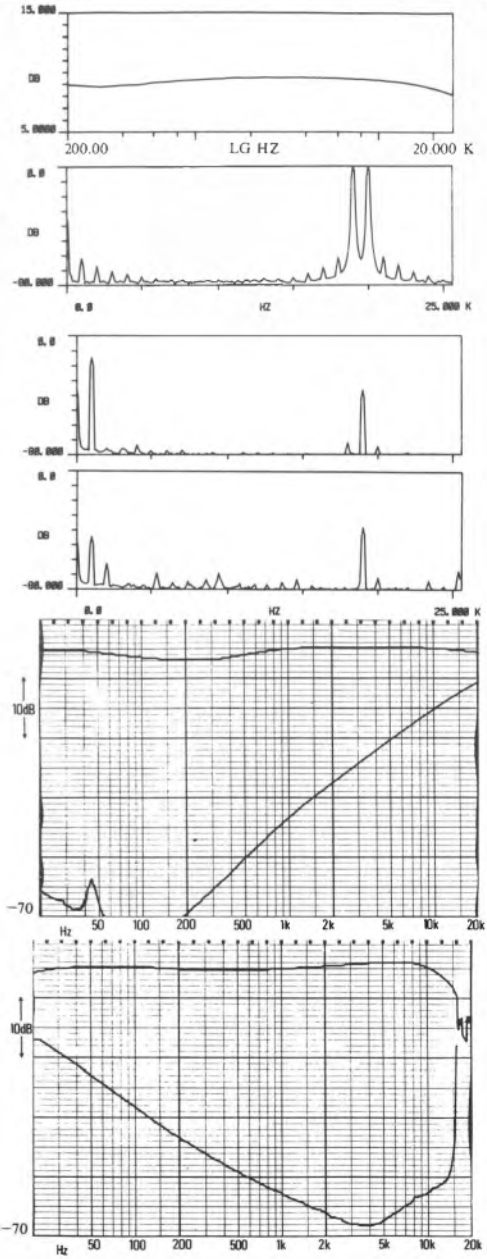
30dB S/N Ratio, mono sensitivity	2.00uV
50dB S/N Ratio, mono/stereo sensitivity	3.50/45uV
IHF 30dB S/N Ratio, mono	4.00uV
Muting level	3.5uV
Limiting level, −1dB	2.5uV
RFIM	69dB
Capture ratio	1.5dB
Selectivity	55dB
IF rejection	94dB
AM suppression	48dB
Image rejection	60dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	75/64dB
Distortion, mono 20%/100% modulation	0.50/1.00%
Distortion, stereo 20%/100% modulation	0.10/0.80%
Pilot tone suppression	−22dB
Crosstalk, 1kHz	−31dB

GENERAL

Total size (W x D x H)	16¾(43) x 11½(30) x 6(15) in(cm)
Approximate weight	15lb
Typical retail price	£135



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)*
1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Mitsubishi DA-U630/DA-F630

Mitsubishi Electric UK Ltd., Otterspool Way, Watford, Hertfordshire WD2 8LD. Tel: (0923) 40566

Presentation, facilities, etc.

These smart 'standard' sized components from Mitsubishi follow the tradition of their predecessors in using plastics moulding extensively in the casework, thus keeping the weight down. Though fairly traditional, the 'split' fascia styling plus logical function positioning makes them ergonomically easy to operate – rather more so perhaps than the (admittedly more compact) receiver also reviewed.

The tuner operates on FM and medium and long wave AM, with aerial screw terminals for 300 and 75 ohm FM and external AM, plus a 75 ohm socket. A ferrite rod for AM is also provided, though the casing permits this to be fitted internally so the tuner may need to be moved around a bit for optimum reception. Facilities are very basic, and include stereo-plus-muting/mono-without switching, plus signal strength and tune light displays, while stereo is indicated by a colour change on the tuning scale illumination. The amplifier has phono socketry throughout, with DIN-duplication on tape. Facilities include normal tone controls, high and subsonic filters, loudness, tape cross-dubbing, plus indicators on input selection, power and 'power level'. In summary, this is a conventional combination with features appropriate to its modest price, but with attractive presentation and standard of finish.

Lab performance

Offering quite a generous power output for the price, delivery shows the usual single/both channel drive differences, but is quite well maintained into low impedances. The disc input bandwidth is rather excessively extended (aux. input being curtailed at 50kHz), and the frequency response shows sufficient variation to cause some coloration (but is better than on the *430* receiver). The input capacitance is a little high to match some cartridge/arm combinations optimally, but other inputs and outputs should pose no problems. Performance parameters were generally average, with IM distortion performance below average.

Strangely the sensitivity was measured as slightly lower than for the cheaper receiver, though most of the other parameters apart from the poor pilot tone suppression showed a slight or significant improvement, particularly on the more marginal parameters like AM rejection, so perhaps the *630* was victim of a slight misalignment problem. So while our example did not inspire enthusiasm for DXing, and again the frequency response showed slight brightness plus an early rolloff, in other respects the performance was pretty good.

Subjective impressions

Preferred to its stablemate, the *630* combination scored fractionally below average overall and was more consistently received, with comments of a general 'softness' and lack of 'punch' which masked information, though the amplifier never sounded objectionable. FM quality was quite pleasant, though not special. In use, the changing dial colours were a bit strange, while the muting was set rather high and the absence of a tuning 'steering' indication was disliked. AM sound quality was reasonable, but spurii, low sensitivity, and distortions marred the overall performance.

Conclusions

While these are respectable performers, results

were insufficiently exceptional for firm recommendation. Assuming the sensitivity was slightly atypical, then this combination certainly merits consideration.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 8Hz–107kHz
Bothchannels20Hz/1kHz/20kHz(8 ohms,0.1% dist)... 50/55/54 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 65/85/70 Watts
Burst power 1kHz, 8/4/2 ohms ..... 75/110/94 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.9	46 k	250pF
Disc MC	—	—	—	
Tuner/aux	Phono	160	150k	
Tape	Phono	160	150k	
Tape	DIN	160	150k	

Disc overload 1kHz 37dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	260	750
Tape	DIN	125	100k
Headphones (8 ohms)	Jack	56	—

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −84dB
Aux ref volume ..... −75dB
Disc ref volume ..... −77dB

Other

Damping factor 39
THD performance ..... average
IMD performance ..... below average
Hum performance ..... average

TUNER

RF Performance

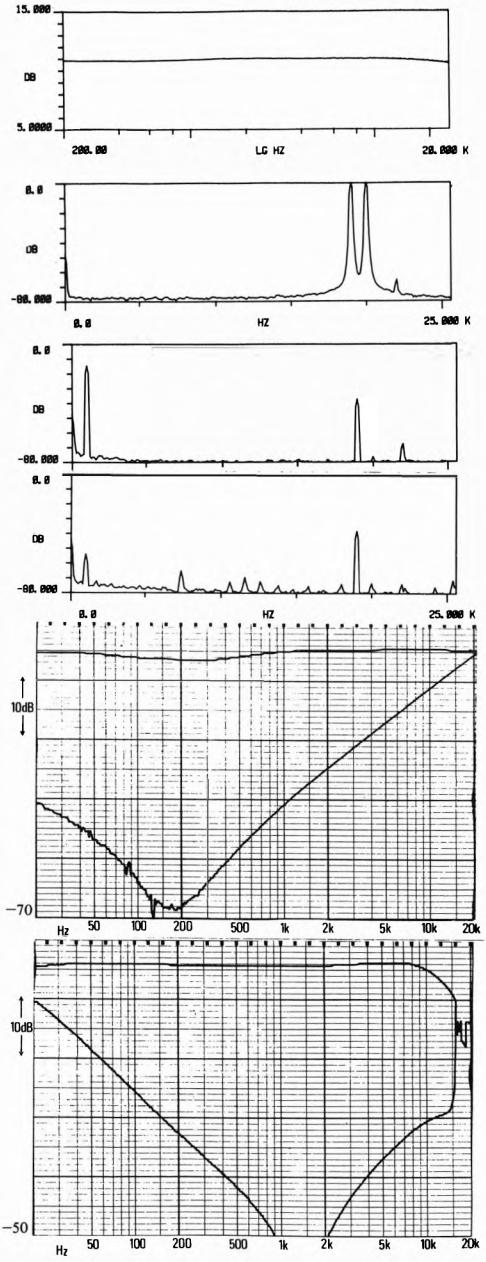
30dB S/N Ratio, mono sensitivity 2.50uV
50dB S/N Ratio, mono/stereo sensitivity 3.50/50uV
IHF 30dB S/N Ratio, mono 5.00uV
Muting level 5.0uV
Limiting level, −1dB 3.3uV
RFIM 74dB
Capture ratio 1.5dB
Selectivity 53dB
IF rejection 101dB
AM suppression 63dB
Image rejection 105dB

Audio Section

S/N ratio 1mV i/p, mono/stereo 74/63dB
Distortion, mono 20%/100% modulation 0.14/0.70%
Distortion, stereo 20%/100% modulation 0.10/0.45%
Pilot tone suppression ..... −22dB
Crosstalk, 1kHz ..... −40dB

GENERAL

Total size (W x D x H) ..... 16¾(43) x 10½(26) x 10¾(27) in(cm)
Approximate weight 21lb
Typical retail price ..... £136+£97

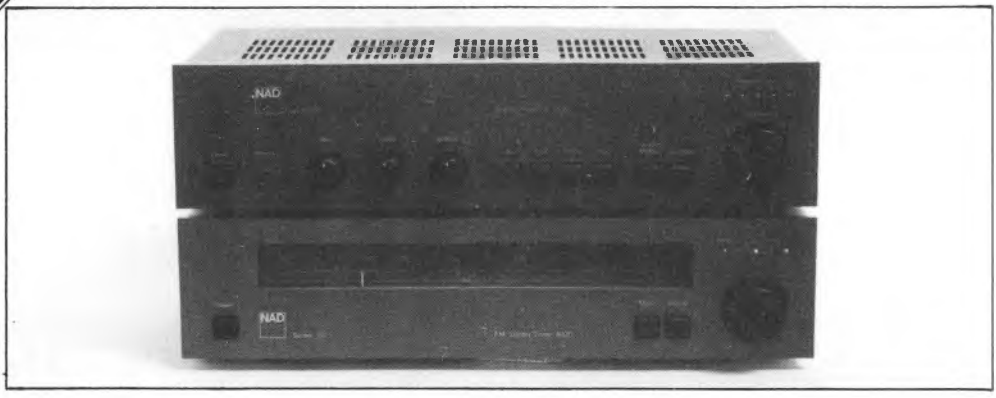


CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

BEST BUY

NAD 3020/4020

Hi-Fi Markets, Unit 3, Colonial Way, Watford, Hertfordshire
Tel: (0923) 27737



Presentation, facilities, etc.

NAD's *3020* amplifier has already acquired something of a cult reputation in a surprisingly short time, featuring as it does some quite advanced circuitry ideas from some of America's leading designers; rather less Press attention has been paid to the matching *4020* tuner which is included in this review.

The tuner is a basic FM-only model, with switched muting and mono, and light indicators for stereo and centre-tune. The rear panel accepts 75 and 300 ohm aerials, and offers switchable 25/50/75us de-emphasis. The amplifier has ample facilities without excessive frills, with four phono inputs and DIN duplication on tape, simple tone controls with loudness and muting, pre/power break socketry, a single set of speaker sockets and a headphone output. The rear socketry is conveniently accessible on a horizontal panel. The amplifier features a selectable 'soft-clipping' circuit, which is intended to allow the unit to exceed its rated power on short peaks without audible degradation. Both matching units are reasonably slim, and discretely dark coloured with matt finish.

Lab performance

The limited power is nevertheless respectable for the price, and the delivery under various conditions was quite reasonable, with the usual single/dual channel differences, and fair performance into low impedances, marred a little by the 'burst' figure on 2 ohms. The special 'soft clipping' switch appeared to have the desired effect, though it also reduced the available power by some 50%, and might therefore be better left out of circuit for normal listening. The disc input had a sensibly limited bandwidth, with capacitance that can be matched to all cartridge/arms, though the frequency response characteristic might mislead by exaggerating detail, and crosstalk was below average. Other inputs/outputs are fine. Performance measurements were generally good, but with hum only average.

The tuner gave consistently average or better than average results, with pilot tone suppression very good.

Subjective impressions

The listening tests gave significantly above average results, though not entirely consistently, with descriptions of impressive 'solidity' and integration, slightly lacking in 'punch', but not aggressive. FM was felt to be a little 'bassy', but again above average. In use, the sensitivity did not seem very high, calibration showed a slight consistent error, there was some multipath sensitivity, and muting and stereo thresholds were set a little high.

Conclusions

The generally fine performance and good auditioning results at a modest price dictate firm recommendation, though the tuner leaves some room for improvement.

NAD 3020/4020

BEST BUY

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 14Hz–40kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 31/35/34 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 36/48/45 Watts
Burst power 1kHz, 8/4/2 ohms ..... 42/67/16 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	3.4	47	60pF
Disc MC	—	—	—	
Tuner/aux	Phono	230	14k	
Tape	Phono	230	15k	
Tape	DIN	230	15k	

Disc overload 1kHz 38dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	200	6k
Tape	DIN	55	70k
Headphones (8 ohms)	Jack	85	—

Noise (ref 1 Watt, 8 ohms)
Zero volume ..... −92dB
Aux ref volume ..... −81dB
Disc ref volume ..... −89dB

Other
Damping factor 60
THD performance ..... excellent
IMD performance ..... good
Hum performance ..... average

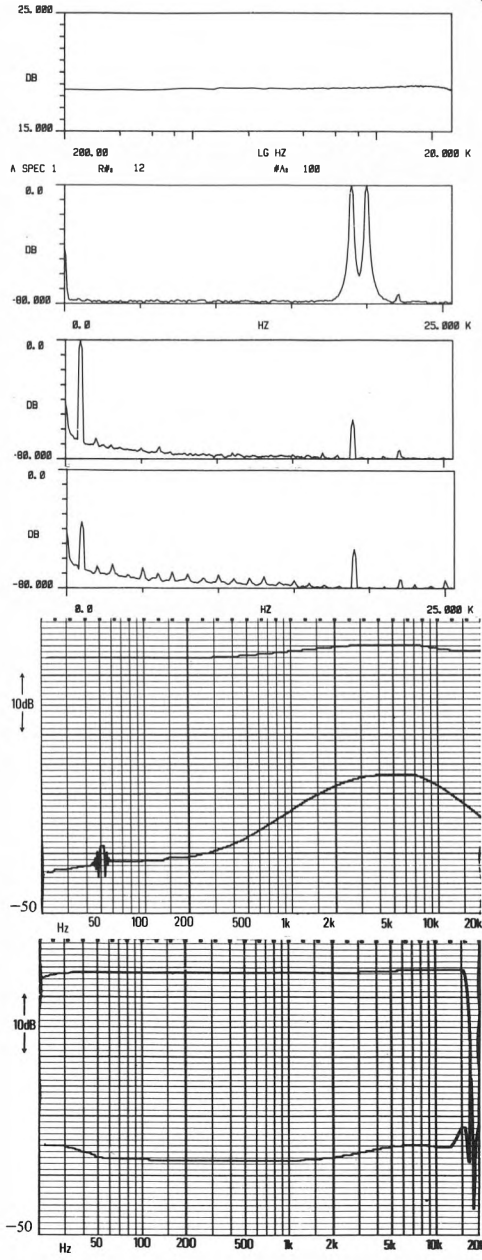
TUNER

RF Performance
30dB S/N Ratio, mono sensitivity 1.25uV
50dB S/N Ratio, mono/stereo sensitivity 2.25/32uV
IHF 30dB S/N Ratio, mono 1.50uV
Muting level 7.0uV
Limiting level, −1dB 1.0uV
RFIM 70dB
Capture ratio 1.5dB
Selectivity 70dB
IF rejection 80dB
AM suppression 56dB
Image rejection 52dB

Audio Section
S/N ratio 1mV i/p, mono/stereo 73/69dB
Distortion, mono 20%/100% modulation 0.40/0.30%
Distortion, stereo 20%/100% modulation 0.63/0.40%
Pilot tone suppression ..... −53dB
Crosstalk, 1kHz ..... −35dB

GENERAL

Total size (W x D x H) ..... 16½(42) x 8¼(21) x 10(25) in(cm)
Approximate weight 21lb
Typical retail price ..... £86+£86



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)*
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THE COMPLETE BUYER'S GUIDE TO STEREO/HI-FI EQUIPMENT

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NAD

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Tel: 01 520 7277

London N1
88 Pentonville Road. Tel: 01 837 4416

London N13
359 Green Lanes. Tel: 01 882 5888

London NW6
79-81 Fairfax Road,
Tel: 01-328 6666

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242 Tottenham Court Road.
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Tel: 0202 291524

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19-20 Market Street. Tel: 0223 51791

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Tel: 0270 211091

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Tel: 01-654 1231/2040

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13 The Marlowes. Tel: 0442 40999

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87 Norwich Road. Tel: 0473 217217

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185 Highgate. Tel: 0539 25728

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68 Stamford Road. Tel: 0536 515266

Leicester
27 Churchgate. Tel: 0533 58662

Lincoln
271a High Street. Tel: 0522 20265

Liverpool
20-22 Whitechapel. Tel: 051-709 9898

Loughton, Essex
152 High Road. Tel: 01-5080247

Manchester
25-29 Station Road, Urmston
Tel: 0617 475181

Middlesbrough
234 Linthorpe Road. Tel: 0642 248793

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35 High Street. Tel: 01-942 9567

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74 High Street, Gosforth. Tel: 0632 844476

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156 Alfreton Road. Tel: 0602 784015

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256 Banbury Road
Tel: 0865 53072/511767

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Tel: 0752 60264

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Tel: 0734 61416

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Tel: 0734 691758

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149 Leigh Road, Leigh-on-Sea
Tel: 0702 79150

Southport
6 Princes Street. Tel: 0704 36901

Stamford
9 Red Lion Square. Tel: 0780 2128

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Tel: 0793 28383

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7 Davygate Arcade. Tel: 0904 51712

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38 Station Road. Tel: 0492 30982

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Tel: 031 5571672

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21 Railway Road. Tel: 0265 52843

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Glen Vine. Tel: 0624 851437

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Prices correct at time of going to press.
All Prices include VAT @ 15%

RECOMMENDED

Nytech CTA252 XDII

Nytech Audio Ltd., High Street, Chew Magna, Bristol BS18 8PW
Tel: (027589) 3232

Presentation, facilities, etc.

There is no way that either author can be entirely unprejudiced about this model, as both have known it too long, coming to appreciate its virtues and learn to accept its idiosyncracies. That said, this unusual British design (intended originally for the Scandinavian market) has been around a number of years, acquiring an excellent reputation for sound quality, marred perhaps by some reports of unreliability (now thought to be a problem of the past!) It is certainly the most compact receiver in the book, if not on the market, and unusually is available ex-factory only in either moving magnet or moving-coil pickup matching options.

Tuning FM only *via* 75 ohm socket, four presets are concealed beneath a top plate sliding cover and selected from the main pushbutton array, in addition to a manual tune facility; both the tuning wheels and frequency meter have constricted ranges of movement, so fine discrimination is difficult. Indicators are provided for signal strength, centre-tune and stereo, and AFC and mono are switchable. In addition to the aforementioned pickup input option, *via* phono plugs, there are DIN tape and pre/power sockets, plus three sets of DIN speaker outputs and two headphone sockets; one of the speaker outlets has no switching in the signal path, though the others are top plate controlled. Other facilities include switching for mono/stereo, high and low filters and loudness, while the tone controls include 'middle' alongside bass and treble. Ergonomically the slant top plate layout is perhaps the most convenient for shelf-mounted equipment, and though the array of pushbuttons with ideogram legends, and the row of sliders and 'cramped' tuning mechanism/scale are less than ideal, these are certainly offset to some degree by the preset provisions and compactness.

Lab performance

Considering the compactness, power output is quite good, though it also comes fairly expensive. The delivery showed a commendably small difference between single and dual channel drive, and was reasonably well maintained into low impedances. Disc frequency response showed a gentle rise which will be audible, and the sensitive disc input has a well-controlled input bandwidth, though the capacitance resisted our measurement and the overload margin was lower than most. The DIN inputs/outputs operate to phono-type standards. Performance parameters were average, with IM distortion performance below average.

Tuner measurements were generally good, but with stereo sensitivity (50dB S/N), AM rejection and crosstalk below average. RFIM and pilot tone rejection were excellent.

Subjective impressions

Despite our prejudices, the Nytech did not score quite as well as we had expected, though it was nevertheless well above average, and described as informative, busy and detailed, but with some muddling and bass softening. FM was also very well received. In use, the fiddly tuning wheels and small scale were not particularly liked, though the presets largely render them redundant once set up, and the centre-tune meter was effective. Sensitivity was on the low side, and an odd HF instability was noticed when detuning.

Nytech CTA252 XDII

RECOMMENDED

Conclusions

Competent technical performance and good listening test results at a not unreasonable price dictate recommendation for this low powered receiver. The unusual, though to our eyes practical styling and ergonomics, plus our own possible prejudices nevertheless suggest that our own enthusiasm remains fairly muted, while inviting readers to check the model out for themselves!

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 8Hz–30kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 23/25/25 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 28/37/17 Watts
Burst power 1kHz, 8/4/2 ohms ..... 36/52/20 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	1.0	47k	?
Disc MC		optional, ex factory		
Tuner/aux	DIN	80	90k	
Tape	DIN	950	32k	

Disc overload 1kHz 28dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	DIN	300	4k
Headphones (8 ohms)	Jack	170	—

Noise (ref 1 Watt, 8 ohms)
Zero volume ..... −86dB
Aux ref volume ..... −74dB
Disc ref volume ..... −84dB

Other
Damping factor 99
THD performance ..... average
IMD performance ..... below average
Hum performance ..... average

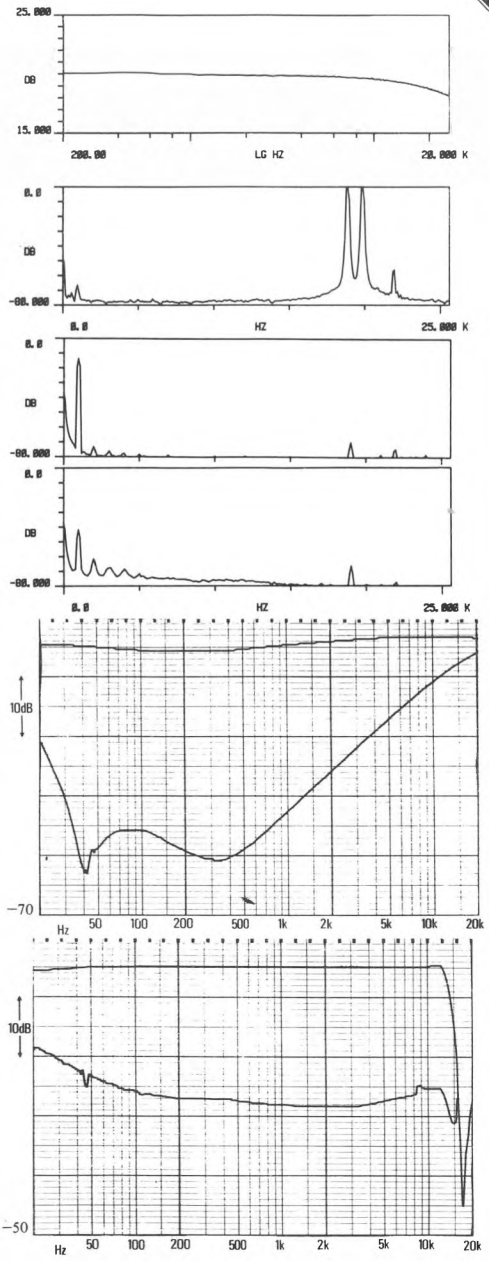
TUNER

RF Performance
30dB S/N Ratio, mono sensitivity 1.20uV
50dB S/N Ratio, mono/stereo sensitivity 3.75/80uV
IHF 30dB S/N Ratio, mono 3.25uV
Muting level 2.5uV
Limiting level, −1dB 2.5uV
RFIM 76dB
Capture ratio 1.2dB
Selectivity 56dB
IF rejection 95dB
AM suppression 40dB
Image rejection 67dB

Audio Section
S/N ratio 1mV i/p, mono/stereo 73/69dB
Distortion, mono 20%/100% modulation 0.10/0.63%
Distortion, stereo 20%/100% modulation 0.09/0.63%
Pilot tone suppression ..... −57dB
Crosstalk, 1kHz ..... −28dB

GENERAL

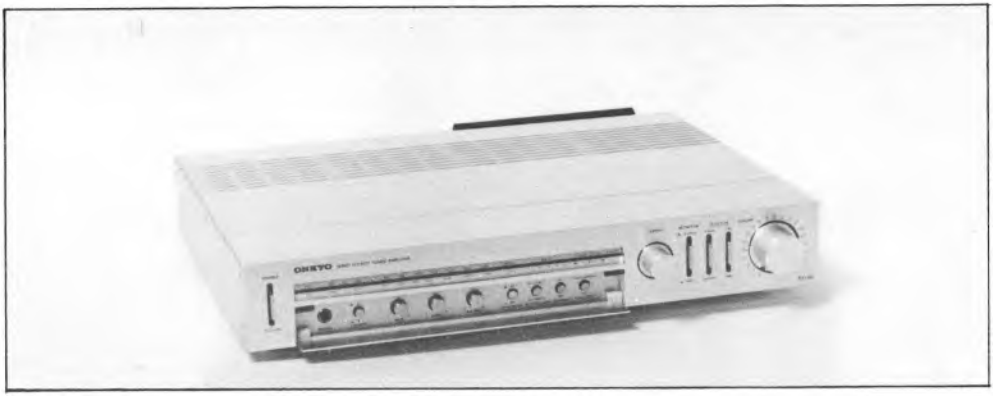
Total size (W x D x H) ..... 8½(22) x 15(38) x 4½(12) in(cm)
Approximate weight 10lb
Typical retail price £300



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Onkyo TX20

Audiotrend Ltd., 33 Bridle Path, Watford, Hertfordshire WD2 4BZ
Tel: (0923) 33019



Presentation, facilities, etc.

Onkyo may be a new name to the British market, but they have been well established in Japan for many years. Furthermore they are being imported by the appropriate division of the experienced KJ group, so unfamiliarity should prove no barrier to their acceptance. The *TX-20* receiver also happens to be one of the neatest, most visually appealing and ergonomically well thought out models in this book. The casing, made up from 'solid' rather than sheet metal panels, has an attractive 'sculptured' look, and only the essential controls are mounted on the main front panel; 'push to open' and a magnetically held section of the panel opens to reveal the less frequently used functions.

Aerial inputs use screw terminals for external AM and 300 ohm FM (a balun may be needed to match conventional 75 ohm co-ax downleads), and a properly pivoted AM ferrite rod is fitted. Operating on FM and medium wave AM without presets, the tuning scale, signal strength, centre-tune and stereo are indicated by rather bright lights, while a single switch selects between muting and phase-locking on stereo, or mono without. The amplifier has phono inputs, and outputs to headphones and two sets of speakers; other functions include loudness and high filter. Altogether this is an attractive and distinctive design, making up one of a series described as 'midi' components by the manufacturer.

Lab performance

With reasonable power output for the price, delivery shows an encouraging similarity between single and dual channel drive, and reasonable low impedance performance (somewhat less than might have been expected into 4 ohm steady state however). Disc input bandwidth was sensibly limited, and capacitance low enough to permit widespread matching, though the sensitivity was lower than usual. Other inputs and outputs should pose no problems. Harmonic distortion performance was good, but the IM distortion and hum characteristics were rated below average.

The tuner section gave reasonable but mixed results, with sensitivity being a little below average, the limiting threshold and the capture ratio on the high side, selectivity sharper than most, pilot tone suppression rather poor, but RFIM excellent.

Subjective impressions

Listening test results were a little inconsistent, but the *TX-20* scored significantly below average overall, with the most consistent criticism relating to a degree of 'muddling', particularly on complex passages, and to some sibillance exaggeration. FM was considered rather better, though still sibillant. In use, the tuner was quite liked, noise appearing to be very low and having an inoffensive character, though the absence of 75 ohm socketry was missed. AM was slightly above average, with the usual restricted bandwidth, average sensitivity but low apparent distortion.

Conclusions

This attractive compact model gave reasonable measured performance for the price, but with rather unbalanced tuner parameters and disappointing results in our listening tests.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	5Hz–39kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	36/36/53 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	40/47/34 Watts
Burst power 1kHz, 8/4/2 ohms	45/62/51 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	4.4	48k	80pF
Disc MC	—	—	—	
Tuner/aux	Phono	190	100k	
Tape	Phono	190	100k	
Disc overload 1kHz				34dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	210	2k
Headphones (8 ohms)	Jack	85	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−82dB
Aux ref volume	−72dB
Disc ref volume	−78dB

Other

Damping factor	40
THD performance	good
IMD performance	below average
Hum performance	below average

TUNER

RF Performance

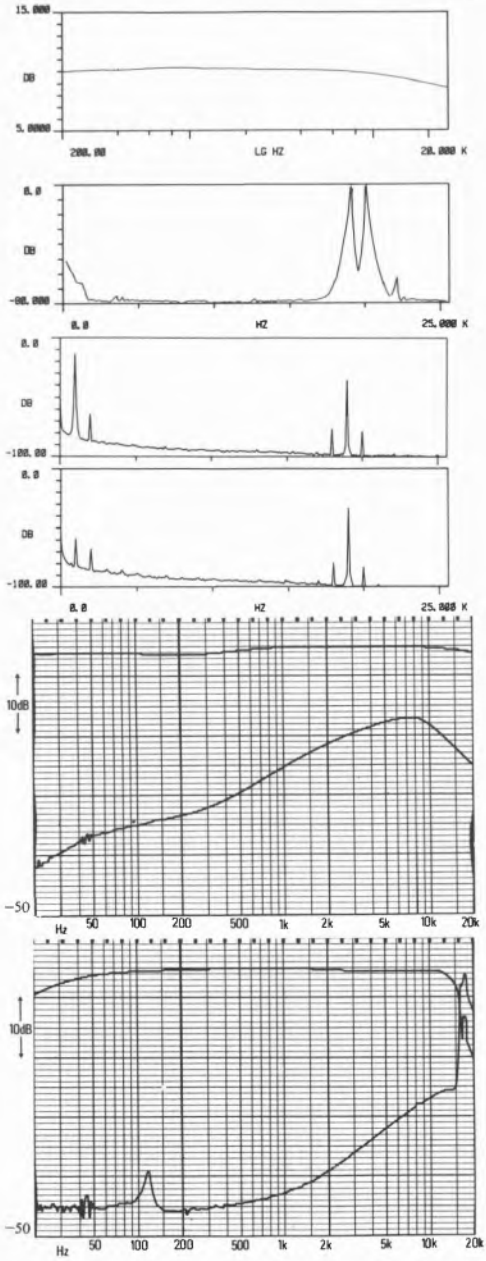
30dB S/N Ratio, mono sensitivity	2.00uV
50dB S/N Ratio, mono/stereo sensitivity	4.00/45uV
IHF 30dB S/N Ratio, mono	7.00uV
Muting level	4.0uV
Limiting level, −1dB	5.0uV
RFIM	80dB
Capture ratio	5.5dB
Selectivity	85dB
IF rejection	90dB
AM suppression	52dB
Image rejection	67dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	73/70dB
Distortion, stereo 20%	0.3%
Pilot tone suppression	−20dB
Crosstalk, 1kHz	−44dB

GENERAL

Total size (W x D x H)	16½(42) x 15(38) x 2¾(7) in(cm)
Approximate weight	16lb
Typical retail price	£180

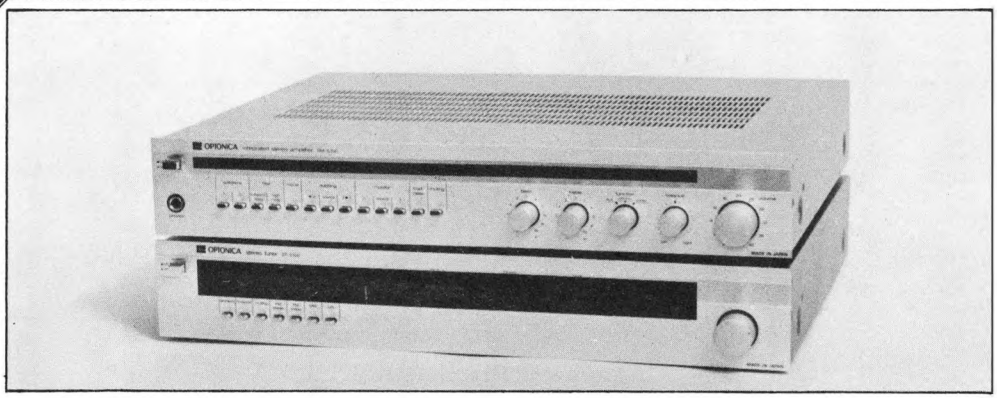


CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

RECOMMENDED

Optonica SM5100/ST5100

Sharp Electronics (UK) Ltd., Sharp House, Thorpe Road, Newton Heath, Manchester M10 9BE. Tel: (061) 205 2333



Presentation, facilities, etc.

If any prizes had been given for styling at the 1979 Harrogate show, Optonica would certainly have cleaned up with their new low-profile *'100* series, which drew envious glances from other importers. These attractive 'slimline' components take up no more space than a 'standard' receiver, and use neat well-ordered switching accompanied by bright rather garish lighting.

The aerial connections match 300 and 75 ohm FM and also accommodate external AM in addition to the fitted ferrite, which is hinged but unfortunately not pivoted, so it may be necessary to move the unit for the best AM results. Lights indicate selection of FM (mono or stereo), long or medium wave AM, muting, 'hi-blend' and 'air-check' (for presetting tape recorder input levels to the tuner's output on maximum FM deviation), plus signal strength, stereo, and centre-tune; no FM presetting facilities are provided. Amplifier inputs are phono throughout, including a pre/power break, with DIN duplication on Tape 2, while the light-indicated functions include two speaker sets, high and subsonic filters, mono, muting, and loudness, plus tape selection and cross-dubbing. Standard tone controls complete the line-up of this attractive and beautifully finished model.

Lab performance

Offering reasonable power for the price, this combination showed quite good similarity between single and dual channel drive, and good performance into low impedances. Disc input bandwidth was unnecessarily extended, but the capacitance was well chosen for cartridge matching, while other inputs and outputs also gave typical values. Of the performance parameters, hum and harmonic distortion were fine, but IM distortion performance was well below average.

The below average sensitivity and noise figures were probably due to sample misalignment, as a second sample was checked subjectively and did not confirm these observations at all, and most of the other parameters were significantly better than average, notably pilot tone rejection, RFIM, capture ratio and crosstalk.

Subjective impressions

Slightly inconsistent listening test results placed the Optonicas (—cae?) slightly above average overall, with some criticism of bass 'looseness' but a pleasant, unaggressive 'openness', while the FM (and AM) tuner results were also considered above average. In use the combination had an uncanny knack of winning the confidence of users, with praise for the muting and tuning meter, and the general FM abilities (despite irrelevant scale divisions), and a wider than usual AM bandwidth with low distortion but average sensitivity.

Conclusions

If one assumes the indifferent tuner measurements were due to a sample problem and unlikely to be typical, the otherwise competent subjective and objective results and the undeniably attractive styling suggests that this combination merits recommendation.

Optonica SM5100/ST5100

RECOMMEND

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 6Hz–122kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 37/38/36 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 43/65/72 Watts
Burst power 1kHz, 8/4/2 ohms ..... 47/78/106 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	3.2	47k	140pF
Disc MC	—	—	—	
Tuner/aux	Phono	160	47k	
Tape	Phono	160	55k	
Tape	DIN	160	55k	

Disc overload 1kHz 38dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	260	980
Tape	DIN	30	77k
Headphones (8 ohms)	Jack	80	—

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −81dB
Aux ref volume ..... −77dB
Disc ref volume ..... −78dB

Other

Damping factor 59
THD performance ..... good
IMD performance ..... well below average
Hum performance ..... above average

TUNER

RF Performance

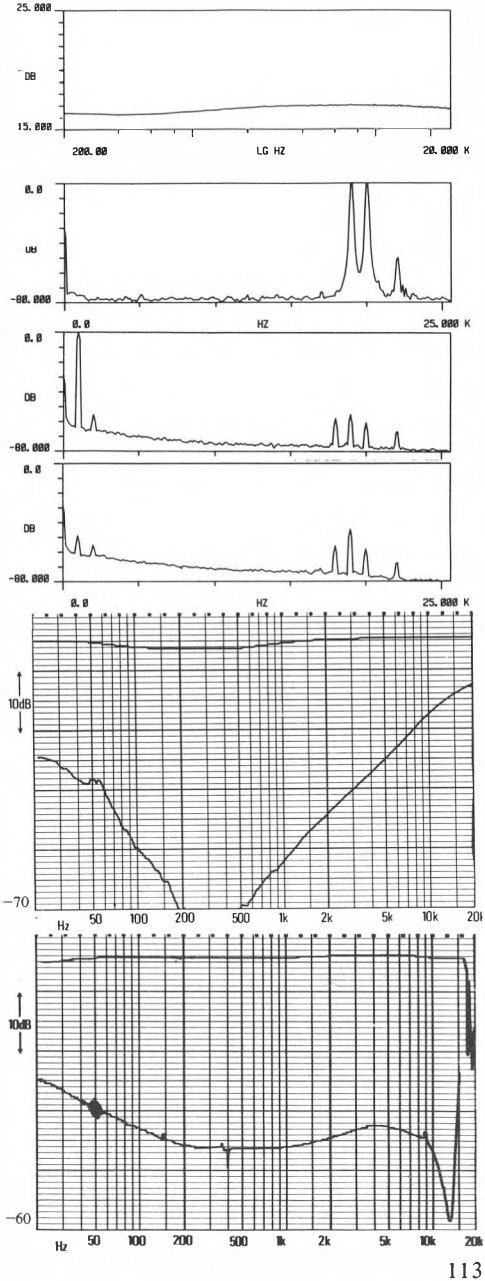
30dB S/N Ratio, mono sensitivity 4.00uV
50dB S/N Ratio, mono/stereo sensitivity 10.00/50uV
IHF 30dB S/N Ratio, mono 5.00uV
RFIM 72dB
Capture ratio 1.0dB
Selectivity 68dB
IF rejection 79dB
AM suppression 57dB
Image rejection 81dB

Audio Section

S/N ratio 1mV i/p, mono/stereo 60/60dB
Distortion, mono 20%/100% modulation 0.30/0.40%
Distortion, stereo 20%/100% modulation 0.30/0.56%
Pilot tone suppression ..... −53dB
Crosstalk, 1kHz ..... −48dB

GENERAL

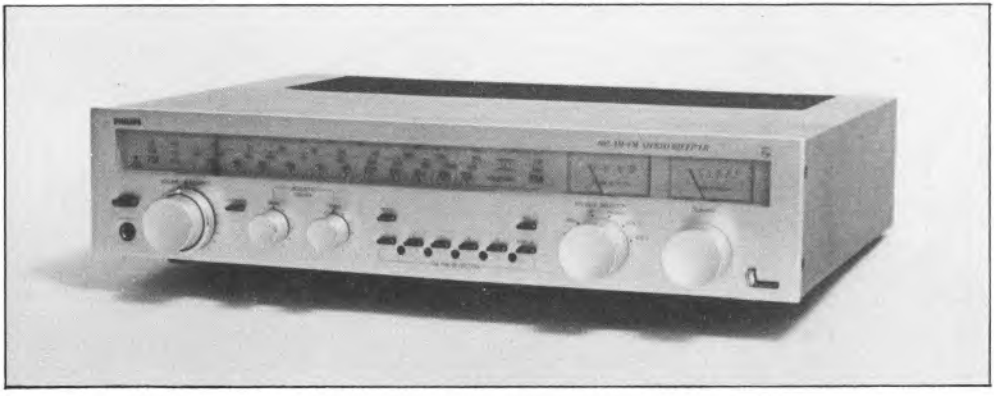
Total size (W x D x H) ..... 17(43) x 17(43) x 5¼(15) in(cm)
Approximate weight 28lb
Typical retail price ..... £115+£115



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)*
1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Philips 602

Philips Electrical Ltd., City House, 420–430 London Road, Croydon CR9 3QR
Tel: (01) 689 2166



Presentation, facilities, etc.

This slim, attractively finished receiver forms part of Philips' 'Black Tulip' range. The ergonomics were felt to be particularly well thought out, with useful facilities including FM presets being presented with the minimum of fuss and clutter.

The tuner operates on FM, with five presets and manual tune, and on the medium and long wave AM bands. Aerial socketry is provided for 75 and 300 ohm FM and external AM; the plastics case helps to reduce the overall weight and enables the AM ferrite rod to be mounted internally, though this has the disadvantage that its orientation with respect to the receiver is fixed, so the whole unit may need to be moved slightly to get the best results here. Dials indicate signal strength and the FM preselect frequency tuned, while a stereo beacon and AFC are also provided. The input sockets are phono apart from DIN-duplication on Tape 1, which is curious considering both sets of speakers are connected *via* DINs; pre-amp output sockets are fitted for use particularly with Philips' MFB (active) speakers. The amplifier features normal tone controls and concentric volume/balance, headphone socket, and switchable loudness. Overall this is a particularly attractive simple model with excellent user-convenience designed in the fashionable 'international' style.

Lab performance

This modestly powered receiver showed quite a significant difference between single and dual channel drive, and did not maintain power well into low impedances. Though the disc input capacitance and bandwidth seemed well chosen, the frequency response showed a less than neutral character, and the overload margin was only 11dB at 20kHz. Other inputs and outputs were quite typical. Some crossover products were visible in the distortion residual, while the other performance parameters were below or well below average.

Respectable tuner sensitivities were marred by poor rejection parameters and capture ratio, the selectivity curve being very asymmetric (misalignment). Treble rolloff was a little early, and crosstalk below average.

Subjective impressions

Reactions on the listening tests were generally rather negative, with an overall result well below average. Frequent comments were made concerning over-brightness and some bass 'looseness', with complex music passages described as 'muddled'. The tuner was rather better received, giving a well-balanced sound. In use the electrical alignment problem was reflected in the tuning scale, while the tuning indicator could have been more energetic. AM sensitivity was above average, the selectivity too 'tight' for daytime work, but useful at night; the sound was dull and bass-heavy, though with low distortion.

Conclusions

Generally rather disappointing, the tuner section nonetheless had promise, though the alignment problem was common to all the Philips models, which may indicate a faulty line-up jig in use somewhere in the organisation.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	9Hz–50kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	26/28/26 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	36/28/9 Watts
Burst power 1kHz, 8/4/2 ohms	33/31/15 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	3.3	50k	110pF
Disc MC	—	—	—	
Tape	Phono	210	400k	
Tape	DIN	210	400k	
Disc overload 1kHz				26dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	250	2k
Tape	DIN	50	480k
Headphones (8 ohms)	Jack	78	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−86dB
Aux ref volume	−83dB
Disc ref volume	−83dB

Other

Damping factor	40
THD performance	below average
IMD performance	well below average
Hum performance	well below average

TUNER

RF Performance

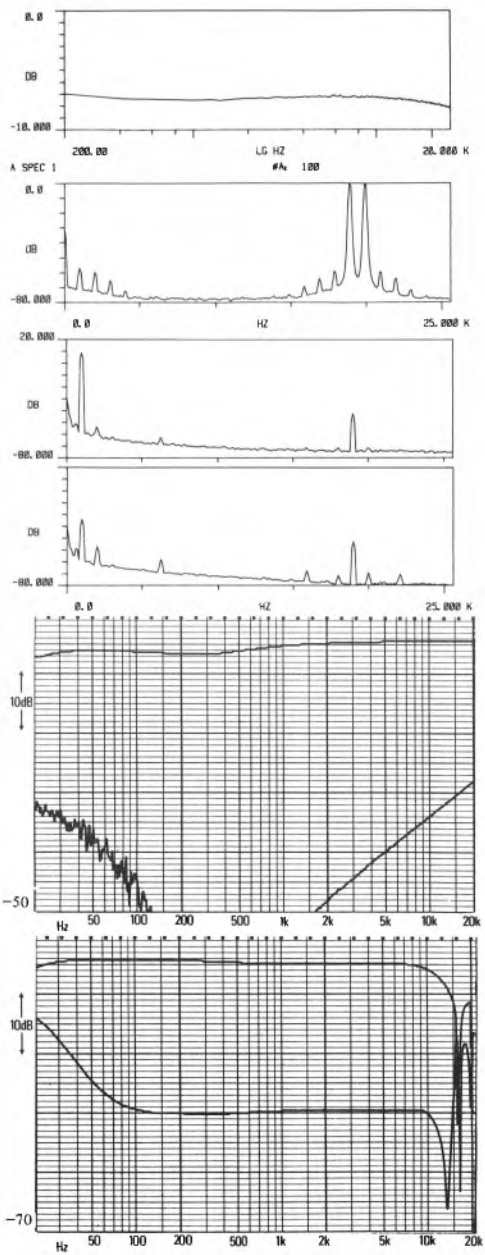
30dB S/N Ratio, mono sensitivity	1.00uV
50dB S/N Ratio, mono/stereo sensitivity	4.00/35uV
IHF 30dB S/N Ratio, mono	4.00uV
Muting level	None
Limiting level, −1dB	4.0uV
RFIM	63dB
Capture ratio	11.0dB
IF rejection	53dB
AM suppression	35dB
Image rejection	52dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	73/68dB
Distortion, mono 20%/100% modulation	0.40/0.30%
Distortion, stereo 20%/100% modulation	0.50/1.00%
Pilot tone suppression	−45dB
Crosstalk, 1kHz	−30dB

GENERAL

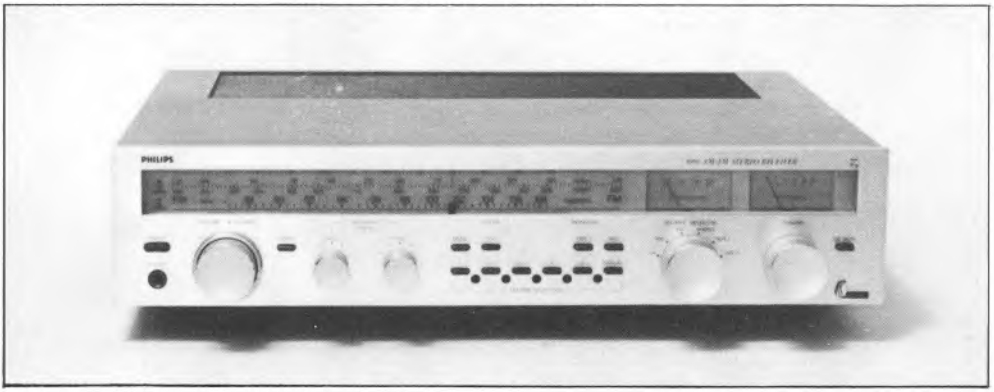
Total size (W x D x H)	17¾(45) x 14½(37) x 4(10) in(cm)
Approximate weight	15lb
Typical retail price	£137



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Philips 604

Philips Electrical Ltd., City House, 420–430 London Road, Croydon CR9 3QR
Tel: (01) 689 2166



Presentation, facilities, etc.

Despite using similar plastic mouldings to the other 'Black Tulip' models reviewed, this receiver is quite heavy, indicating the use of a generous power supply and confirming the generous heat sinks on the rear. Careful attention to ergonomics and intelligent selection of facilities has kept this model uncluttered despite its 'low-profile' fascia; it is also unusual in combining traditional 'international' styling with preset tuning provision.

Operating on FM and long and medium wave AM, there are five screwdriver-set FM presets on the front panel in addition to a manual switch which selects the whole scale. The approximate frequency selected by the presets is displayed on a small auxiliary meter, and a signal strength meter is also fitted. Indicators are provided for stereo and tune, switching for AFC, mono and muting, and aerial socketry for 75 and 300 ohm FM and external AM. The internal AM ferrite, enabled by the plastics case, cannot be swivelled, so the whole unit may need to be moved slightly for best AM signal strength. Curiously, the amplifier uses phono inputs throughout (DIN-duplication on Tape 1), but DIN-type speaker sockets (two sets); outputs for headphones and MFB speakers (effectively a pre-amp output) are also provided. Simple tone controls and concentric volume/balance are supplemented by high filter, loudness and tape monitor. Overall this is a simple, elegant and easy to use package of reasonable compactness.

Lab performance

The generous power output for the price was not reflected in the delivery pattern, which was strongly limited into impedances below 8 ohms, no readings being possible on steady state signals and even 'burst' showing sharp curtailment; the single/dual channel performance was better controlled than most. The disc input bandwidth was sensibly limited, though the capacitance resisted our measurement, and the frequency responses in general could have been flatter. Other inputs and outputs were fine, and performance parameters average or above average.

Though pilot tone suppression and RFIM were quite good, selectivity curve asymmetry was found, and the other measured parameters were generally below average, which perhaps indicates other alignment problems, and is similar to the findings for the other Philips tuners.

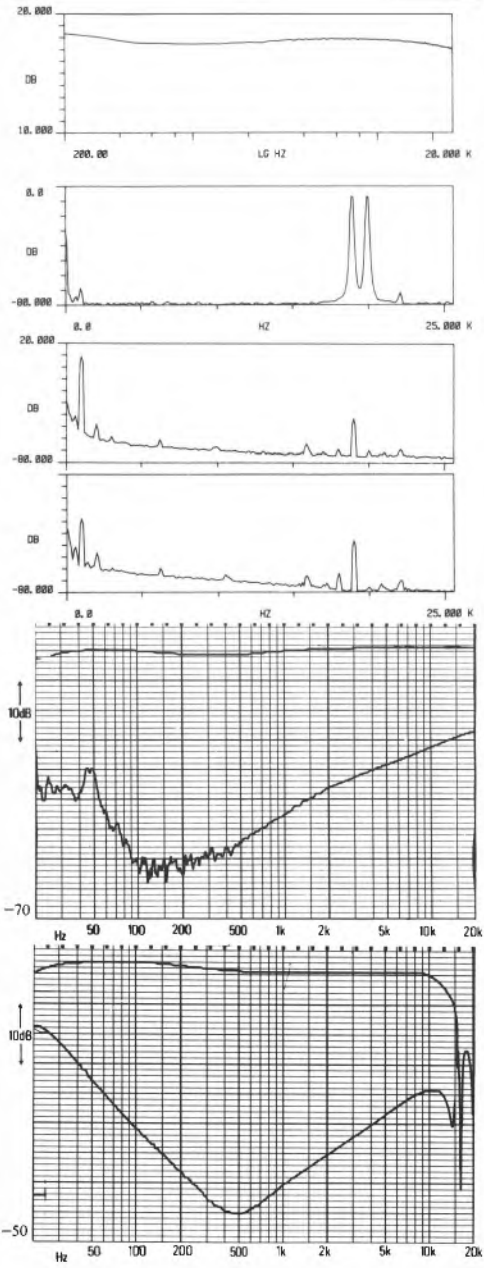
Subjective impressions

Though better than for the *602*, listening test results were still significantly below average, with criticisms of a 'shut-in' quality, but with detached, 'bright' high frequencies, and a tendency to become unpleasant and clip easily when driven loud. Radio performance seemed quite acceptable. In use the tuner was rather insensitive on FM, with similar scale calibration errors and rather indifferent tuning meter as other Philips models. AM was a little better than average, with reasonable sensitivity but sharp selectivity resulting in a dull 'boomy' sound.

Conclusions

Despite the generous power, the delivery pattern was not encouraging, and the tuner suggested unrealised potential. It is difficult to be certain that some of the problems we encountered were not peculiar to our sample, but the similarities noted

between the different Philips models tested regrettably suggests that they may be typical.



AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	9Hz–54kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	65/66/65 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	73/—/— Watts
Burst power 1kHz, 8/4/2 ohms	83/47/15 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.7	47k	?
Disc MC	—	—	—	
Tape	Phono	175	445k	
Tape	DIN	175	340k	

Disc overload 1kHz 29dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	260	2k
Tape	DIN	50	450k
Headphones (8 ohms)	Jack	50	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−76dB
Aux ref volume	−70dB
Disc ref volume	−70dB

Other

Damping factor	160
THD performance	good
IMD performance	average
Hum performance	average

TUNER

RF Performance

30dB S/N Ratio, mono sensitivity	3.50uV
50dB S/N Ratio, mono/stereo sensitivity	7.00/80uV
IHF 30dB S/N Ratio, mono	4.50uV
Limiting level, −1dB	4.0uV
RFIM	74dB
Capture ratio	6.0dB
Selectivity	39dB
IF rejection	47dB
AM suppression	52dB
Image rejection	43dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	71/68dB
Distortion, mono 20%/100% modulation	0.24/0.24%
Distortion, stereo 20%/100% modulation	0.50/0.80%
Pilot tone suppression	−50dB
Crosstalk, 1kHz	−35dB

GENERAL

Total size (W x D x H)	17¾(45) x 15(38) x 4(10) in(cm)
Approximate weight	20lb
Typical retail price	£192

CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Philips 103/305

Philips Electrical Ltd., City House, 420–430 London Road, Croydon CR9 3QR
Tel: (01) 689 2166

Presentation, facilities, etc.

These two separate components from Philips' 'Black Tulip' range use the same cases as the receivers also reviewed, making them a well-matched pair visually, rather bulkier than the receivers of course, and a little larger *in toto* than a 'standard'-sized component. Appearance, finish and ergonomics are all good, though the overall result is rather more cluttered than the receiver units.

The tuner covers long and medium AM bands and the FM band, which may be tuned by five presets in addition to the manual full scale; preset-tuned station frequencies are indicated by a small auxiliary meter. Other indicators include signal strength, tune and stereo, while switching is provided for AFC and muting, and an output level control is also fitted. Aerial socketry matches 300 and 75 ohm FM, and provides for external AM to supplement the internal ferrite rod, which cannot be reoriented without moving the tuner. The amplifier has phono socketry, DIN-duplicated on Tape 1, and again with DIN on speakers; pre-amp output sockets intended for Philips' MFB (active) speakers are also fitted. Facilities include normal tone controls and concentric volume/balance, speaker/MFB selection, mono, loudness and high filter, plus vestigial 'power' meters. In summary these are attractive units, unusually offering presets in an 'international'-styled component, but with one or two curiosities in the selection of the other facilities.

Lab performance

On the expensive side for the power output, delivery showed the usual single/dual differences and generally poor delivery into low impedances. The disc input bandwidth was sensibly constrained, but the frequency response was far from flat, disc overload poor, while the capacitance resisted our measurement; other inputs/outputs should pose no problems. Performance parameters were generally better than average, with IM distortion performance below average (the spectrum shown here also contains some hum, which is our fault!)

Although pilot tone suppression was reasonable, the frequency response showed an early rolloff and unexceptional crosstalk, while sensitivity, rejections and capture ratio were all below average, which perhaps suggests alignment problems.

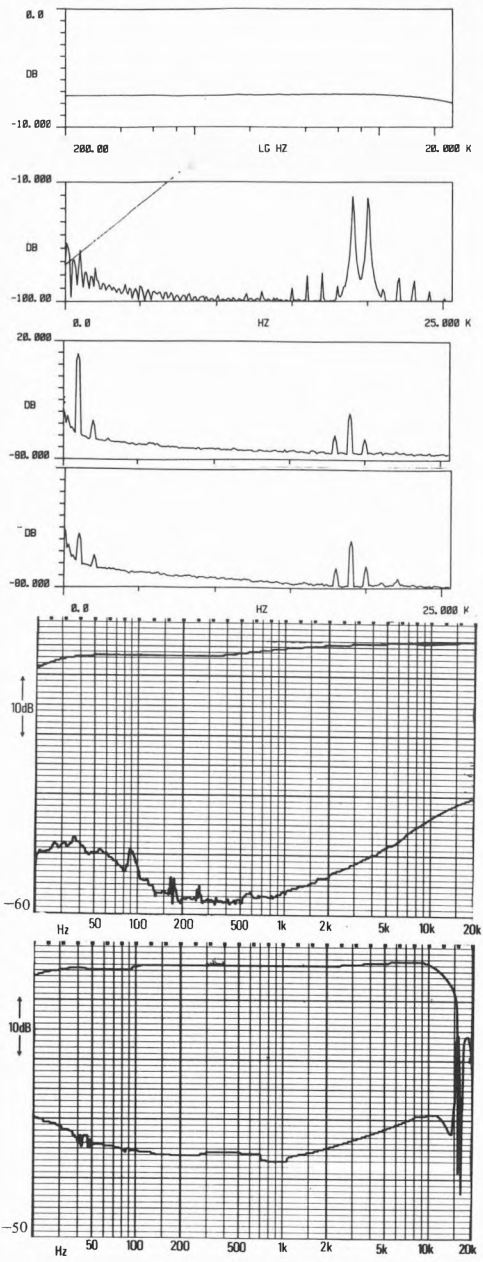
Subjective impressions

Preferred to the other Philips models, and scoring marginally above average overall, though with some inconsistency, the results were bound to be influenced by the disc frequency response. The sound was considered quite reasonable, if 'bright' at low levels, and tended to clip easily, becoming harsh. Radio was generally felt to sound better than average. In use, the (slight) scale calibration error found in all the Philips models was noted, plus confusing and irrelevant markings on AM. The tuning indicator lacked 'brio', and mono/stereo would have been appreciated. AM had an unpleasantly tight bandwidth, but this helped spurii rejection, and with the above average sensitivity this model should be good for evening listening.

Conclusions

The reasonable subjective results for the price might have been sufficient to accord these models recommendation, but certain other aspects of the

designs failed to win our confidence, though the combination remains worth considering.



AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 13Hz–50kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 50/51/50 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 59/36/13 Watts
Burst power 1kHz, 8/4/2 ohms ..... —/—/— Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.4	47k	?
Disc MC	—	—	—	
Tuner/aux	Phono	150	100k	
Tape	Phono	150	100k	
Tape	DIN	150	100k	

Disc overload 1kHz 26dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	250	2k
Tape	DIN	50	480k
Headphones (8 ohms)	Jack	50	—

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −84dB
Aux ref volume ..... −77dB
Disc ref volume ..... −82dB

Other

Damping factor 73
THD performance ..... good
IMD performance ..... below average
Hum performance ..... above average

TUNER

RF Performance

30dB S/N Ratio, mono sensitivity 1.75uV
50dB S/N Ratio, mono/stereo sensitivity 3.50/150uV
IHF 30dB S/N Ratio, mono 2.00uV
RFIM 79dB
Capture ratio 6.0dB
Selectivity 62dB
IF rejection 55dB
AM suppression 45dB
Image rejection 42dB

Audio Section

S/N ratio 1mV i/p, mono/stereo 68/66dB
Distortion, mono 20%/100% modulation 0.40/0.40%
Distortion, stereo 20%/100% modulation 0.40/0.60%
Pilot tone suppression ..... −48dB
Crosstalk, 1kHz ..... −45dB

GENERAL

Total size (W x D x H) ..... 17¾(45) x 15½(39) x 8(20) in(cm)
Approximate weight 28lb
Typical retail price ..... £117+£118

CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

BEST BUY

Pye 6692

Pye Ltd., 137 Ditton Walk, Cambridge CB5 8QD
Tel: (02205) 2781

Presentation, facilities, etc.
This compact low-profile receiver from the Pye *Sound Prcject* range manages to incorporate most normal receiver functions on a small fascia without tending to look cluttered (compare the Rotel *1000*, which is admittedly fractionally smaller and has a couple of extra facilities). The lack of clutter is enhanced by the logical layout and tiny push-buttons (which are nevertheless very easily operated). The standard of finish is very good indeed.

The tuner operates on FM, and medium and long wave AM without presets. Rear socketry matches 75 and 300 ohm FM plugs, and provision is made for an external AM aerial in addition to the hinged ferrite rod, which unfortunately does not pivot with respect to the receiver; this means that the receiver may have to be moved slightly to receive optimum AM signal strength. The only other radio facilities are centre-tune metering, stereo beacon, and mono switch. The amplifier uses predominantly phono inputs, though one tape input is DIN, as is one set of speaker terminals. Normal tone controls with a loudness switch are fitted, and the balance is concentric with the volume control; a headphone socket is also provided. In summary, this is a neat compact design, beautifully presented, with limited facilities which are nevertheless sufficient for most needs and appropriate to its modest price.

Lab performance
Quite powerful for the modest price, single/dual channel differences were better than many and low impedance drive quite reasonable into 4 ohms, but very limited into 2 ohms. Disc input bandwidth was a little wide, with sensibly chosen capacitance, but the overload margin was a little on the low side; other inputs and outputs were generally typical. Performance parameters were average or better.

The tuner measurements gave good and very good results for nearly all parameters, with no weakspots apart perhaps from the slightly bright frequency response 'peak' and the gentle bass rolloff.

Subjective impressions
Not entirely consistent remarks gave results about average overall, which is encouraging considering the modest price. Its main virtue seemed to be generally gentle inoffensive characteristics with stable imagery, rather than any particular liveliness or detailing, and bass was emphasised. FM was described as a little 'thin' and 'empty' sounding. In use there was slight criticism of scale calibration error and rather 'jerky' tuning action. AM was generally quite liked, with reasonable distortion performance and spurii rejection, but a very poor over-wide and asymmetric skirt response, though the 'nose' was symmetrical with the usual rather tight bandwidth.

Conclusions
In spite of the low price, this unit produced consistently competent technical performance measurements with few criticisms, and had reasonable listening test results (suggesting a character well-suited to budget equipment) and very good FM performance. Ergonomics were well-liked, so the unit deserves firm recommendation.

Pye 6692

BEST BUY

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	6Hz–74kHz
Both channels 20Hz/1kHz/20kHz(8 ohms, 0.1% dist)	31/32/31 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	37/44/5 Watts,
Burst power 1kHz, 8/4/2 ohms	43/54/5 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	3.5	47k	120pF
Disc MC	—	—	—	
Tape	Phono	275	68k	
Tape	DIN	275	73k	

Disc overload 1kHz 29dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	320	2k
Tape	DIN	25	247k
Headphones (8 ohms)	Jack	100	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−86dB
Aux ref volume	−77dB
Disc ref volume	−84dB

Other

Damping factor	70
THD performance	good
IMD performance	average
Hum performance	average

TUNER

RF Performance

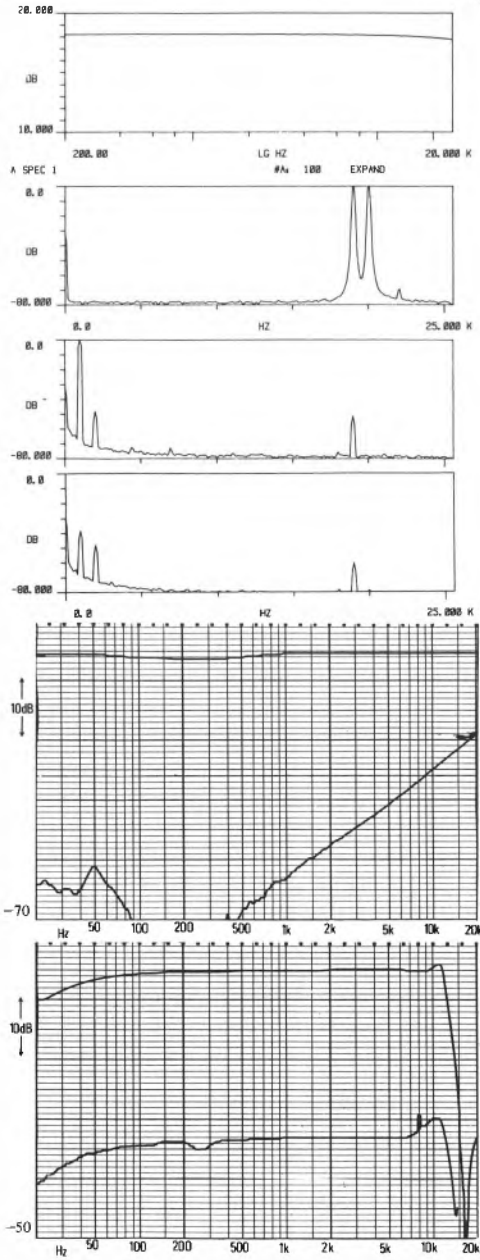
30dB S/N Ratio, mono sensitivity	0.70uV
50dB S/N Ratio, mono/stereo sensitivity	1.25/50uV
IHF 30dB S/N Ratio, mono	1.00uV
Muting level	None
Limiting level, −1dB	0.7uV
RFIM	63dB
Capture ratio	2.0dB
Selectivity	51dB
IF rejection	90dB
AM suppression	58dB
Image rejection	61dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	76/73dB
Distortion, mono 20%/100% modulation	0.21/0.30%
Distortion, stereo 20%/100% modulation	0.45/0.24%
Pilot tone suppression	−47dB
Crosstalk, 1kHz	−36dB

GENERAL

Total size (W x D x H)	16½(42) x 16(41) x 4(10) in(cm)
Approximate weight	16lb
Typical retail price	£110



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

RECOMMENDED

Revox B780

F. W. O. Bauch Ltd., 49 Theobald Street, Borehamwood, Hertfordshire WD6 4RZ
Tel: (01) 953 0091

Presentation, facilities, etc.

This beautifully finished Swiss heavyweight has probably more comprehensive facilities than any other model in this book. Typically Revox with its blue-grey and silver finish, this is a big unit with massive heatsinks, though little apparent wasted space – indeed it effectively combines the company's separate amplifier and tuner in a case the size of one of them.

The microprocessor-controlled FM only tuner section features full frequency synthesis with complex mechanisms for dialling and scanning the frequency band, plus some eighteen 'memory' presets, which are preserved when power is disconnected by backup batteries. Indicators are provided for signal strength, stereo and centre-tune, variable thresholds for station and stereo selection; switching for de-emphasis, noise reduction, high-blend, mono, muting, and stereo only; and socketry for 75 and 300 ohm aerials, plus 'scope feed' and a 'blank', intriguingly labelled 'ant contr', which will perhaps permit automatic control of aerial rotation? On the amplifier side, socketry is phono, but with DIN on Tape 2 and pre/power, and with a front panel 'pre-out' jack. Headphones and two sets of switchable speakers (one DIN) are provided. Switchable tone controls cover bass, presence and treble, and other switches cover loudness, mono, −20dB muting, and one of three filter positions (low, high, and the appallingly named 'low high'). Electronic switching permits any input to be fed to 'record' while any input is playing. Though it is hard to think of anything omitted, the control layout is a trifle fussy and cluttered, and the ease of use is only marginally improved by a small and awkward folding flap, that leaves plenty of superficial controls still on display. The quality of construction inspires considerable confidence.

Lab performance

The high power output of this model comes expensive, shows very good stability between single and dual channel drive, but is rather restricted into low impedances (a pity, as the mass and heatsinking suggest this may not be necessary). Disc input bandwidth was unnecessarily wide (with aux. restricted at 70kHz), capacitance well-chosen, and a frequency response that perhaps conformed to the IEC recommendations, but was less flat than desirable. Other inputs/outputs seem fine, and performance parameters reasonable, though the well below average IM distortion performance could have been better.

Quite outstanding tuner measurements were recorded throughout, the measurements being highly consistent, often testing the limits of the test gear, and imparting considerable confidence.

Subjective impressions

Well above average listening test results were reasonably consistent, with comments concerning a slightly 'thick' sound, though with praise for good general control, definition, and power, but criticism of the performance near and into clipping. FM was also liked, and had a good bandwidth. Users confronted with this device were normally slightly overwhelmed (*ie* 'wow'), and started reading the manual. Once mastered (?), RF performance was exemplary, though a slight asymmetry of response (or error of reading) was detected. The final plea from our consultant was for an AM version.

Revox B780

RECOMMENDED

Conclusions

The outstanding tuner performance and above average amplifier performance dictate recommendation, though the high price mitigates against value-for-money endorsement.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 17Hz–130kHz
Bothchannels20Hz/1kHz/20kHz(8 ohms,0.1% dist) ... 96/102/96 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ... 107/137/29 Watts
Burst power 1kHz, 8/4/2 ohms ..... 156/246/45 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	3.8	49k	115pF
Disc MC	—	—	—	
Tuner/aux	Phono	190	53k	
Tape	Phono	190	53k	
Tape	DIN	190	53k	

Disc overload 1kHz 31dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	200	2k
Tape	DIN	70	?
Headphones (8 ohms)	Jack	45	—

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −83dB
Aux ref volume ..... −76dB
Disc ref volume ..... −80dB

Other

Damping factor 98
THD performance ..... good
IMD performance ..... well below average
Hum performance ..... average

TUNER

RF Performance

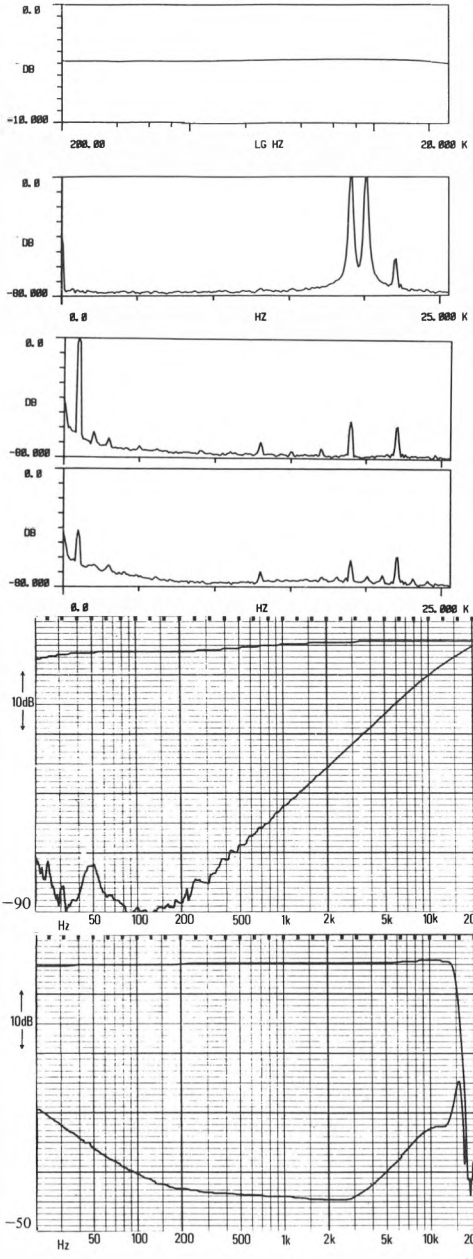
30dB S/N Ratio, mono sensitivity 0.50uV
50dB S/N Ratio, mono/stereo sensitivity ..... 1.30/15uV.
IHF 30dB S/N Ratio, mono 1.00uV
Muting level 7.0uV
Limiting level, −1dB 0.8uV
RFIM 75dB
Capture ratio 2.0dB
Selectivity 67dB
IF rejection 110dB
AM suppression 61dB
Image rejection 110dB

Audio Section

S/N ratio 1mV i/p, mono/stereo 74/71dB
Distortion, mono 20%/100% modulation 0.06/0.12%
Distortion, stereo 20%/100% modulation 0.10/0.30%
Pilot tone suppression ..... −50dB
Crosstalk, 1kHz ..... −40dB

GENERAL

Total size (W x D x H) ..... 17¾(45) x 16½(42) x 5½(14) in(cm)
Approximate weight 35lb
Typical retail price £1000



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Rogers A75 Series 3/T75 Series 2

Swisstone Electronics Ltd., 4–14 Barmeston Road, London SE6 3BN
Tel: (01) 697 8511

Presentation, facilities, etc.

The Rogers designs have changed little in external appearance over the years, which implies that they should retain their value well. The cases are narrower than most, though fairly high, and the line of the black fascia is broken by a grille effect at the top and bottom, offset by wooden endplates; each unit has a particularly substantial 'feel'.

The FM-only tuner has no presets, and offers signal strength, stereo and centre-tune indicators, AFC, muting, mono/stereo switching, and output level. Both aerial types are accommodated, with an additional switch to reduce sensitivity in strong signal areas. Tuner output is variable, *via* a DIN socket (unlike the amplifier's tuner input!) The amplifier offers the fairly standard range of facilities, with phono inputs DIN-duplicated for tape on front and rear, and with variable sensitivity on the disc input. The high frequency filter is unusually elaborate, offering a choice of two turnover frequencies and variable slope; this offers scope for precise fine tuning of the high frequency response. These discrete if somewhat severe looking units are quite compact, needing less shelf space than most, and feel reassuringly 'solid'; the tuning scale illumination was felt to be a little bright.

Lab performance

Though on the expensive side for the power offered, delivery is reasonably well maintained into low impedances, but shows the usual marked difference between single and dual channel drive. Disc input bandwidth was rather excessive, though with sensible LF rolloff, while the frequency response showed a lower midrange suckout that is likely to be audible; the impedance and capacitance was complex, and resisted our measurement. In general performance parameters were fine, but hum performance was considered below average.

Distortion was a little high at 100% mod levels and crosstalk and RFIM performances were also mildly below average, but in general the tuner gave good results, indicative of a well balanced and properly aligned design.

Subjective impressions

Scoring average overall, this amplifier's listening test reception was clearly affected by the frequency response, with consistent criticism of undue brightness, and further observations of lack of bass definition and power, plus some muddling, while at the same time having good overall clarity and definition. FM was considered generally very pleasant. In use the scale divisions were difficult on the eye and meaningless, while the signal strength meter was unusually insensitive, the centre-tune slightly misaligned, and inoperative with AFC selected. Some 'spit' was detected from the stereo decoder on zero and very weak signal inputs.

Conclusions

Overall this is a competent design without any significant weaknesses, though a few mild opportunities for improvement. The listening test results may have been influenced by the frequency response characteristic, but are insufficient to ensure recommendation at the fairly high price.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	16Hz–159kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	41/42/42 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	53/73/73 Watts
Burst power 1kHz, 8/4/2 ohms	66/109/89 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	Var	?	?
Disc MC	—	—	—	
Tuner/aux	Phono	130	50k	
Tape	Phono	130	50k	
Tape	DIN	120	50k	
Disc overload 1kHz				35dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	225	100
Tape	DIN	120	81k
Headphones (8 ohms)	Jack	120	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−76dB
Aux ref volume	−75dB
Disc ref volume	−76dB

Other

Damping factor	70
THD performance	good
IMD performance	average
Hum performance	well below average

TUNER

RF Performance

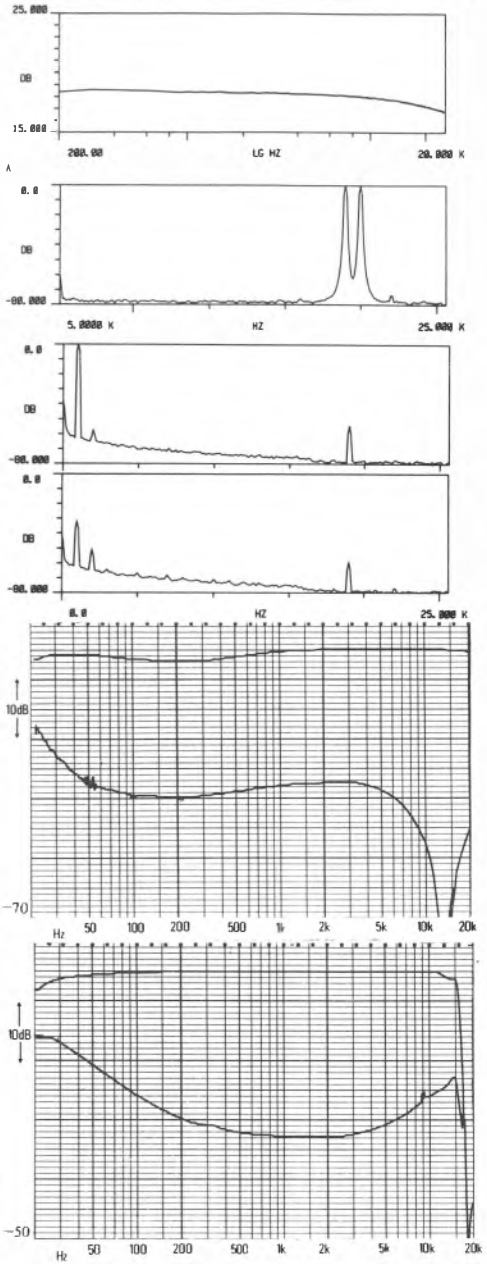
30dB S/N Ratio, mono sensitivity	1.20uV
50dB S/N Ratio, mono/stereo sensitivity	2.25/19uV
IHF 30dB S/N Ratio, mono	1.25uV
Muting level	1.5uV
Limiting level, −1dB	2.5uV
RFIM	56dB
Capture ratio	1.0dB
Selectivity	60dB
IF rejection	85dB
AM suppression	57dB
Image rejection	88dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	78/64dB
Distortion, mono 20%/100% modulation	0.40/1.25%
Distortion, stereo 20%/100% modulation	0.17/1.50%
Pilot tone suppression	−52dB
Crosstalk, 1kHz	−32dB

GENERAL

Total size (W x D x H)	14¼(36) x 12(31) x 9½(24) in(cm)
Approximate weight	31lb
Typical retail price	£220+£155

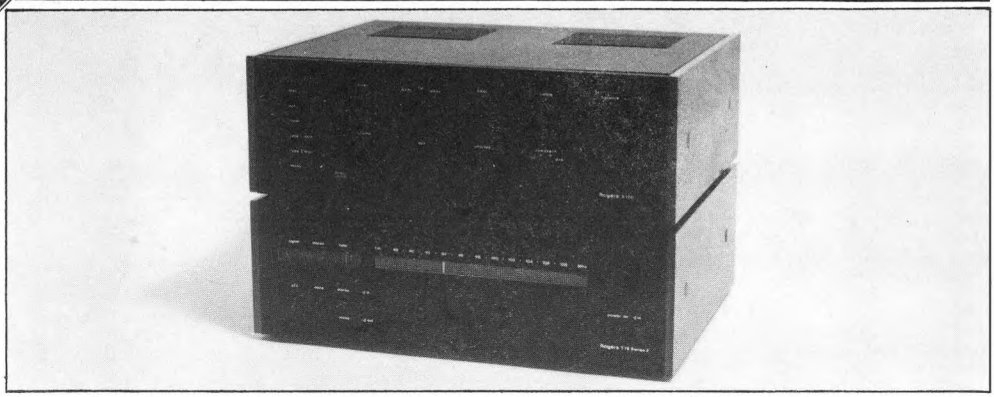


CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

RECOMMENDED

Rogers A100/T75 Series 2

Swisstone Electronics Ltd., 4–14 Barmeston Road, London SE6 3BN
Tel: (01) 697 8511



Presentation, facilities, etc.

This alternative combination from Rogers partners the same *T75-2* tuner with the more recent and more powerful *A100* amplifier. Presentation is practically identical to the cheaper pair, with the austere but discrete black fascias broken by a 'grille' effect, and attractive wooden endplates. Though fairly high, the units are narrower than most, and will use correspondingly less shelf space.

The FM-only tuner is rather brightly lit and has indicators for signal strength, stereo and centre-tune, and switches for mono, AFC and muting; the back panel DIN socket has variable output, and the aerial sockets have a switchable sensitivity reduction for operating in strong signal areas. The amplifier front panel has switching for the rear (phono) inputs and a DIN auxiliary input on the front. Tone controls are conventional, but the HF filtering is unusually sophisticated, with choice of two operating frequencies and variable slope. Two sets of speakers and headphones may be connected, and the rear panel also has European-style mains sockets, and switches for 'fine-tuning' the disc input loading. The overall effect is attractively smart, yet restrained, sturdy and fairly compact.

Lab performance

Quite expensive for the power output offered, delivery was well maintained into low impedances, but with the usual single/dual channel difference. Disc input bandwidth followed the new IEC recommendations for bass rolloff, and was a little over-extended at HF (though much better than the '75). Disc input capacitance was usefully variable, and other inputs/outputs should pose no problems. Once again performance parameters were average or better, with hum performance well below average, but a significantly flatter frequency response than the '75 on disc was measured.

In general the tuner gave good results, indicating a fundamentally well-balanced design, though crosstalk, RFIM and distortion at 100% mod levels left some room for improvement.

Subjective impressions

Described as significantly more 'authoritative' than the '75, the *A100* was rated significantly above average overall, with particularly favourable comments at lowish powers, describing nice balance with plenty of detail, good bass performance and good overall control, though it was a trifle bright with tendencies to harshness nearer full power. The tuner sound was very pleasant. In use the scale divisions and disablement of tuning meter with AFC were both found irritating, but muting thresholds and alignments were fine (except on the centre-tuning meter), and the stereo decoder was found to 'spit' slightly with very weak signals.

Conclusions

Although on the expensive side, this combination had evidence of a general competency of design, with few if any weak spots, so the added confidence of respectable listening test results implies recommendation.

Rogers A100/T75 Series 2

RECOMMENDED

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	20Hz–85kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	53/53/53 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	63/91/100 Watts
Burst power 1kHz, 8/4/2 ohms	75/116/107 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	1.8	49k	Var
Disc MC	—	—	—	
Tuner/aux	Phono	110	50k	
Tape	Phono	110	50k	
Tape	DIN	110	50k	

Disc overload 1kHz 38dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	280	460
Tape	DIN	150	82k
Headphones (8 ohms)	Jack	120	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−75dB
Aux ref volume	−73dB
Disc ref volume	−74dB

Other

Damping factor	82
THD performance	good
IMD performance	average
Hum performance	well below average

TUNER

RF Performance

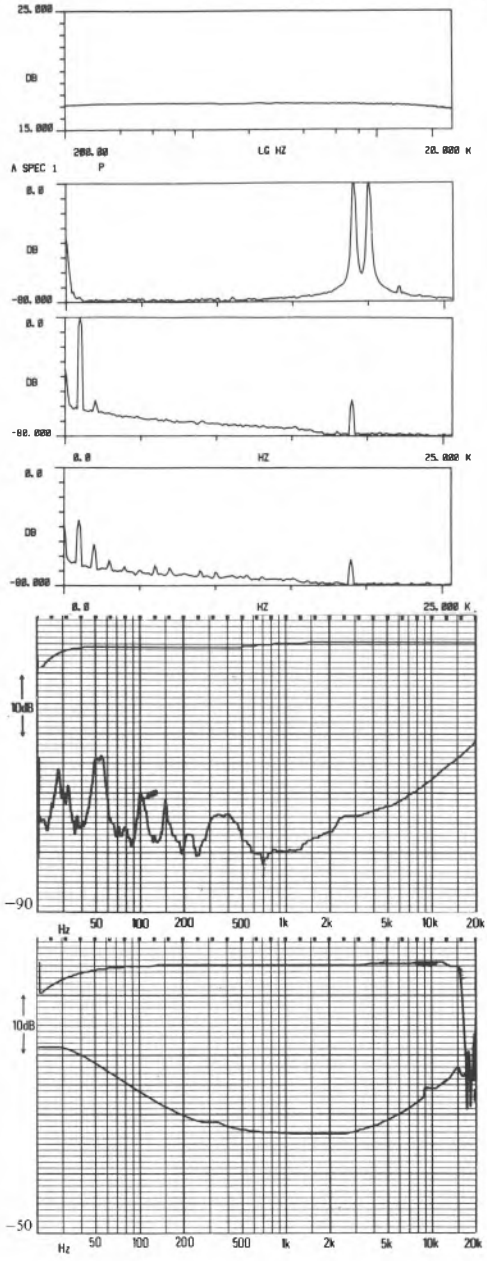
30dB S/N Ratio, mono sensitivity	1.20uV
50dB S/N Ratio, mono/stereo sensitivity	2.25/19uV
IHF 30dB S/N Ratio, mono	1.25uV
Muting level	1.5uV
Limiting level, −1 dB	2.5uV
RFIM	56dB
Capture ratio	1.0dB
Selectivity	60dB
IF rejection	85dB
AM suppression	57dB
Image rejection	88dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	78/64dB
Distortion, mono 20%/100% modulation	0.40/1.25%
Distortion, stereo 20%/100% modulation	0.17/1.50%
Pilot tone suppression	−52dB
Crosstalk, 1kHz	−32dB

GENERAL

Total size (W x D x H)	14¼(36) x 12(31) x 9½(24) in(cm)
Approximate weight	33lb
Typical retail price	£320+£155



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

RECOMMENDED

Rotel RX300

Rotel UK, 2–4 Erica Road, Stacey Bushes, Milton Keynes, Buckinghamshire
Tel: (0908) 317707

Presentation, facilities, etc.
Rotel's *300* series of 'budget' models has shown an unusually consistent run of success with the various Hi-Fi Choice assessors, receiving recommendations in the *Stereo Systems, Cassette Decks* and *Turntables* issues. The *Systems* book assessed the separate tuner and amplifier components, so this is the first time we have examined the *RX300* receiver, which turns out to be a compact and fairly lightweight unit, with the traditional front panel size and layout in brushed aluminium, encased in an attractive wooden sleeve.

The tuner operates on FM, and medium and long wave AM, without presets but with stereo and signal strength indicators and mono switching. Normal aerial inputs are available for 300 and 75 ohm FM, and AM, and there is also an internal ferrite aerial for the latter; as this is not pivoted, it may be necessary to move the receiver slightly for best AM reception. Amplifier facilities are fairly restricted – as befits a budget model – being limited to simple tone controls, loudness and mono switching, with a headphone socket and one set of speaker terminals. Overall this is a pleasingly finished simple model of conventional appearance.

Lab performance
Modestly powered, but equally low in price, the delivery showed a fairly slight difference between single and dual channel drive, and reasonable behaviour into low impedances. The disc input showed a significant frequency response anomaly, slightly wide bandwidth, and slightly high capacitance, though other inputs and outputs should pose no problems. Performance parameters were generally respectable, but with hum performance below average.

The tuner measurements were generally pretty poor, with evidence of cost-cutting hardly surprising, as the whole receiver costs less than most tuners. Notable deficiencies were in sensitivity and frequency response (though within 1dB, 50Hz–10kHz), while the general feeling was that results should be adequate for undemanding and not over-critical local reception.

Subjective impressions
Overall listening results were a comfortable 'average', which is very good for the price, while consistent comments concerning some 'brightness', 'muddling' and 'thickening' were made. Pleasant enough at low powers, aggressiveness became apparent when higher powers were demanded. FM was considered quite acceptable. The very limited facilities and sensitivity caused little enthusiasm in use, while AM was insensitive, dull sounding, and poor on weak inputs.

Conclusions
Decent listening test results within limitations that are only to be expected at the price, plus respectable amplifier measurements generally dictate recommendation, though the rather indifferent tuner prevents further confirmation. This should make an excellent 'starter' model for those for whom radio is but a secondary source.

RECOMMENDED

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 17Hz–70kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 20/20/20 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 23/34/29 Watts
Burst power 1kHz, 8/4/2 ohms ..... 24/41/36 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.7	47k	180pF
Disc MC	—	—	—	
Tuner/aux	Phono	165	51k	
Tape	Phono	165	60k	
Tape	DIN	165	60k	

Disc overload 1kHz 34dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	300	48
Tape	DIN	60	88k
Headphones (8 ohms)	Jack	70	—

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −83dB
Aux ref volume ..... −72dB
Disc ref volume ..... −72dB

Other

Damping factor 39
THD performance ..... good
IMD performance ..... average
Hum performance ..... below average

TUNER

RF Performance

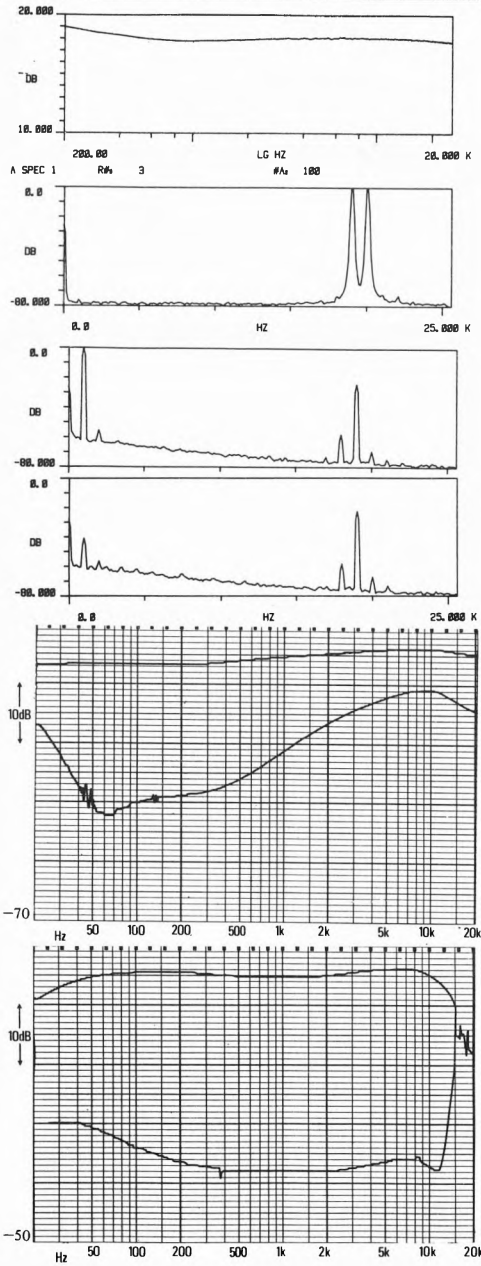
30dB S/N Ratio, mono sensitivity 4.00uV
50dB S/N Ratio, mono/stereo sensitivity 7.00/100uV
IHF 30dB S/N Ratio, mono 12.00uV
Limiting level, −1dB 7.0uV
RFIM 58dB
Capture ratio 5.0dB
Selectivity 42dB
IF rejection 58dB
AM suppression 66dB
Image rejection 50dB

Audio Section

S/N ratio 1mV i/p, mono/stereo 74/68dB
Distortion, mono 20%/100% modulation 0.30/0.50%
Distortion, stereo 20%/100% modulation 0.30/1.00%
Pilot tone suppression ..... −22dB
Crosstalk, 1kHz ..... −36dB

GENERAL

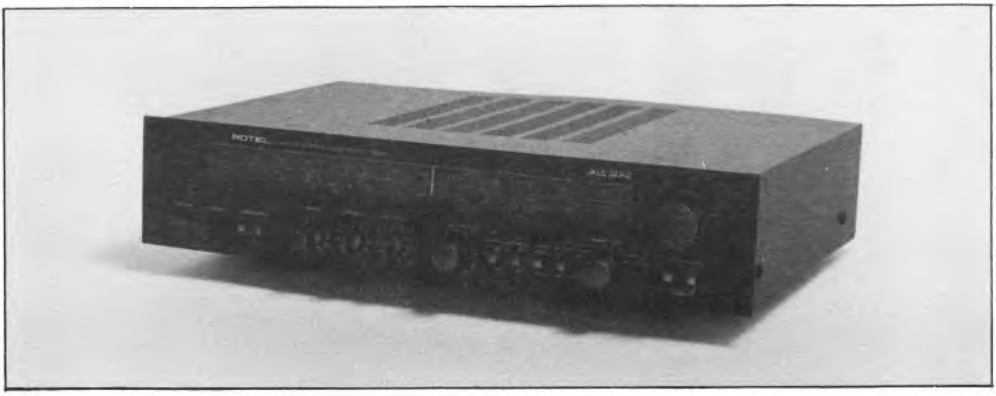
Total size (W x D x H) ..... 16¼(41) x 11(28) x 5(13) in(cm)
Approximate weight 13lb
Typical retail price £100



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)*
1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Rotel RX1000L

Rotel UK, 2–4 Erica Road, Stacey Bushes, Milton Keynes, Buckinghamshire
Tel: (0908) 317707



Presentation, facilities, etc.
This member of Rotel's new *1000* series of low profile models naturally has a somewhat 'busy' fascia layout to accommodate full receiver facilities. Perhaps some simplification of the legends (particularly the omission of the unnecessary information 'PLL MPX' in a clashing typeface) could have further improved a commendably compact design which uses a discrete dark brown fascia.

The tuner operates on FM, and medium and long AM wavebands, without presets but with aerial socketry for 75 and 300 ohm FM and AM; an AM ferrite aerial is hinged (but not properly pivoted) on the rear; as the direction of the ferrite rod cannot be changed, the hinging is perhaps superfluous, and the orientation of the receiver may need to be adjusted to get the best results here. Switching is provided for mono and for muting, and indicators for signal strength, centre-tune and stereo. Other switches select speakers (two sets), loudness, subsonic filter and tape monitor, permitting dubbing in one direction from (phono) Tape 1 to (DIN) Tape 2. A headphone socket is provided, and speaker fuses are readily accessible. Overall this is an attractively compact design with slim styling and dark finish, which incorporates most basic features.

Lab performance
Good power output for the price is coupled to a good delivery pattern, with only a slight difference between single and dual channel drive, and with reasonable characteristics into low impedances. Disc input is sensibly constrained in bandwidth, but not entirely flat in frequency response, while the 200pF capacitance will exclude a few cartridge/arm combinations from optimum matching. Other inputs/outputs should pose no problems. Performance parameters gave a steadily average result throughout.

The tuner measurements were generally average or a little below average, with comparatively poor results for RFIM and pilot tone suppression. The *1000L* therefore follows the price trend, lying between the *300* and *604* in terms of tuner performance.

Subjective impressions
Marginally below average overall results showed good correlation of comments describing a 'soft' and rather 'tame' sounding amplifier, which was too passive and 'slow' to be good, but was unlikely to become aggressive (and hence might be a useful adjunct to a modest system, where a more 'dynamic' amplifier could prove an embarrassment). FM was not particularly liked, being described as rather 'rough' at HF. In use the tuning meter was excellent, and operation well liked apart from the irritating doubling up of FM mute and MW/LW switching (no doubt when LW was added as an afterthought for the UK market). AM sound quality was satisfactorily bright with average sensitivity (some misalignment), and some distortion.

Conclusions
This model gave a generally respectable though hardly inspiring performance at a very reasonable price, and while not formally recommended, it remains well worth considering, and has a particular sound character that will suit certain applications.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 8Hz–63kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 34/38/34 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 41/59/59 Watts
Burst power 1kHz, 8/4/2 ohms ..... 52/72/90 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.9	50k	200pF
Disc MC	—	—	—	
Tuner/aux	Phono	170	48k	
Tape	Phono	160	48k	
Tape	DIN	160	53k	

Disc overload 1kHz 38dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	250	1k
Tape	DIN	100	90k
Headphones (8 ohms)	Jack	70	—

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −78dB
Aux ref volume ..... −76dB
Disc ref volume ..... −77dB

Other

Damping factor 46
THD performance ..... average
IMD performance ..... average
Hum performance ..... average

TUNER

RF Performance

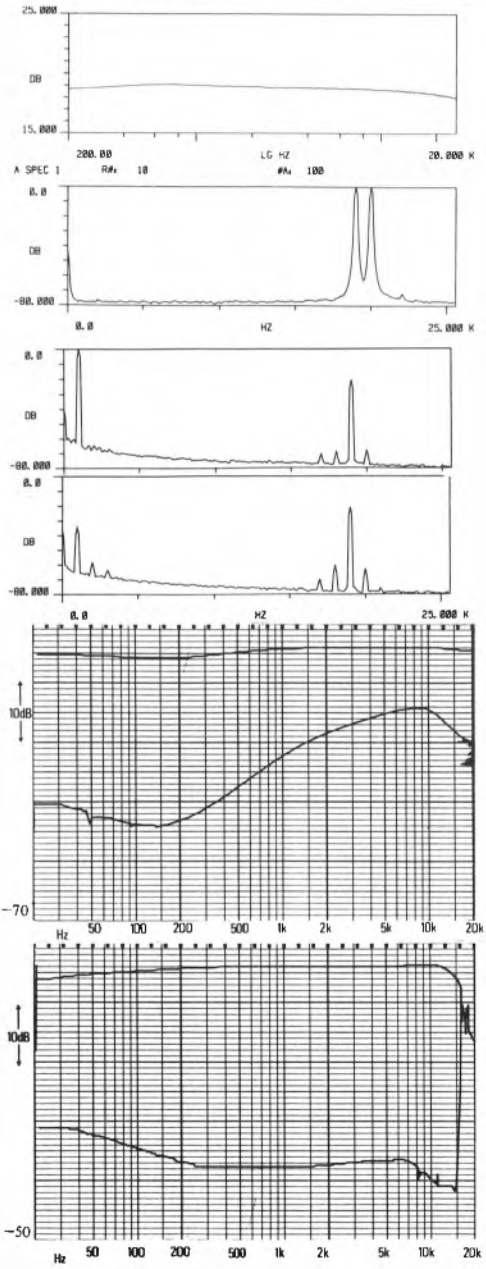
30dB S/N Ratio, mono sensitivity 2.00uV
50dB S/N Ratio, mono/stereo sensitivity 4.00/80uV
IHF 30dB S/N Ratio, mono 5.00uV
Limiting level, −1dB 5.0uV
RFIM 49dB
Capture ratio 1.7dB
Selectivity 70dB
IF rejection 77dB
AM suppression 53dB
Image rejection 51dB

Audio Section

S/N ratio 1mV i/p, mono/stereo 60/57dB
Distortion, mono 20%/100% modulation 0.45/0.90%
Distortion, stereo 20%/100% modulation 0.40/1.00%
Pilot tone suppression ..... −20dB
Crosstalk, 1kHz ..... −38dB

GENERAL

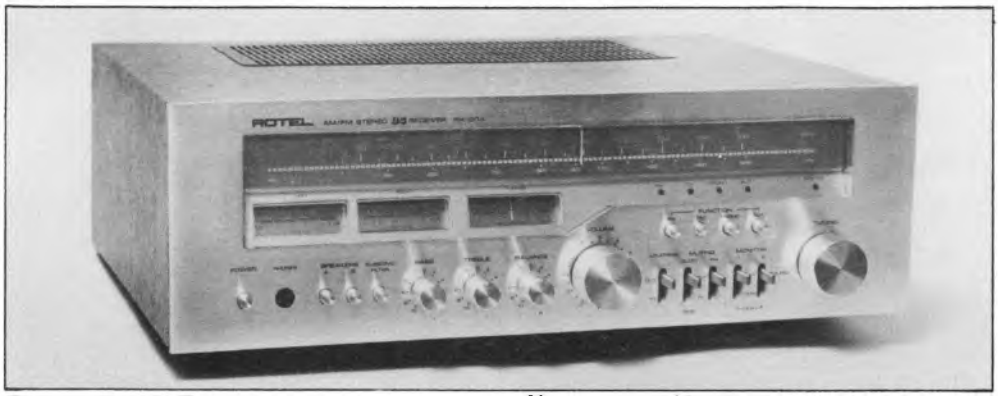
Total size (W x D x H) ..... 17(43) x 15(38) x 3¾(9) in(cm)
Approximate weight 17lb
Typical retail price £140



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)*
1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Rotel RX604

Rotel UK, 2–4 Erica Road, Stacey Bushes, Milton Keynes, Buckinghamshire
Tel: (0908) 317707



Presentation, facilities, etc.
This conventionally styled/sized receiver is surprisingly heavy, which is evidence of a generous power supply. The brushed aluminium fascia has an abundance of switches and indicators, and the unit is mounted within a wooden sleeve case.

The receiver tunes FM and medium wave AM without presets, has an FM muting switch, an indicator for centre-tune on FM and signal strength AM, and a stereo beacon. The amplifier section has two rather rudimentary 'power' meters, switching for loudness, speakers (two) and subsonic filter, −15 dB muting to extend the volume control range, and tape monitoring with 1–2 dub. Standard tone controls are fitted, and input selection is LED indicated. Most inputs are phono apart from Tape 2 which is DIN. Aerial connection is provided for 75 and 300 ohm FM, and external AM to augment the ferrite rod which is fitted within the case (which has the disadvantage that the whole receiver may need to be rotated to get the best AM signal).

Lab performance
With quite generous power for the price, delivery showed a significant difference between single and dual channel drive, but was quite well maintained into low impedances. The disc input showed sufficient frequency response errors to affect audible results, plus a rather over-extended bandwidth (wider than the line input) and highish capacitance for matching some combinations optimally. Other inputs and outputs suggest no problems. Both IM distortion and hum performances were below average.

Very respectable tuner measurements were particularly good on sensitivity and crosstalk, but slightly below average on AM and Image rejection and RFIM.

Subjective impressions
Listening tests were rather inconsistent, giving an overall result a little below average. Favourable comments concerned solidity and general clarity, but with criticism of brightness and some lack of cohesion. FM was considered reasonable though not exceptional, with a rather 'rich' character. In use, stereo/mono switching was missed (the stereo threshold being set too low). AM sounded dull due to a tight and asymmetric IF passband, and was prone to spurious whistles, while the AGC caused 'plops' on strong signal input.

Conclusions
Generally respectable measurements particularly on RF, no serious faults, and quite reasonable though inconsistent listening test results make this model quite close to recommendation, and certainly worth considering, particularly if it is available at 'bargain' end-of-range prices, which we understand may well be the case.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 5Hz–110kHz
Both channels 20Hz/1kHz/20kHz(8 ohms, 0.1% dist) ... 44/44/44 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 59/87/83 Watts
Burst power 1kHz, 8/4/2 ohms ..... 59/95/106 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.2	49k	200pF
Disc MC	—	—	—	
Tuner/aux	Phono	140	22k	
Tape	Phono	140	40k	
Tape	DIN	140	44k	

Disc overload 1kHz 40dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	290	556
Tape	DIN	60	89k
Headphones (8 ohms)	Jack	68	—

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −79dB
Aux ref volume ..... −76dB
Disc ref volume ..... −76dB

Other

Damping factor 66
THD performance ..... good
IMD performance ..... below average
Hum performance ..... below average

TUNER

RF Performance

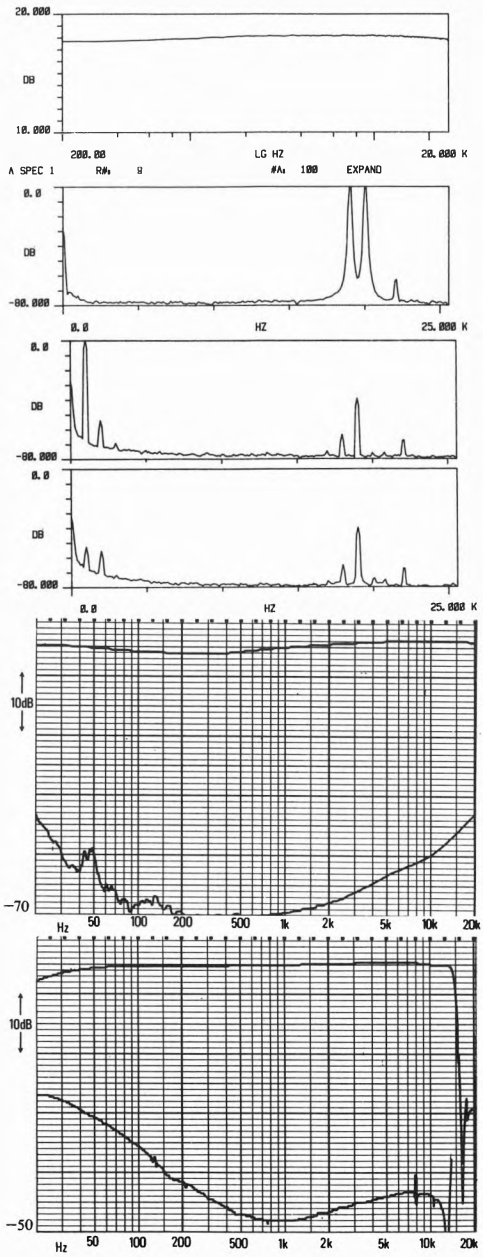
30dB S/N Ratio, mono sensitivity 0.70uV
50dB S/N Ratio, mono/stereo sensitivity 1.25/22uV
IHF 30dB S/N Ratio, mono 1.50uV
Muting level 2.0uV
Limiting level, −1dB 2.0uV
RFIM 59dB
Capture ratio 2.2dB
Selectivity 68dB
IF rejection 93dB
AM suppression 50dB
Image rejection 42dB

Audio Section

S/N ratio 1mV i/p, mono/stereo 70/66dB
Distortion, mono 20%/100% modulation 0.45/0.30%
Distortion, stereo 20%/100% modulation 0.43/0.30%
Pilot tone suppression ..... −42dB
Crosstalk, 1kHz ..... −50dB

GENERAL

Total size (W x D x H) ..... 17(43) x 13½(34) x 5½(14) in(cm)
Approximate weight 23lb
Typical retail price £160

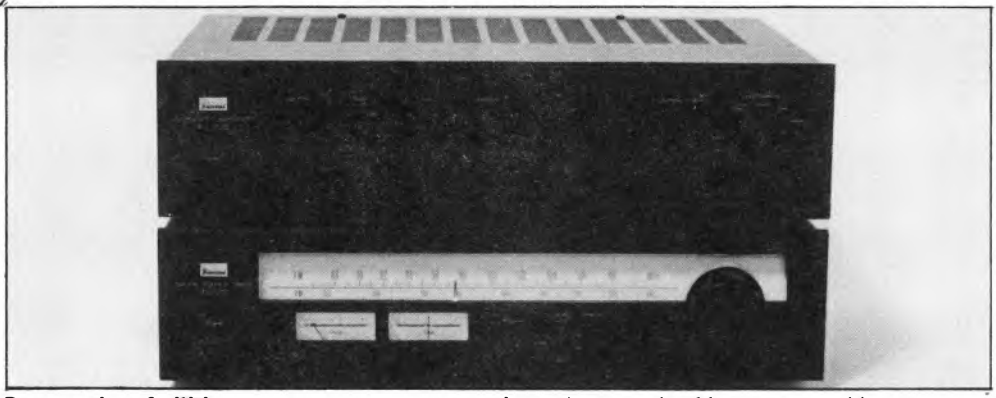


CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)*
1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

BEST BUY

Sansui AU217II/TU217

Sansui UK Ltd., Unit 10A, Lyon Industrial Estate, Rockware Avenue, Greenford, Middlesex UB6 0AA. Tel (01) 573 1133



Presentation, facilities, etc.

Sansui's *217* series has been a firm favourite with *Choice* (and other) reviewers for some time now, receiving recommendation in both *Amplifiers*, and *Stereo Systems*. These are the smallest and cheapest separates in Sansui's 'normal' range, finished in matt black, though the company has since introduced a completely separate range of 'silver' 'budget' models, which we have not assessed.

The tuner is almost identical to the *317* (omitting the high blend function), and has indicators for stereo, centre-tune and signal strength, and switching between stereo-with-muting/mono-without. Aerial terminals match 75 and 300 ohm FM, and provide external AM to supplement the properly pivoted ferrite rod fitted. The surprisingly heavy amplifier has normal tone controls, high filter, and loudness, plus tape monitor and an alternative Disc input with fixed subsonic filtering. Socketry is exclusively phono apart from the front panel headphone jack. In summary, the weight of this plain and simple amplifier suggests that the money has probably been spent inside, where it counts, and as a combination the two items are smart, if a little severe, slim, discrete, and easy to operate.

Lab performance

Reasonable power output for the price, this design showed reasonable 'stiffness' between single and dual channel drive, and performed quite well into low impedances, particularly under 'burst' conditions. The disc input showed a sensibly controlled bandwidth and good capacitance value for matching compatibility, with reasonably flat frequency response and good crosstalk, while the other inputs/outputs should pose no matching problems. Performance parameters were generally average or better.

The tuner parameters were generally average or thereabouts, with the sensitivity and AM rejection below average.

Subjective impressions

Reinforcing our previous findings on the amplifier, the *217*s gave a well above average overall result, with descriptions of tight control and good integration without undue harshness, albeit slightly 'coarse'. The tuner was not rated as highly, but was nevertheless reasonable if a bit noisy. In use, FM showed a slight scale calibration error, with some 'grit' on weak signals and susceptibility to multipath. AM gave a reasonable sound on strong inputs, had average sensitivity and 2nd harmonic pickup on IF on Radio 2, 909kHz, and a peaky IF response before the AGC acted, giving bass-heavy and distorted weak-signal reception; 9kHz whistles may be bothersome at night.

Conclusions

Though the tuner is not particularly 'special', results will be quite reasonable under conditions that are not too demanding, and the amplifier once again confirmed our previous findings and prejudices by proving to be an exceptionally nice sounding model in its price class.

Sansui AU217II/TU217

BEST BUY

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 4Hz–60kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 41/41/41 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 47/68/37 Watts
Burst power 1kHz, 8/4/2 ohms ..... 52/83/107 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	3.0	50k	70pF
Disc MC	—	—	—	
Tuner/aux	Phono	200	150k	
Tape	Phono	210	150k	

Disc overload 1kHz 39dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	260	2k
Headphones (8 ohms)	Jack	100	—

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −83dB
Aux ref volume ..... −74dB
Disc ref volume ..... −75dB

Other

Damping factor 96
THD performance ..... good
IMD performance ..... average
Hum performance ..... average

TUNER

RF Performance

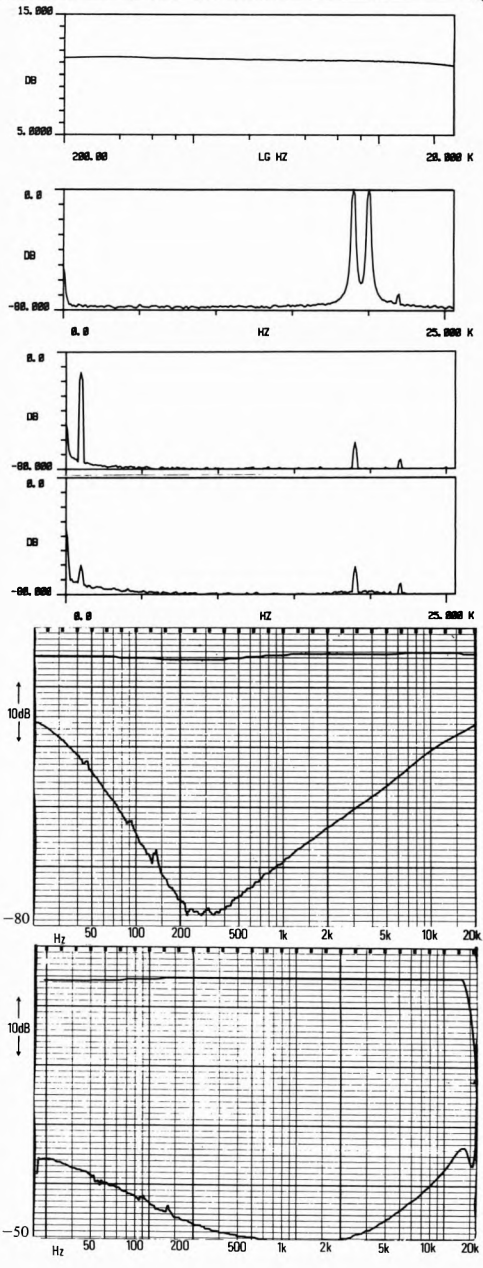
30dB S/N Ratio, mono sensitivity 2.20uV
50dB S/N Ratio, mono/stereo sensitivity 3.50/60uV
IHF 30dB S/N Ratio, mono 3.50uV
Muting level 4.0uV
Limiting level, −1dB 4.0uV
RFIM 54dB
Capture ratio 2.0dB
Selectivity 43dB
IF rejection 85dB
AM suppression 45dB
Image rejection 55dB

Audio Section

S/N ratio 1mV i/p, mono/stereo 74/66dB
Distortion, mono 20%/100% modulation 0.05/0.15%
Distortion, stereo 20%/100% modulation 0.05/0.17%
Pilot tone suppression ..... −47dB
Crosstalk, 1kHz ..... −47dB

GENERAL

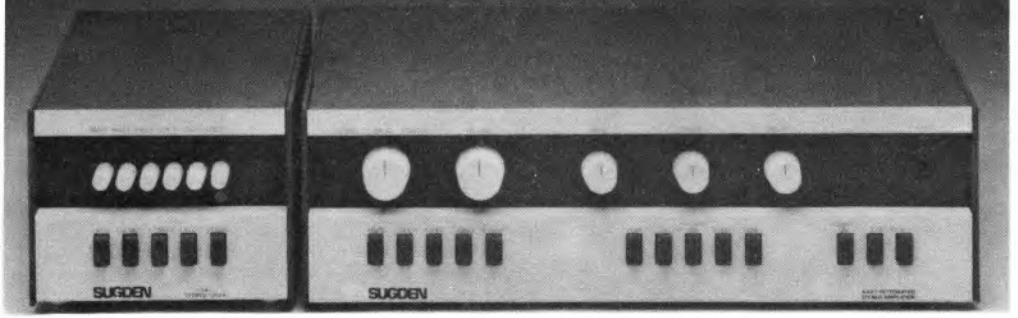
Total size (W x D x H) ..... 17(43) x 13(33) x 8¼(21) in(cm)
Approximate weight 28lb
Typical retail price ..... £121+£107



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

SUGDEN.

INDIVIDUAL & HAND BUILT



You can hardly expect Sugden Hi-Fi to sound anything like mass produced equipment, as indeed, the sound is as individual as its manufacture.

The clear, natural and transparent way in which Sugden equipment allows you to hear into the very heart of the sound being reproduced, is a revelation which few others can offer.

This refreshing experience, one which you will never grow tired of, is a direct result of our philosophy—"Quality above all."

At Sugden we have never forgotten the original meaning of 'manufacture' which means to make by hand.

It is in exactly this way that we still assemble our products, allowing one person to build an individual unit which allows a fierce pride of achievement, impossible in a mass production line, to be kept alive within our walls.

With such an individual approach, is it surprising that Sugden equipment is outstanding in its ability to reproduce sounds faithfully or that we can confidently guarantee our workmanship for life?

J. E. Sugden & Co. Ltd., Carr Street, Cleckheaton, West Yorkshire BD19 5LA. Telephone: Cleckheaton 0274 872501.

To J. E. Sugden & Co. Ltd., Carr Street, Cleckheaton, West Yorkshire BD19 5LA.
Send me the full Sugden story and leaflets on your products.

Name

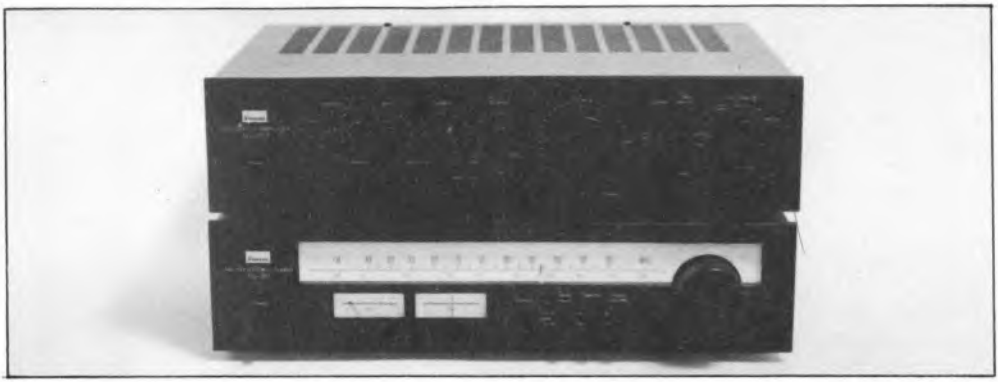
Address

SUGDEN
Individual & Hand Built

The Sugden range consists of the A48 Integrated Amplifier, T48 Stereo Tuner, C51 Control Unit, P51 Amplifier and R51 Stereo Tuner, all of which are built to our no compromise standards.

Sansui AU317II/TU317

Sansui UK Ltd., Unit 10A, Lyon Industrial Estate, Rockware Avenue, Greenford, Middlesex UB6 0AA. Tel (01) 573 1133



Sansui's electronics have acquired an impressive reputation for good sound quality in this and other journals in recent years, the *317* and *217* models being particularly successful, no doubt due to their elegant slim matt black styling, giving a smart but self-effacing appearance.

The tuner operates manually on FM and medium wave AM, with terminals for 75 and 300 ohm FM and external AM aerials; a properly pivoted ferrite for AM is also fitted. Signal strength, centre-tune and stereo indicators are provided, and switches control stereo-with-mute/mono-without, and 'noise canceler' (presumably a 'high blend' to help with noisy stereo signals). The amplifier has a number of useful facilities, including an alternative disc input circuit with built in subsonic filter, and 'defeat' switching on the conventional tone controls; loudness, high filter, and mike mixing *via* a front panel jack are also fitted. Using phono socketry throughout, there is switching between two sets of speakers and a front panel headphone jack. In all, these are neat, compact, solidly built, and easy to use units, with sensibly chosen facilities, which makes their current commercial success easy to appreciate.

The unfortunate timing of 'the theft', and the late submission of these models meant that several different samples were used, and measurements could only be taken on some of the tuner parameters. This showed very close correlation with the *217*, except for sensitivity where each parameter was approximately half as good (or twice as bad), suggesting minor misalignment here. The other parameters showed below average AM and image rejections and above average capture ratio and RFIM.

In the listening tests the *317*s were reasonably well accepted but not as enthusiastically or consistently as the cheaper *217*s, and rated about average overall, with criticism of a rather 'thick', 'muddled' bass quality, plus a slightly 'harsh' HF noted on disc and FM. In use the FM was considered a little lacking in sensitivity and had a scale calibration error but low-level-signal distortion was good, and thresholds sensible. AM was considered reasonable on strong signals, but the IF was 'peaky' before the AGC started to operate, making low-level signals bass-heavy. The second harmonic of the IF will interfere on Radio 2, 909kHz, and 9kHz 'whistles' might be troublesome at night.

We are naturally reluctant to praise or condemn a unit that has only been halfway through the reviewing mill; we considered dropping the review entirely, but on balance decided that limited coverage was more useful than none at all. Despite the 50% increase in power spec. over the *217*s (unchecked, but reflected in the weight), we did not find this combination in the same exalted class subjectively. Nevertheless it remains worth some consideration, assuming that the sensitivity problem was peculiar to the tested sample.

TUNER DATA

30dB S/N Ratio, mono sensitivity	4uV
50dB S/N Ratio, mono/stereo sensitivity	7.5/120uV
IHF 30dB S/N Ratio, mono	6uV
Muting level	5uV
Limiting level, −1dB	5uV
RFIM	61dB
Capture ratio	1.5dB
Selectivity	45dB
IF rejection	100dB
AM suppression	48dB
Image rejection	54dB
S/N ratio 1mV i/p, mono/stereo	75/66dB

RECOMMENDED

Scott 430A/510TL

Scott Hi-Fi, Clement Electronics, Unit 8, Road 3, Winsford Industrial Estate, Winsford, Cheshire. Tel: (06065) 57131

Presentation, facilities, etc.

No-one could accuse Scott of being in the van of fashion on the strength of these models, though they are neatly styled and well-finished, with a sensible control layout, if a little on the bulky side for their modest pretensions. The name Scott is linked with a long tradition of American hi-fi manufacture, but is nowadays basically a marketing operation for Japanese-made products.

The tuner operates on FM, and long and medium wave AM without presetting, and has screw terminals for 300 and 75 ohm and external AM in addition to a rear panel ferrite rod, which is pivoted to permit adequate reorientation. Indicators are fitted for signal strength, centre-tune and stereo, and switching may be made between stereo+muting and mono. The amplifier has phono inputs throughout, DIN-duplicated on Tape 2, and is fitted with normal tone controls. Switching is provided between loudspeakers and headphones, for tape monitoring and 2–1 dubbing, stereo/mono and loudness, while indicators are provided on input selection, together with rather rudimentary power meters. In all, this is a simple combination with conventional specification, to which one's only real objection might be the amount of fresh air within the boxes!

Lab performance

Offering good power output for the price, delivery was also competent, but with early onset of distortion at frequency extremes; single/dual channel differences were reasonable, and likewise delivery into low impedances. The disc input bandwidth was sensibly limited, with the capacitance a little high for optimum matching with some arm/cartridge combinations; other inputs and outputs were quite typical. Hum was rated excellent, but IM distortion performance was well below average.

Tuner performance is best described as monumentally indifferent, with practically all parameters measuring below average or poor, though subjective assessment of a second sample did indicate that some of this was probably due to misalignment.

Subjective impressions

Although rather inconsistent, overall listening test results were nevertheless marginally above average, with general comments relating to a lively full sound (*cf* LF rise on disc frequency response), if rather coarse and lacking subtlety. FM was described as rather bland, bass heavy and slightly sibillant. In use, rather bright lighting did not make the tuning functions very easy to read; though performance was satisfactory with strong signals, sensitivity was fairly low. AM performance was described as 'dreadful', with far too many spurii received *via* the FM downlead.

Conclusions

Good power delivery and reasonable though inconsistent listening test results for the price, with generally competent amplification performance should dictate positive recommendation, though the tuner was disappointing and prevents further confirmation.

Scott 430A/510TL

RECOMMENDED

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 6Hz–47kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 44/57/49 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 63/79/13 Watts
Burst power 1kHz, 8/4/2 ohms ..... 66/116/47 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	3.0	49k	240pF
Disc MC	—	—	—	
Tuner/aux	Phono	190	40k	
Tape	Phono	190	40k	
Tape	DIN	190	40k	

Disc overload 1kHz 36dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	240	4k
Tape	DIN	35	79k
Headphones (8 ohms)	Jack	80	—

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −82dB
Aux ref volume ..... −72dB
Disc ref volume ..... −75dB

Other

Damping factor 55
THD performance ..... good
IMD performance ..... well below average
Hum performance ..... excellent

TUNER

RF Performance

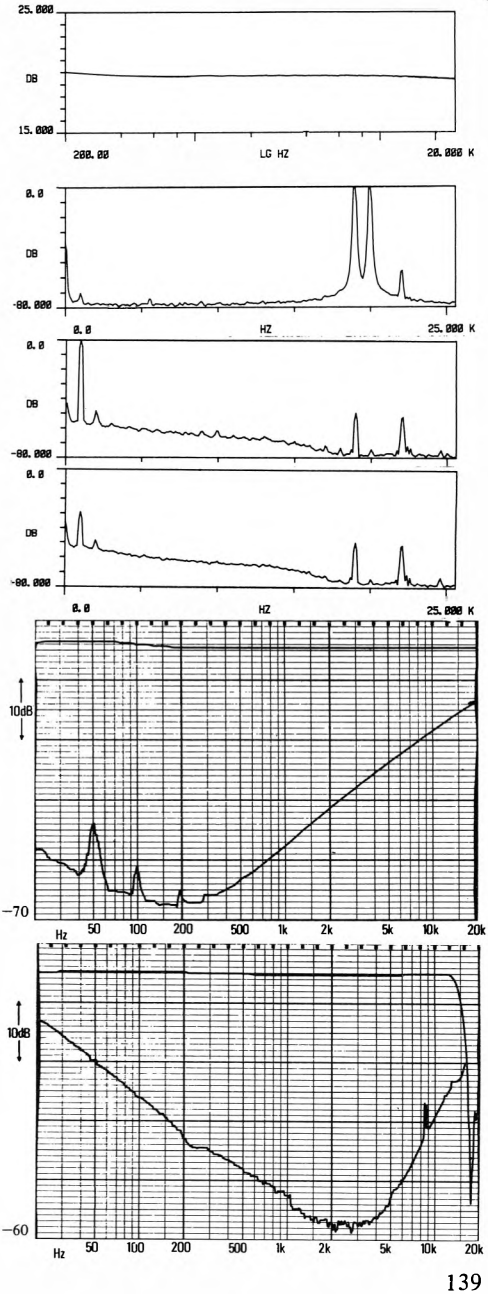
30dB S/N Ratio, mono sensitivity 7.00uV
50dB S/N Ratio, mono/stereo sensitivity 10.00/125uV
IHF 30dB S/N Ratio, mono 12.50uV
Muting level 12.5uV
Limiting level, −1dB 12.5uV
RFIM 51dB
Capture ratio 4.0dB
Selectivity 30dB
IF rejection 90dB
AM suppression 64dB
Image rejection 44dB

Audio Section

S/N ratio 1mV i/p, mono/stereo 73/64dB
Distortion, stereo 20% modulation 0.50%
Pilot tone suppression ..... −46dB
Crosstalk, 1kHz ..... −30dB

GENERAL

Total size (W x D x H) ..... 17(44) x 11(28) x 13(33) in(cm)
Approximate weight 20lb
Typical retail price ..... £90+£65

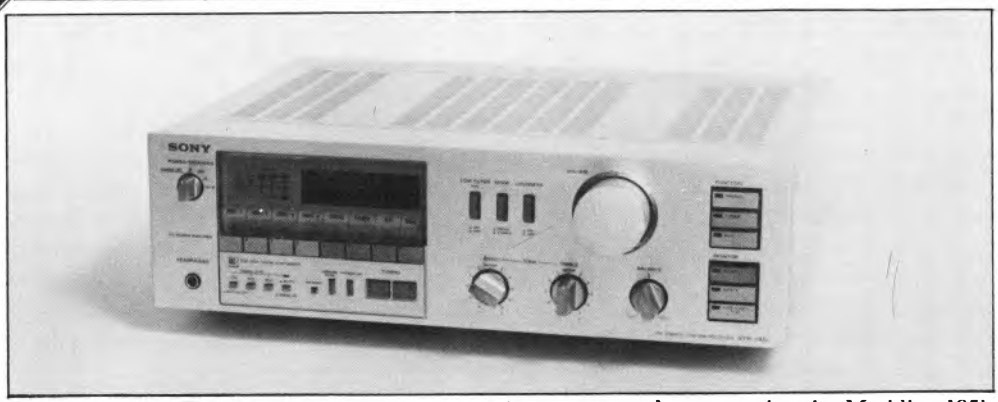


CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

RECOMMENDED

Sony STR-V45L

Sony UK Ltd., 134 Regent Street, London W1
Tel: (01) 439 3874



Presentation, facilities, etc.

The 'smaller' of two models in Sony's new receiver range, the *'45L* is in fact heavier than the *'55* because it uses a conventional power supply instead of Sony's switching type, though both are housed in the same case. Though conventional in size, the ergonomics have perhaps been designed better than usual by mounting all the tuner functions on a fascia 'sub-panel', similar in size to that usually found on cassette decks for the transport systems.

Operating on FM and medium and long wave AM, the tuner has eight presets and a digital display, plus a variety of electronically automated push-button operated functions. Quartz-locking should ensure accurate tuning, and signal strength and stereo indicators are fitted. Terminals match 300 and 75 ohm FM and external long and medium wave AM aerials, to supplement the pivoted AM ferrite fitted. Amplifier input socketry is entirely phono, apart from the front panel headphone jack and the two sets of switchable speaker terminals. The conventional tone controls have a centre position labelled 'defeat', and switching controls loudness, subsonic filter, stereo/mono, tape monitor and 1–2 dubbing. Ergonomically well laid out, the tuning presets *et al* should be particularly useful once one has mastered the electronic control functions.

Lab performance

Reasonable power output for the price showed quite a small single/dual channel power difference, but delivery into low impedances was heavily curtailed, and there was unusually no reserve on 'burst' (in this respect the amplifier behaved as a 'current source', compared to the *Meridian 105*'s near 'voltage source' performance). The disc input had sensible capacitance and bandwidth limiting, plus a noticeable lower-mid suckout; other other inputs/outputs were fine. Harmonic and IM distortion performances were excellent, and hum average.

The tuner measurements were an odd mix, though sensible nonetheless, with ultimate sensitivity below average, but the more useful '50dB stereo' above average. Pilot tone suppression and RFIM were excellent, the AM rejection and capture ratio below average.

Subjective impressions

We considered this to be the best of the Sonys under audition, and it scored a slightly inconsistent though overall slightly above average overall result, considered clean, clear and controlled, but with a rather 'detached', 'lumpy' bass, and slight midband coloration. FM was considered a bit muddled but nevertheless quite good, and again a little coloured. In use, the FM section was well liked and for a 'digital' quite easy to grasp, though the display did not quite match up to minimum distortion points and a tuning 'steering' indicator would have been useful. AM IF had a narrow 'nose' and poor 'skirt', so the above average sensitivity was marred by the usual 'dull' sound, though distortion was very reasonable.

Conclusions

Attractive useful ergonomics, reasonable listening test findings, and generally good though occasionally odd technical results suggest that this model deserves recommendation at its reasonable price.

Sony STR-V45L

RECOMMENDED

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	4Hz–59kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	53/58/56 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	64/32/13 Watts
Burst power 1kHz, 8/4/2 ohms	64/32/13 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.6	45k	120pF
Disc MC	—	—	—	
Tuner/aux	Phono	150	46k	
Tape	Phono	150	46k	

Disc overload 1kHz 37dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	165	7k
Headphones (8 ohms)	Jack	48	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−80dB
Aux ref volume	−74dB
Disc ref volume	−75dB

Other

Damping factor	44
THD performance	excellent
IMD performance	excellent
Hum performance	average

TUNER

RF Performance

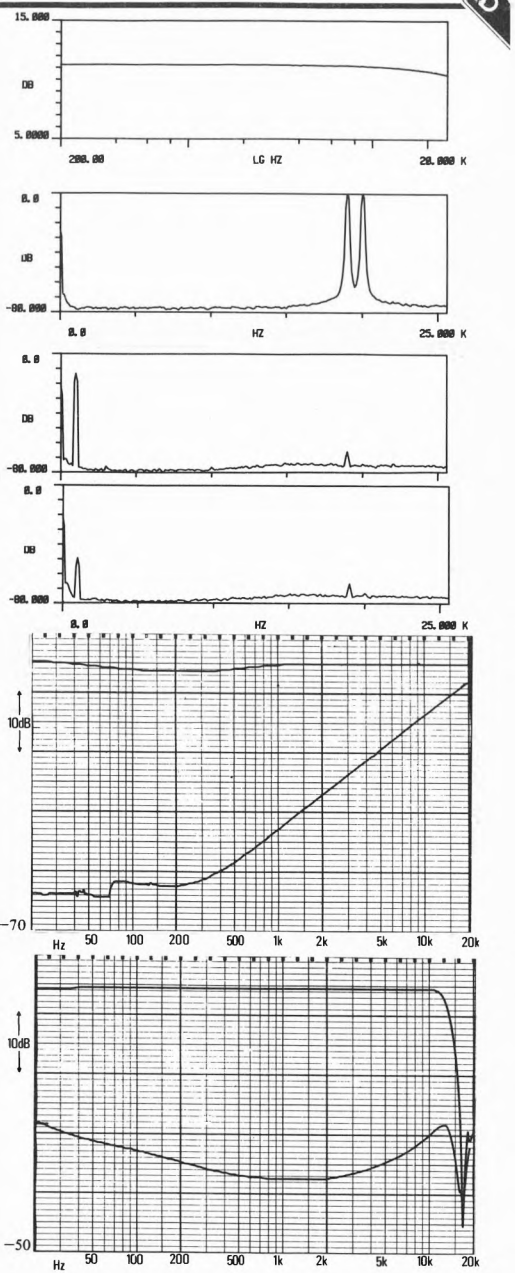
30dB S/N Ratio, mono sensitivity	2.50uV
50dB S/N Ratio, mono/stereo sensitivity	3.50/30uV
IHF 30dB S/N Ratio, mono	2.50uV
Muting level	4.0uV
Limiting level, −1dB	3.0uV
RFIM	75dB
Capture ratio	3.0dB
Selectivity	76dB
IF rejection	89dB
AM suppression	47dB
Image rejection	83dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	74/70dB
Distortion, mono 20%/100% modulation	0.07/0.26%
Distortion, stereo 20%/100% modulation	0.08/0.45%
Pilot tone suppression	−51dB
Crosstalk, 1kHz	−37dB

GENERAL

Total size (W x D x H)	17(43) x 16½(42) x 5(13) in(cm)
Approximate weight	18lb
Typical retail price	£230



CAPTIONS *(1–6 top to bottom rt. handcolumn, all at 1 watt/8 ohms)*
1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Sony STR-V55

Sony UK Ltd., 134 Regent Street, London W1
Tel: (01) 439 3874

Presentation, facilities, etc.

Slightly lighter than its 'junior' brother the *V45L*, this is accounted for by the pulse power supply system adopted by Sony on their more expensive models. Both receivers tested use the same basic chassis and control layout, wherein the tuner functions are conveniently confined to a separate sub-panel, about the same size and location as that providing the transport mechanism on a cassette deck, which is a rather neat touch visually.

Operating on FM and medium wave AM only, aerial terminals are provided for 75 and 300 ohm FM and external AM, while a properly pivoted AM ferrite is also provided. The rather garish indicators include a digital frequency display, stereo beacon, and a curiously-shaped signal strength display, Three modes of tuning are provided, including eight presets, electronic manual and automatic scanning, this last stopping at received stations according to a threshold selector which cancels the muting on its lowest setting. Though clever, the operating functions are perhaps a trifle too complex for easiest use. The amplifier has conventional tone controls with the centre position labelled 'defeat', and switches for loudness, low filter, mono/stereo and audio muting. Provision for m-c cartridges, tape monitoring and cross-dubbing and speaker selection is also made. Socketry is phono throughout, with a front panel headphone jack. In summary, a neat, attractive but rather complex receiver, that remains relatively easy to operate, and possesses some useful facilities.

Lab performance

Offering good power output for the price, like the *'V45* the delivery pattern showed fairly well controlled single/dual channel differences, but was rather limited in its ability to drive low impedances. The disc input shows a similar frequency response error, and again a well-controlled bandwidth, but the 250pF input capacitance will be too high for the optimum matching of some cartridges. Other inputs/outputs should pose no problems. Hum was excellent, but IM distortion performance only average.

The tuner section recorded very similar results to the *'45*, returning slightly better figures for AM suppression and capture ratio, and again excellent RFIM and pilot tone suppression, but below average sensitivity.

Subjective impressions

Listening tests placed the *'V55* a little below average, and it was not quite as well received as its cheaper 'twin', mainly because it was liked less at higher levels, where it was described as 'thickened' and 'woolly', while attempts to drive it fairly hard (on a 'difficult' load to be sure) caused the protection circuitry to operate (which didn't happen with the *'V45*). FM was described as a little 'thin' sounding, with some brashness. This was generally one of the easier digitals to master, though the extra 'preset display' is really just another button, and a tuning 'steering' indicator was missed. AM was again a little better than average, but dull sounding.

Conclusions

Once again this is an attractive receiver with good

ergonomics and generally respectable behaviour, but with a slightly unusual balance of strengths and weaknesses. In fact the *'V45* receives our recommendation, being marginally preferred and cheaper, but the *'V55* remains worth considering, providing careful choice of loudspeakers is made.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	4Hz–53kHz
Both channels20Hz/1kHz/20kHz(8 ohms, 0.1% dist)	71/78/77 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	85/53/— Watts
Burst power 1kHz, 8/4/2 ohms	101/102/19 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.9	46k	250pF
Disc MC	Phono	0.2	120	
Tuner/aux	Phono	170	40k	
Tape	Phono	170	45k	

Disc overload 1kHz 32dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	190	6k
Headphones (8 ohms)	Jack	46	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−81dB
Aux ref volume	−72dB
Disc ref volume	−73dB

Other

Damping factor	48
THD performance	good
IMD performance	average
Hum performance	excellent

TUNER

RF Performance

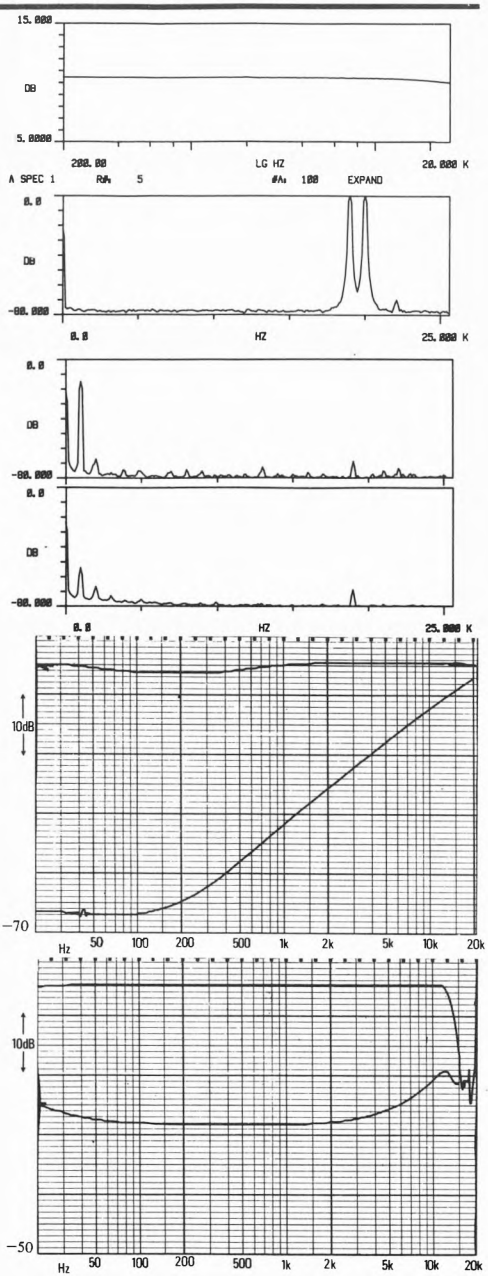
30dB S/N Ratio, mono sensitivity	2.50uV
50dB S/N Ratio, mono/stereo sensitivity	3.75/40uV
IHF 30dB S/N Ratio, mono	2.50uV
Muting level	4.0uV
Limiting level, −1dB	2.0uV
RFIM	77dB
Capture ratio	2.2dB
Selectivity	75dB
IF rejection	81dB
AM suppression	56dB
Image rejection	76dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	74/69dB
Distortion, mono 20%/100% modulation	0.10/0.24%
Distortion, stereo 20%/100% modulation	0.45/0.26%
Pilot tone suppression	−53dB
Crosstalk, 1kHz	−40dB

GENERAL

Total size (W x D x H)	17(43) x 16½(42) x 5(13) in(cm)
Approximate weight	15lb
Typical retail price	£255



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Sony TA-F35/ST-A35L

Sony UK Ltd., 134 Regent Street, London W1
Tel: (01) 439 3874

Presentation, facilities, etc.

These brand new slimline separates are beautifully made, though perhaps a little 'busy' with lots of knobs and lighted displays. However the ergonomics have clearly received attention, and the units are easy to use despite the variety of options. Considering that they are close to the bottom of Sony's extensive range, their quite elaborate facility provision is perhaps a little surprising.

The tuner operates manually on FM and long and medium wave AM, with 75 and 300 ohm FM and external AM terminals, together with a properly pivoted ferrite rod for local AM work. Indicators are provided for signal strength, stereo and (servo-locked) centre-tune, while switching operates muting on stereo at two thresholds, 'high-blend' and 'rec cal'. The amplifier has 'power' indicators, conventional tone controls labelled 'defeat' at their centre positions, and switching for speakers, loudness, low filter, and a head-amp for m-c cartridges. Socketry is phono throughout apart from the front panel headphone jack. In summary these are neat and attractive units with unusually good facilities for their expected prices, the head-amp provision being particularly unusual and potentially useful on such a modestly priced amplifier.

Lab performance

The quite generous power output showed a significant single/dual channel drive difference, and appeared to give reasonable delivery into lower impedances, though this was not confirmed subjectively (see later), and in practice measurements were made with some difficulty. The disc input bandwidth is too wide, the frequency response showing a slight though significant deviation from 'flat', but the capacitance is well chosen; the 0.2uV m-c sensitivity is on the low side for a number of such cartridges, but other inputs/outputs should pose no problems. Performance parameters were very good – indeed excellent on IM distortion.

The tuner showed slightly poorer sensitivity, capture ratio and RFIM results than the other Sony models, but was nevertheless quite satisfactory, and had good pilot tone suppression.

Subjective impressions

These were not entirely consistent and below average overall, one panel's quite favourable reactions being marred by the over-exuberant protection circuitry; generally it was felt that this combination had a pleasant though rather 'soft' and 'veiled' sound quality, with slightly 'detached' bass. FM was considered well-controlled with similar characteristics. In use, a minor scale calibration error was noted, and slight IF asymmetry, but reasonable results obtained on reasonable signals. AM was disliked because of heavy distortion on strong inputs.

Conclusions

Loudspeaker matching needs some care to exploit these designs to the full, and while our findings were by no means poor, they were insufficiently exceptional for recommendation to be made.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	3Hz–147kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	53/59/56 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	72/77/33 Watts
Burst power 1kHz, 8/4/2 ohms	93/116/82 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	3.0	50k	100pF
Disc MC	Phono	0.2	100	
Tuner/aux	Phono	200	100k	
Tape	Phono	200	100k	

Disc overload 1kHz	34dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	190	6k
Headphones (8 ohms)	Jack	45	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−83dB
Aux ref volume	−77dB
Disc ref volume	−79dB

Other

Damping factor	48
THD performance	good
IMD performance	excellent
Hum performance	good

TUNER

RF Performance

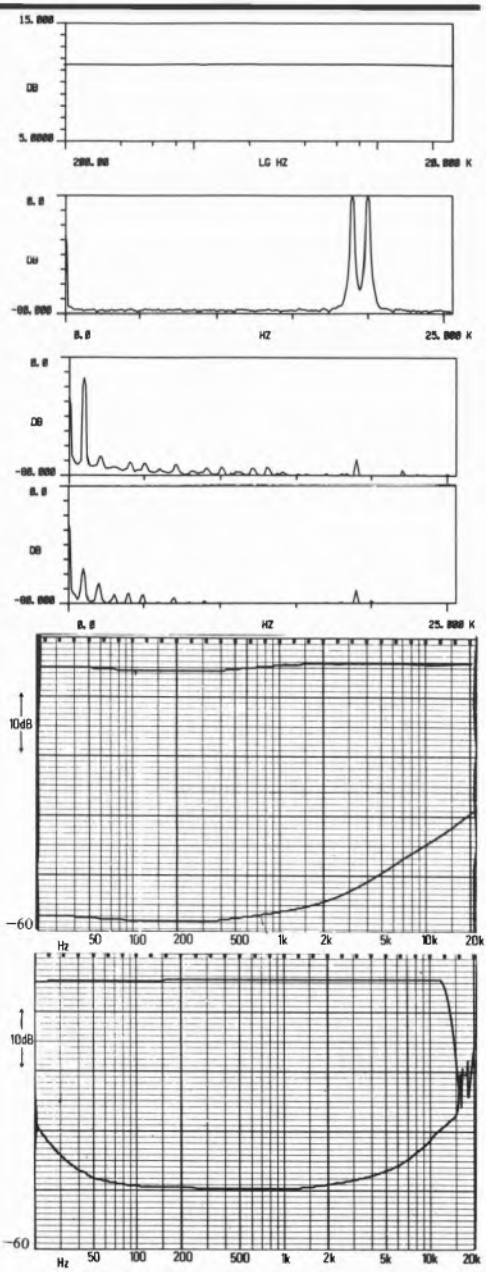
30dB S/N Ratio, mono sensitivity	3.50uV
50dB S/N Ratio, mono/stereo sensitivity	5.00/65uV
IHF 30dB S/N Ratio, mono	6.00uV
Muting level	7.5uV
Limiting level, −1dB	3.5uV
RFIM	55dB
Capture ratio	4.2dB
Selectivity	80dB
IF rejection	100dB
AM suppression	58dB
Image rejection	100dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	75/71dB
Distortion, mono 20%/100% modulation	0.08/0.24%
Distortion, stereo 20%/100% modulation	0.24/0.24%
Pilot tone suppression	−55dB
Crosstalk, 1kHz	−43dB

GENERAL

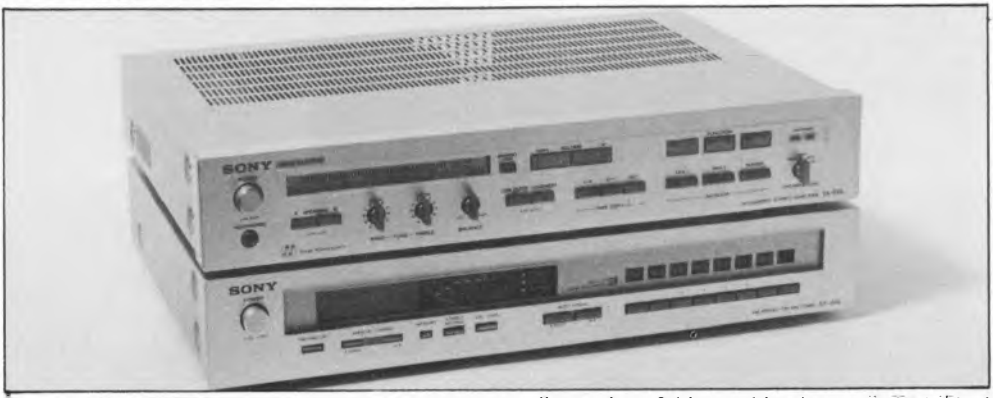
Total size (W x D x H)	17(43) x 14½(37) x 6(15) in(cm)
Approximate weight	23lb
Typical retail price	£115+£105



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)*
1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Sony TA-F55/ST-J55L

Sony UK Ltd., 134 Regent Street, London W1
Tel: (01) 439 3874



Presentation, facilities, etc.

These two elegant slimline components are heavily electronic in terms of their operating functions, even to the replacement of the traditional volume control by up/down push-buttons with an associated indicator scale. Curiously they are lighter than the lower specification '45 separates, but this is due to their use of Sony's switching-type power supply.

The tuner operates on FM and medium and long wave AM, with eight presets and a variety of auto-seeking/scanning operations. Indicators are provided for signal strength, stereo, 'cal tone' (for presetting cassette deck record levels), and muting, while accurate tuning is assured by quartz-locking. Aerial terminals cover 300 and 75 ohm FM plus long and medium wave externals to supplement the properly pivoted ferrite provided. With its predominantly push-button operation the amplifier matches the tuner well visually. It has normal tone controls labelled 'defeat' at their centre points, a four-position cartridge matching switch offering two different capacitances for m-ms and two impedances for m-cs, plus speaker selection, loudness and low filter. The stepped electronic volume control naturally requires some visual indication of its state, and this is provided by an LED scale. Socketry is exclusively phono apart from the front panel headphone jack. Though highly elegant, the amplifier was found less easy to operate than the tuner, though this is probably largely a matter of acquiring the right habits; the controls were logically ordered, and the cartridge matching facility in particular deserves praise.

Lab performance

Nominal power output is quite generous at the medium price of this combination, and single/dual channel differences are fairly slight, but the delivery into low impedances is quite severely constrained, despite a reasonable 4 ohm 'burst' figure, which would suggest that the protection might have been mis-set too 'hard' on our early production samples. Disc input bandwidth was rather wide, and the same frequency response error noted on other Sony models was measured. The 180/350pF capacitance option may be useful, but is still on the high side, while the m-c sensitivity is rather low (though the impedance matching option will be of some assistance). Performance parameters were generally good.

Similar to the other Sonys, sensitivity, capture ratio and AM rejection were a little below average, but RFIM, crosstalk and pilot tone suppression were very good.

Subjective impressions

Marred again by the activities of the protection circuitry, which we hope may not be entirely representative, results were below average, with quite pleasant rendition at low levels, but generally a rather 'small' sound, lacking 'weight', with some 'muddling' and a 'light' balance. In use the tuner was liked, with reasonable sensitivity and good 'birdies' rejection, though a tuning 'steering' indicator would have been appreciated. AM results were rather indifferent with 'tight' bandwidth, low distortion and average sensitivity.

Conclusions

The rather good pre-amp and generally very acceptable tuner were marred by the behaviour of the power amplifier into low impedances; with

careful speaker selection quite good results should be possible.

AMPLIFIER

Power

Bandwidth (−3 dB ref max power, disc)	3 Hz–93 kHz
Both channels 20 Hz/1 kHz/20 kHz (8 ohms, 0.1% dist)	74/76/74 Watts
Single channel 8/4/2 ohms (1 kHz, 0.1% dist)	81/26/4 Watts
Burst power 1 kHz, 8/4/2 ohms	81/131/29 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.7	47k	Var
Disc MC	Phono	0.2	Var	
Tuner/aux	Phono	170	37k	
Tape	Phono	170	50k	

Disc overload 1 kHz	34 dB

Outputs (5 mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	200	6k
Headphones (8 ohms)	Jack	48	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−85 dB
Aux ref volume	−76 dB
Disc ref volume	−76 dB

Other

Damping factor	38
THD performance	good
IMD performance	above average
Hum performance	good

TUNER

RF Performance

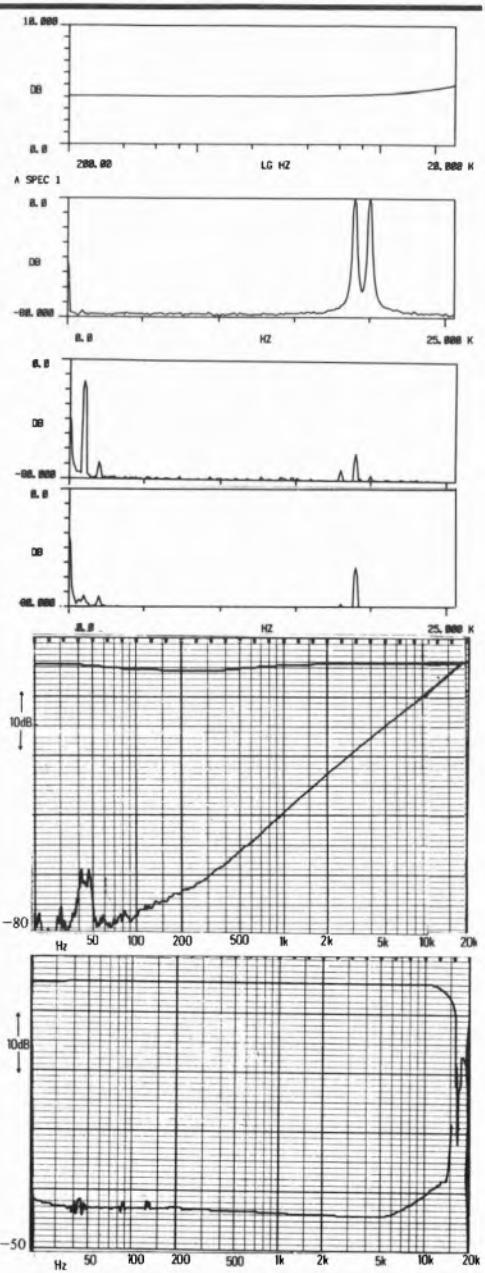
30dB S/N Ratio, mono sensitivity	2.50uV
50dB S/N Ratio, mono/stereo sensitivity	8.00/30uV
IHF 30dB S/N Ratio, mono	3.50uV
Muting level	1.5uV
Limiting level, −1dB	3.5uV
RFIM	78 dB
Capture ratio	3.0dB
Selectivity	80dB
IF rejection	88 dB
AM suppression	51dB
Image rejection	79dB

Audio Section

S/N ratio 1 mV i/p, mono/stereo	74/70dB
Distortion, mono 20%/100% modulation	0.17/0.24%
Distortion, stereo 20%/100% modulation	0.19/0.24%
Pilot tone suppression	−49 dB
Crosstalk, 1 kHz	−60dB

GENERAL

Total size (W x D x H)	17(43) x 14½(37) x 6(15) in(cm)
Approximate weight	19lb
Typical retail price	£170+£150

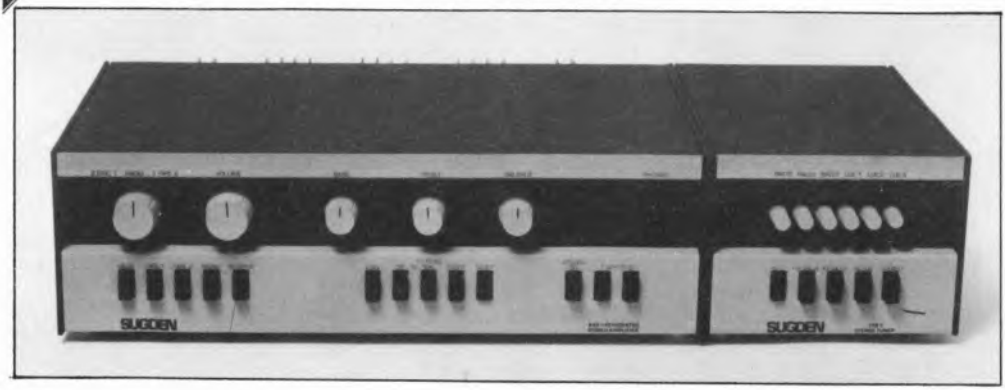


CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

RECOMMENDED

Sugden A48II/T48II

J. E. Sugden and Co. Ltd., Carr Street, Cleckheaton, West Yorkshire BD19 5LA
Tel: (0274) 872501



Presentation, facilities, etc.

One might be forgiven for an Oldenberg-inspired shock when first seeing this unusually styled combination from the well established Yorkshire firm: "It looks furry" being one reaction. In fact, the exterior is in the very durable Nextel finish, which has a suede-like appearance; the lack of reflections and tastefully chosen two-tone brown makes this an appropriately well-domesticated product. Construction is reassuringly 'solid', though placed side by side (the obvious configuration), the units will take up a fair amount of shelving.

The FM-only tuner uses six rotating push-buttons for preset station selection, the only indicator being a stereo beacon (though rear sockets enable a multi-meter to be connected to assist accurate tuning). Different push-buttons operate the other functions, but their rather unusual nomenclature may take a little getting used to: the 'mute' button merely cancels the output; 'squelch'; operates interstation muting; 'filter' is a 'high-blend' facility; AFC and stereo/mono are also provided. A 75 ohm socket and 300 ohm terminals are provided. The amplifier feeds two sets of switchable speakers and a headphone jack, with inputs on DIN socketry including three sensitivity positions for disc. Traditional tone controls are supplemented by switches for stereo/mono, mode, tape monitoring and cross-dubbing, loudness (labelled 'quiet'), low and high filters, the latter being particularly comprehensive, with six alternatives. In summary, this is an interesting and refreshingly domestic design, soundly constructed, and with plentiful facilities.

Lab performance

The modest power output for the price is perhaps explained by the 'solidity' of delivery, with no difference between single and dual channel outputs, and with reasonable delivery into low impedances (the HF constriction being distortion limited, and not serious). The disc input bandwidth is well constrained, frequency response reasonable, though impedance and capacitance resisted our measure (findings in *Amplifiers* suggesting no problems). The DIN socketry is best used as such. Performance parameters were average, with hum excellent.

The tuner showed (possibly unrealistically) high sensitivity, but below average AM rejection, capture ratio and crosstalk; generally rather good results were found overall.

Subjective impressions

Steadily above average listening test results were recorded, with common descriptions of a smooth, powerful sound, with good 'integration', but a little 'gentle', and perhaps slightly fatiguing when loud. The tuner was felt to sound well above average, a little 'bright' but with good perspectives and coherence, and very gentle noise. The absence of a tuning scale might give some qualms, but our 'enthusiast' consultant found this tuner a joy to use, with good performance and sound quality, and nice muting circuitry, though the thresholds were set a little low.

Conclusions

With decor that is attractive to live with and generally good ergonomics and facilities, the respectable sound quality and technical performance give reassurance that implies recommenda-

RECOMMEND

tion. A built-in head-amp would have been a useful addition.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	21Hz–30kHz
Bothchannels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	41/41/34 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	41/52/60 Watts
Burst power 1kHz, 8/4/2 ohms	52/78/90 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	DIN	Var	?	?
Disc MC	—	—	—	
Tuner/aux	DIN	170	150k	
Tape	DIN	170	150k	

Disc overload 1kHz 31dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	DIN	100	46k
Headphones (8 ohms)	Jack	50	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−75dB
Aux ref volume	−71dB
Disc ref volume	−74dB

Other

Damping factor	52
THD performance	average
IMD performance	average
Hum performance	excellent

TUNER

RF Performance

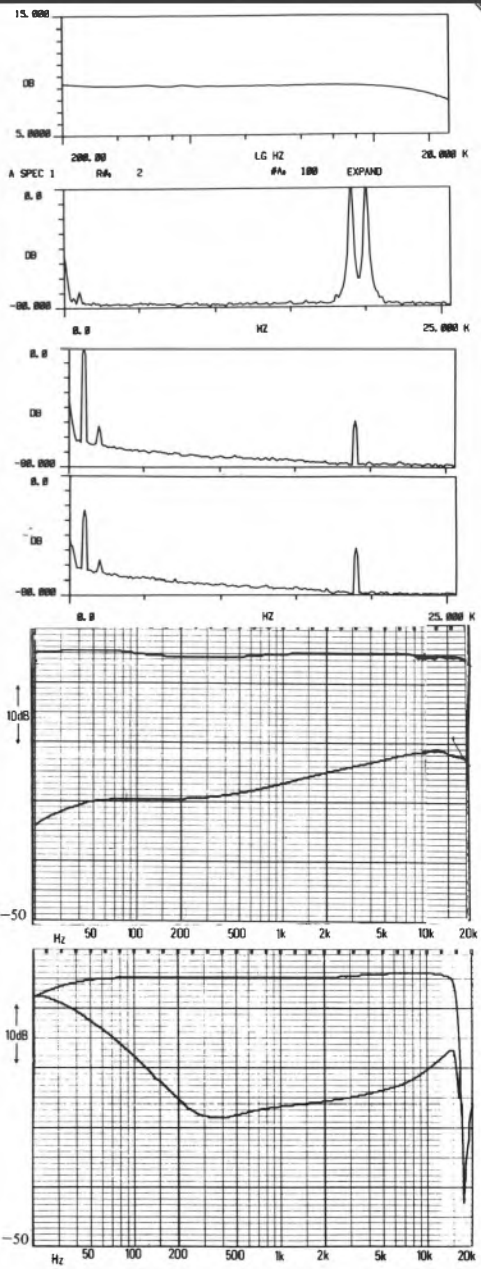
30dB S/N Ratio, mono sensitivity	0.50uV
50dB S/N Ratio, mono/stereo sensitivity	2.00/22uV
IHF 30dB S/N Ratio, mono	1.50uV
Muting level	2.0uV
Limiting level, −1dB	1.5uV
RFIM	57dB
Capture ratio	4.0dB
Selectivity	45dB
IF rejection	71dB
AM suppression	50dB
Image rejection	110dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	70/66dB
Distortion, mono 20%/100% modulation	0.10/0.30%
Distortion, stereo 20%/100% modulation	0.17/0.70%
Pilot tone suppression	−47dB
Crosstalk, 1kHz	−22dB

GENERAL

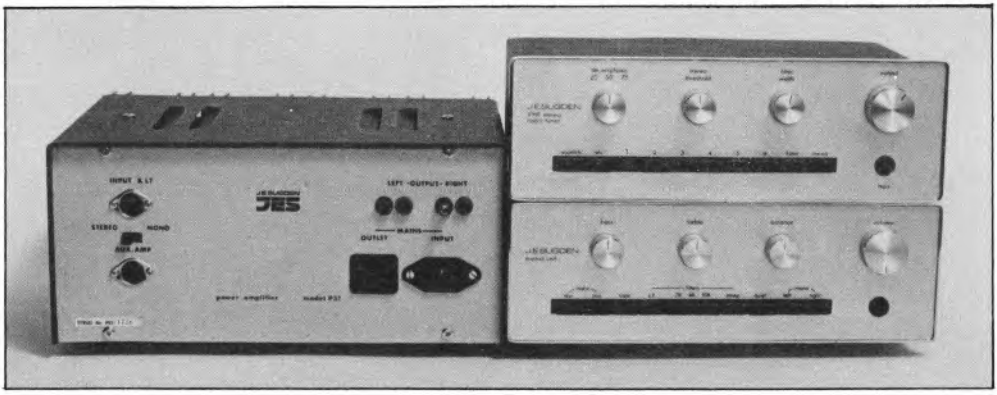
Total size (W x D x H)	22¾(57) x 11½(29) x 5(13) in(cm)*
Approximate weight	31lb
Typical retail price	£250+£150



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Sugden C51/P51/R51

J. E. Sugden and Co. Ltd., Carr Street, Cleckheaton, West Yorkshire BD19 5LA
Tel: (0274) 872501



Presentation, facilities, etc.

This traditional, indeed quite old fashioned looking separates combination has been available in more or less the same overall format, though with continuous technical updating, for a decade or so, and yet it remains a neat and attractive solution to installations where the power amp can be tucked out of sight in a well-ventilated cabinet. The pre-amp and tuner are supplied with brackets for panel mounting, and with alternative self-adhesive feet. Any item may of course be used with other components if desired, and in combination are switched on from the pre-amp.

The FM-only tuner uses six back panel screwdriver-operated presets only for tuning, which could be rather inconvenient in a console site, and the only indicator provided is a stereo beacon, though rear sockets enable a multimeter to be connected. The otherwise comprehensive facilities include variable output, de-emphasis, degree of high-blend ('filter'), and stereo threshold, and switching for 'squelch' (muting), AFC, high-blend ('filter'), and stereo/mono; a 75 ohm socket and 300 ohm aerial terminals are provided. The pre-amp has rather complex input switching, which permits very flexible operation with both phono and DIN sockets, but takes a little learning; the instruction booklet details how disc sensitivities and equalisation may be modified. The traditional tone controls are supplemented by loudness, low and high filters (the latter having six alternative positions), plus mode switching. In summary, this is a highly flexible, compact, if slightly quaint design, though the visual and function layout makes operating a little complex.

Lab performance

With a slight power increase over the *A48* and similarly good delivery patterns, the *'51* remains on the expensive side, but shows good inter-channel 'stiffness' and competent delivery into low impedances. Disc input bandwidth was well constrained, but with a frequency response that will probably cause some coloration; we could not establish the capacitance loading, and the overload margin was lower than most. Inputs and outputs permit phono or DIN interconnection. Performance parameters were average, but with below average hum contrasting with the excellent result obtained on the *'48*, and a lowish damping factor.

The tuner measured very well throughout, with a slightly 'bright' sloping frequency response.

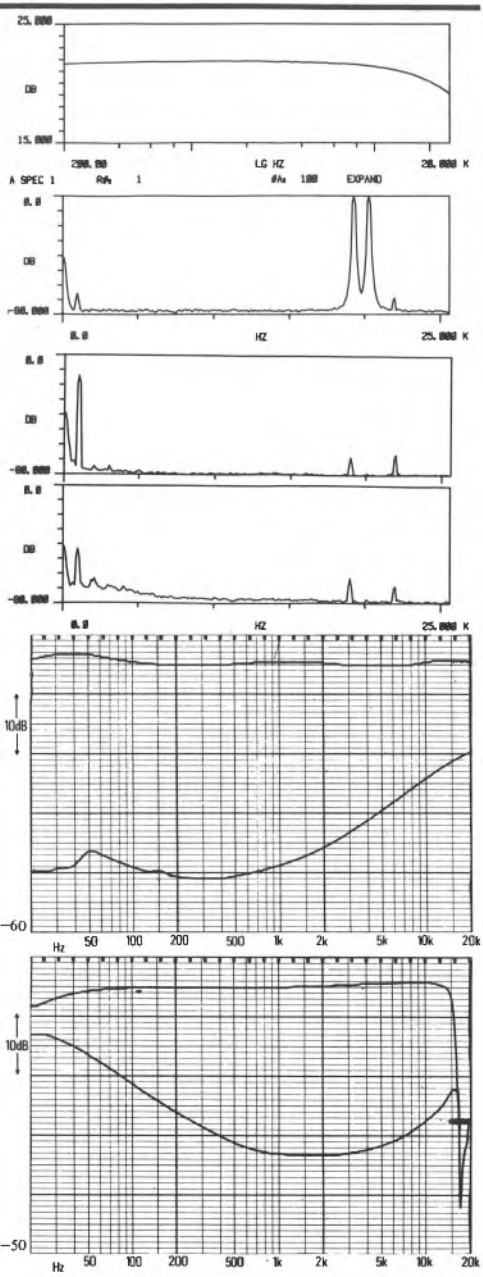
Subjective impressions

Fractionally better overall results than for the *A48* placed this combination comfortably above average, and in comparison with its stablemate it was considered rather more coloured and untidy, but also more detailed and 'livelier', with well-liked treble characteristics. FM was considered good, again in the treble and in terms of 'dynamics'. In use the performance was quite liked, again with praise for the muting circuitry, but with criticism of an excessive holding range on the AFC, which needed to be disabled when changing preselect channels to make sure of getting the right station. The power amp heat sinks became rather hot.

Conclusions

On balance this combination was considered roughly on a par with the rather cheaper *A48/T48*, and the idiosyncratic styling would appear to suit

rather specialised applications, so we feel that the design remains worth considering rather than meriting firm recommendation.



AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 17Hz–27kHz
Bothchannels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 46/50/44 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 51/69/71 Watts
Burst power 1kHz, 8/4/2 ohms ..... 56/85/100 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Both	2.9	47k	?
Disc MC	—	—	—	
Tuner/aux	Phono	200	150k	
Tape	Both	210	150k	

Disc overload 1kHz 25dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	DIN	345	200
Tape	DIN	16	31k

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −73dB
Aux ref volume ..... −70dB
Disc ref volume ..... −73dB

Other

Damping factor 23
THD performance ..... average
IMD performance ..... below average
Hum performance ..... below average

TUNER

RF Performance

30dB S/N Ratio, mono sensitivity 0.90uV
50dB S/N Ratio, mono/stereo sensitivity 2.50/25uV
IHF 30dB S/N Ratio, mono 1.50uV
Muting level 1.3uV
Limiting level, −1dB 1.5uV
RFIM 62dB
Capture ratio 1.0dB
Selectivity 50dB
IF rejection 82dB
AM suppression 55dB
Image rejection 110dB

Audio Section

S/N ratio 1mV i/p, mono/stereo 69/66dB
Distortion, mono 20%/100% modulation 0.12/0.45%
Distortion, stereo 20%/100% modulation 0.09/0.56%
Pilot tone suppression ..... −54dB
Crosstalk, 1kHz ..... −29dB

GENERAL

Totalsize (W x D x H) ..... (Stacked) 11½(29) x 10(25) x 12½(32) in(cm)
Approximate weight 30lb
Typical retail price ..... £138+£161+£161

CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Technics SA202L

Panasonic UK Ltd., 107–109 Whitby Road, Slough, Berkshire SL1 3DR
Tel: (0753) 34522

Presentation, facilities, etc.
Second from the bottom of the range of five conventional receivers from Technics, the *202L* refers to the variant which offers long wave in addition to medium wave AM and FM. As a result the input selection switching has become rather clumsy. The design follows far-Eastern traditions in receiver styling very closely, with the usual brushed aluminium fascia and matt aluminium knobs, all to a high standard of finish.

The tuner section has no presets and can be switched to give muting on stereo or mono without; there are indicators for signal strength and stereo. The aerial socketry is suitable for 300 or 75 ohm FM, the latter unusually designed to accept the bared wires of a co-ax lead, and external AM in addition to the pivoted ferrite rod fitted. The amplifier has phono inputs DIN-duplicated on the second tape sockets, and permits connection of headphones and two pairs of switchable loudspeakers. Facilities on this popularly-priced model are naturally fairly basic, and include simple tone controls in addition to the above. Overall this is a neat, well-finished machine of conventional appearance and specification.

Lab performance
Respectable power delivery for the price nevertheless shows a significant single/dual channel difference, but with reasonable characteristics into low impedances. The disc input showed a rather overwide bandwidth, significantly 'bright' frequency response characteristic, and capacitance that is on the high side for matching some arm/cartridge combinations. Other inputs/outputs should cause no problems. Performance parameters were excellent on distortions, with average hum and a damping factor which was lower than most.

The tuner measurements showed reasonable sensitivity for the price, with generally good measurements marred by slightly below average image rejection and well below average pilot tone rejection.

Subjective impressions
This unit scored consistently below average in the listening tests, partly due perhaps to the 'brash' disc input frequency response, with descriptions of a 'rough' top end and 'coloured' middle recorded. The tuner was considered reasonable, but a bit 'thin' and 'empty' sounding. In use, the muting action was not particularly liked, and the lack of tuning 'steering' indication was a pity, but scale calibration was accurate and sensitivity fine. AM was not liked because of the usual tight bandwidth, with reasonable sensitivity marred by poor distortion.

Conclusions
The quite respectable tuner section was marred by a below average disc input that may have contributed to rather negative listening test findings, so recommendation is not really possible at the nonetheless reasonable price.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 11Hz–83kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 31/34/32 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 43/48/37 Watts
Burst power 1kHz, 8/4/2 ohms ..... 52/73/47 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	3.0	47k	190pF
Disc MC	—	—	—	
Tuner/aux	Phono	175	50k	
Tape	Phono	200	50k	
Tape	DIN	200	50k	

Disc overload 1kHz 35dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	260	370
Tape	DIN	29	80k
Headphones (8 ohms)	Jack	70	—

Noise (ref 1 Watt, 8 ohms)
Zero volume ..... −88dB
Aux ref volume ..... −76dB
Disc ref volume ..... −78dB

Other
Damping factor 24
THD performance ..... excellent
IMD performance ..... excellent
Hum performance ..... average

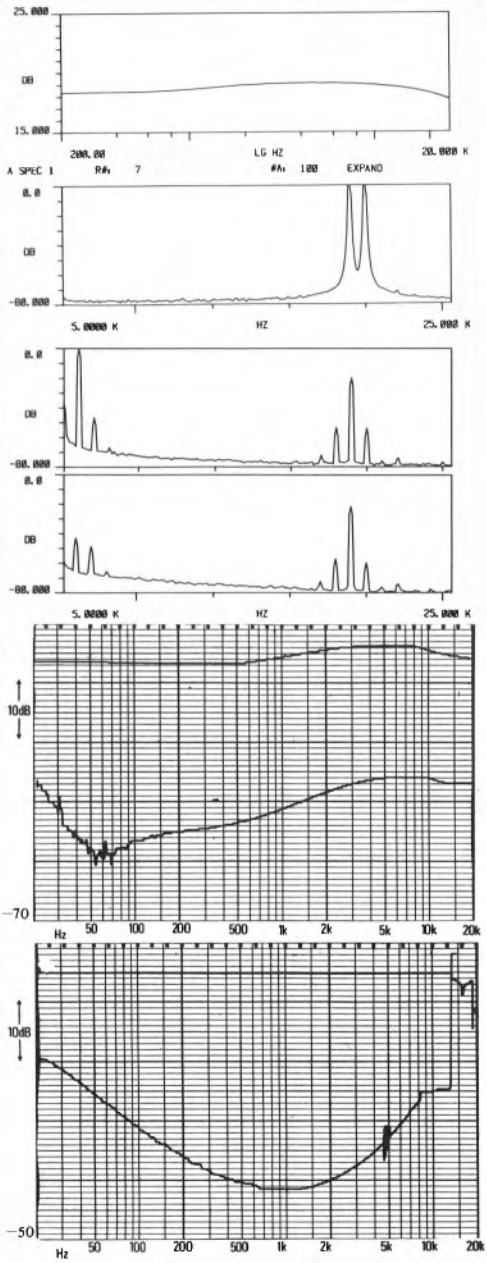
TUNER

RF Performance
30dB S/N Ratio, mono sensitivity 1.25uV
50dB S/N Ratio, mono/stereo sensitivity 1.90/37uV
IHF 30dB S/N Ratio, mono 1.50uV
Muting level 4.0uV
Limiting level, −1dB 2.0uV
RFIM 66dB
Capture ratio 1.0dB
Selectivity 52dB
IF rejection 83dB
AM suppression 55dB
Image rejection 55dB

Audio Section
S/N ratio 1mV i/p, mono/stereo 71/60dB
Distortion, mono 20%/100% modulation 0.05/0.56%
Distortion, stereo 20%/100% modulation 0.05/0.40%
Pilot tone suppression ..... −20dB
Crosstalk, 1kHz ..... −42dB

GENERAL

Total size (W x D x H) ..... 17(43) x 12(30) x 5½(14) in(cm)
Approximate weight 15lb
Typical retail price £160



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)*
1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Technics SA303L

Panasonic UK Ltd., 107–109 Whitby Road, Slough, Berkshire SL1 3DR
Tel: (0753) 34522

Presentation, facilities, etc.
The middle member of a five model receiver series constitutes Technics' traditional line (there are also a couple of digital synthesiser models we have not tested). The *303L* is a conventionally styled design with quite comprehensive facilities. The 'L' suffix refers to variations of the basic models incorporating the long wave AM band for markets where this is appropriate; it could be commented that the additional switching incorporated tends to make input selection a trifle confusing.

The three-band tuner section has no presets but includes a hinged ferrite rod aerial for AM, and connectors for external AM, 300 and 75 ohm FM; the latter *via* a clamp arrangement to connect to the bared co-ax downlead. Indicators include tuning, stereo, and signal strength, while the muting and mono switching is combined to give stereo with muting or mono without. The amplifier has tone controls, loudness and 'hi-filter', and LED-type 'power' meters (which may be switched off). Switching is provided for two sets of speakers (whose protection fuses are admirably accessible), and a headphone socket is also fitted. Inputs are *via* phono sockets, with DIN duplication on Tape 2. Very much the 'standard receiver' in appearance, the *303L* has a very good standard of finish on the brushed aluminium fascia.

Lab performance
Respectable power output for the price showed some difference between single and dual channel drive, but was reasonably well-maintained into low impedances. The disc input showed an improved frequency response compared to its smaller brother, more sensible (but still slightly on the high side) capacitance, and a very sensibly controlled bandwidth. Other inputs/outputs should present no problems. Performance parameters were better than average, with IM distortion excellent, but with a damping factor lower than most.

The tuner measurements were generally very creditable, and overall better than for the *202L*, but again the pilot tone suppression was well below average.

Subjective impressions
Despite the technical improvements over the *202L*, the *303L* still fared indifferently in the listening tests, consistently failing to attract favourable comments, with complaints of 'muddling', 'confusion' and 'lack of control', plus curious bass characteristics and a 'coloured' mid-range. FM was considered reasonable, if a little 'bassy'. In use this receiver was reasonably liked, but the absence of a tuning 'steering' indicator was regretted, a slight scale calibration error was noted, and the muting action was disliked when scanning (appearing to be deviation-based).

Conclusions
Though well-balanced and offering good technical performance for the price, our listening test results were consistently negative enough to prevent our recommendation of this model. We remain reluctant to 'condemn' a product on subjective evidence alone, so invite prospective purchasers to check our findings, and to feel free to disagree!

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	10Hz–50kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	40/46/46 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	55/68/50 Watts
Burst power 1kHz, 8/4/2 ohms	59/90/67 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	3.6	49k	160pF
Disc MC	—	—	—	
Tuner/aux	Phono	200	30k	
Tape	Phono	200	30k	
Tape	Both	230	30k	
Disc overload 1kHz			34dB	

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	230	2k
Tape	DIN	30	78k
Headphones (8 ohms)	Jack	70	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−83 dB
Aux ref volume	−77dB
Disc ref volume	−77dB

Other

Damping factor	34
THD performance	good
IMD performance	excellent
Hum performance	above average

TUNER

RF Performance

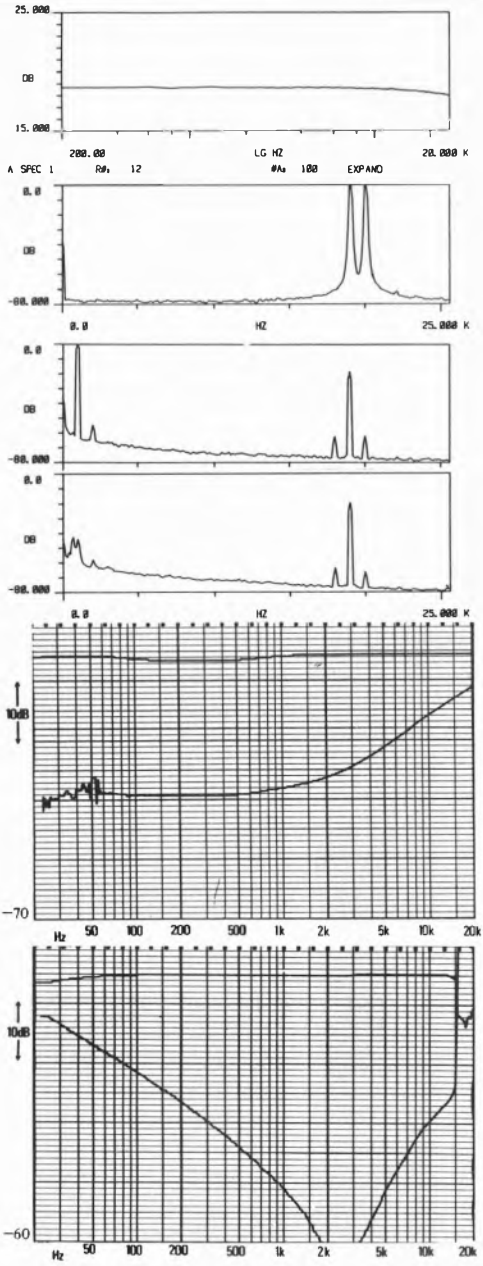
30dB S/N Ratio, mono sensitivity	1.00uV
50dB S/N Ratio, mono/stereo sensitivity	1.50/22uV
IHF 30dB S/N Ratio, mono	1.75uV
Muting level	2.5uV
Limiting level, −1dB	1.5uV
RFIM	59dB
Capture ratio	1.5dB
Selectivity	58dB
IF rejection	89dB
AM suppression	57dB
Image rejection	68dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	73/70dB
Distortion, mono 20%/100% modulation	0.08/0.08%
Distortion, stereo 20%/100% modulation	0.08/0.08%
Pilot tone suppression	−20dB
Crosstalk 1kHz	−42 dB

GENERAL

Total size (W x D x H)	17(43) x 12(31) x 6(15) in(cm)
Approximate weight	18lb
Typical retail price	£190



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)*
1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

RECOMMENDED

Technics SU-V2/ST-S1L

Panasonic UK Ltd., 107–109 Whitby Road, Slough, Berkshire SL1 3DR
Tel: (0753) 34522

Presentation, facilities, etc.
These two modestly priced Technics separates are quite large, and are fairly discretely styled, at least until the light show comes on! (This unfortunately comes in a variety of colours, and cannot resist propagandising this year's 'buzz words': 'new class A synchro-bias', whose benefits are at best debatable.)

The tuner operates on FM and medium and long wave AM, with 75 and 300 ohm FM and external AM terminals plus an internally fitted AM ferrite, which may require the tuner to be re-oriented for the best AM results. Indicators are provided for signal strength, centre-tune, stereo and 'active servo lock', while switches select the latter function, stereo-with-mute/mono-without, and waveband with optimised AM aerial selection. The conventional tone controls have a centre position labelled 'defeat', low and high filters, loudness, speaker selection, and independent selection of main signal and 'record out', with tape cross-dubbing provided. Peak-hold light 'power' meters are fitted (admittedly the most useful kind), and phono socketry is augmented by DIN tape duplication and a headphone jack. In summary an attractive though slightly garish 'standard' sized combination, with quite comprehensive facilites.

Lab performance
Respectable amplifier power for the price was reflected in competent low impedance drive characteristics, but showed significant single/dual channel drive differences. The disc input had a sensibly curtailed bandwidth and reasonable capacitance value, while other inputs and outputs should pose no problems. Performance parameters were better than average or good, and this is clearly a competently designed, well-balanced amplifier.

The tuner section was generally quite respectable too, with good sensitivity but below average capture ratio, AM rejection and pilot tone suppression.

Subjective impressions
Somewhat inconsistent results nevertheless placed this combination above average in sound quality, sounding reasonably good at high levels, slightly 'bright', but not aggressive and quite detailed, though the bass performance was less well favoured. FM was regarded as quite reasonable, though a bit 'noisy' (in contradiction to the measurements). Well-liked in use, the FM section was sensitive, with good weak signal performance, though the tuning indicator gave a slightly asymmetric readout. AM was rather average, with the usual 'tight' bandwidth, average sensitivity and reasonable distortion.

Conclusions
The well-balanced technical performance, plus quite reasonable though not too consistent listening test results, at a very reasonable price, suggest that this model deserves recommendation.

Technics SU-V2/ST-S1L

RECOMMENDED

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	13Hz–40kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	44/47/44 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	56/71/63 Watts
Burst power 1kHz, 8/4/2 ohms	61/96/151 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	3.0	46k	130pF
Disc MC	—	—	—	
Tuner/aux	Phono	190	80k	
Tape	Both	210	80k	
Tape	Phono	180	80k	
Disc overload 1kHz				35dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	280	475
Tape	DIN	32	80k
Headphones (8 ohms)	Jack	66	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−86dB
Aux ref volume	−75dB
Disc ref volume	−78dB

Other

Damping facto	57
THD performance	good
IMD performance	above average
Hum performance	good

TUNER

RF Performance

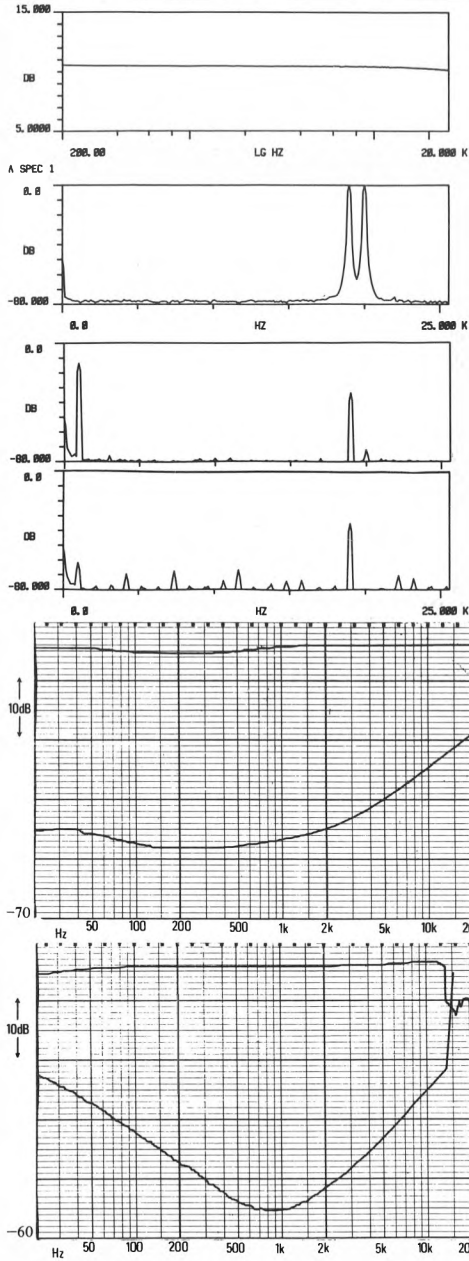
30dB S/N Ratio, mono sensitivity	0.75uV
50dB S/N Ratio, mono/stereo sensitivity	2.00/40uV
IHF 30dB S/N Ratio, mono	1.25uV
Muting level	2.0uV
Limiting level, −1dB	1.0uV
RFIM	63dB
Capture ratio	2.5dB
Selectivity	76dB
IF rejection	93dB
AM suppression	37dB
Image rejection	70dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	74/70dB
Distortion, mono 20%/100% modulation	0.05/0.09%
Distortion, stereo 20%/100% modulation	0.08/0.14%
Pilot tone suppression	−18dB
Crosstalk, 1kHz	−47dB

GENERAL

Total size (W x D x H)	17(43) x 10½(27) x 11(28) in(cm)
Approximate weight	24lb
Typical retail price	£125+£95



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)*
1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Technics SU-V4/ST-S3

Panasonic UK Ltd., 107–109 Whitby Road, Slough, Berkshire SL1 3DR
Tel: (0753) 34522

Presentation, facilities, etc.
Apart from the lamentable bad taste of illuminating the front panel with propaganda proclaiming this year's 'buzz-word': 'New class A synchro-bias' (last year it was 'straight DC+3DA', if I remember correctly), this new Technics combination is rather smart; though the amplifier is of conventional size (and quite heavy to boot), the tuner is remarkably slim and attractive.

Operating on FM and medium wave AM, with seven preset positions available on each, this ergonomically delightful unit also has manual/electronic tuning, quartz-locking, stereo beacon and muting/mode switches; batteries retain the electronic memories when mains are switched off. Terminals are provided to match 75 and 300 ohm FM, plus external AM to supplement the properly pivoted ferrite rod; a special switch is used to automatically optimally align Technics' new indoor 'wing aerial'. The solidly built amplifier has peak hold 'power' meters (which are probably the best type if one must have such things), but they cannot be switched off. Switching is provided for speakers, 'straight DC' (bypassing the traditional tone controls), high and low filters, loudness, separate input and record output selectors, and a head-amp option for m-c type cartridges. Socketry is phono throughout, DIN-duplicated on Tape 1. In summary the slim tuner and fat amplifier make an odd couple, but the overall package is smart, carries an aura of competence, and includes a number of features that we consider particularly useful (*eg* m-c matching, tone defeat, tuning presets).

Lab performance
Respectable power delivery for the price has a quite competent performance into low impedances, though there is the usual single/dual channel difference. The disc input bandwidth was a little on the high side, frequency response was reasonable but with trends that are probably audible, disc input capacitance was on the high side for optimum matching with all cartridges, and the m-c input is a little insensitive for some types. Other inputs/outputs suggest no matching problems, and performance parameters showed excellent hum, good harmonic and average IM distortion performances.

Generally fine tuner measurements were recorded with the exception of below average results on AM rejection and pilot tone suppression.

Subjective impressions
Not quite as well received as the somewhat cheaper 'sister' components, the overall results were a little below average, and not entirely consistent, with common criticism of some lack of HF definition, some uncertainty concerning the bass quality but praise for detail and midrange. FM was interesting and clean, rated above average but with 'odd' noise. The easiest of the digitals to use, general performance was not exceptional with muting threshold a little high. AM seemed heavily HF filtered, with a slight 'ring' on noise, poor sensitivity and narrow bandwidth but reasonable 'presence'.

Conclusions
Though an interesting combination, with a delightfully designed tuner, the technical performance

was generally competent, but results were insufficiently exceptional either subjectively or objectively to rate recommendation.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	5Hz–93kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	62/66/60 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	75/100/90 Watts
Burst power 1kHz, 8/4/2 ohms	92/138/126 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.8	46k	200pF
Disc MC	Phono	0.2	46	
Tuner/aux	Phono	175	80k	
Tape	Both	200	80k	
Tape	Phono	180	80k	
Disc overload 1kHz				36dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	300	32k
Tape	DIN	25	78k
Headphones (8 ohms)	Jack	67	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−85dB
Aux ref volume	−77dB
Disc ref volume	−79dB

Other

Damping factor	57
THD performance	good
IMD performance	average
Hum performance	excellent

TUNER

RF Performance

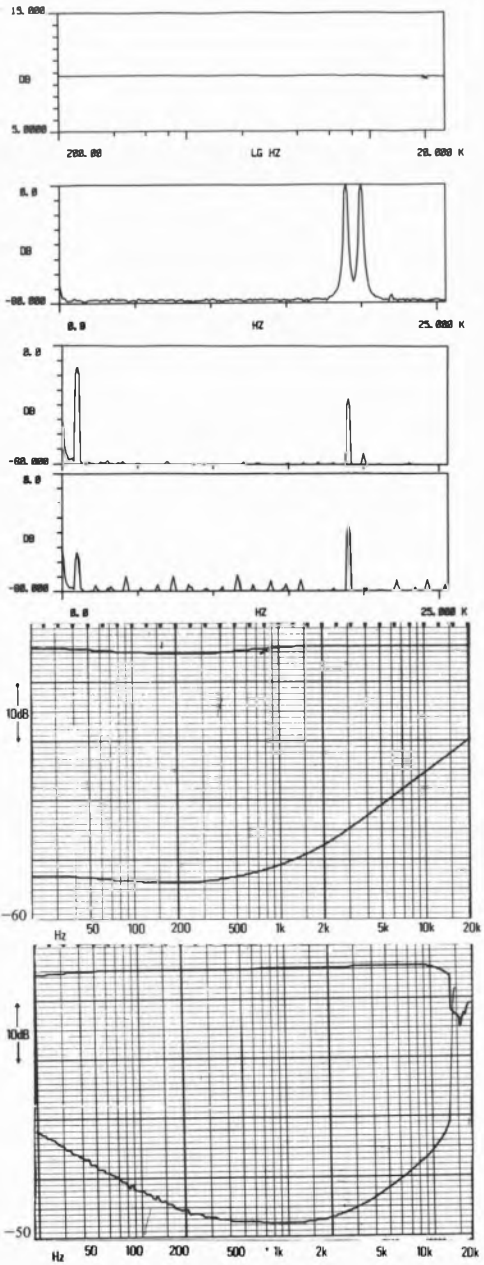
30dB S/N Ratio, mono sensitivity	0.75uV
50dB S/N Ratio, mono/stereo sensitivity	2.00/21uV
IHF 30dB S/N Ratio, mono	1.50uV
Muting level	4.0uV
Limiting level, −1dB	1.5uV
RFIM	59dB
Capture ratio	2.0dB
Selectivity	76dB
IF rejection	110dB
AM suppression	43dB
Image rejection	78dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	71/70dB
Distortion, mono 20%/100% modulation	0.05/0.15%
Distortion, stereo 20%/100% modulation	0.05/0.15%
Pilot tone suppression	−20dB
Crosstalk, 1kHz	−40dB

GENERAL

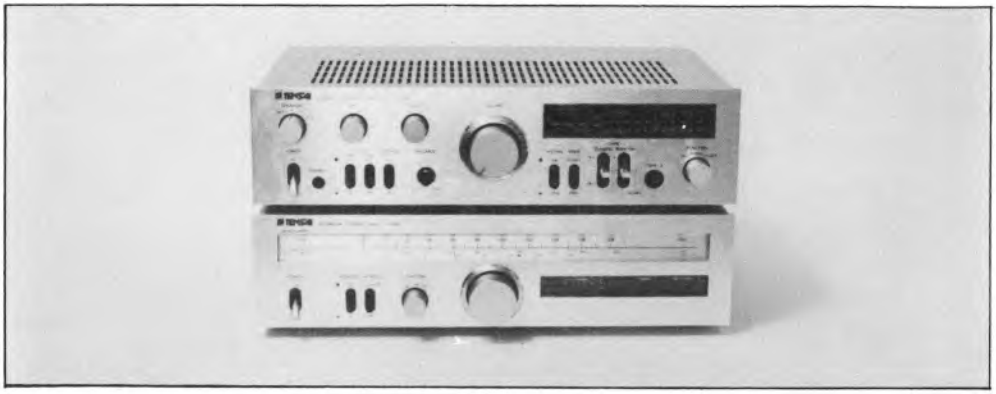
Total size (W x D x H)	17(43) x 11½(29) x 7½(19) in(cm)
Approximate weight	25lb
Typical retail price	£150+£145



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Tensai TA2350/TT3345

Wren Electronics, Dawson Road, Mount Farm Estate, Milton Keynes, Buckinghamshire. Tel: (0908) 71611



Presentation, facilities, etc.

These two matching units under the Tensai banner are marketed in the UK by the Wren Group. Shinier in finish than most units, they are slightly thinner than the 'standard' dimension, and the controls are logically ordered. Prominent lighting displays on both units should ensure that they are unlikely to remain unnoticed.

The tuner operates on FM, and long and medium AM bands without presets. Two pivoted ferrite rods for AM are fitted on the rear, and socketry is provided for 300 and 75 ohm FM and external AM aerials. Facilities include light indicators for signal strength, centre-tune and stereo, with switching between stereo mute and mono or 'hi-blend'. In addition to the normal volume, balance and tone controls, switches control loudness, high and low filters, −20dB mute, stereo/mono, and monitoring and dubbing between two tape machines. Inputs are phono, but the tape connections are DIN-duplicated, '1' on the rear and '2' on the front panel. An LED type 'power' display is featured, and inputs selected are light indicated. Overall then these are fairly compact units with generally well-chosen facilities, though they are a little on the garish side.

Lab performance

Offering quite good power for the price, the characteristics suggest a rather 'soft' power supply, with reasonable performance into lowish impedances. Frequency responses are pretty flat, with mild treble rolloff and a sensibly restrained power bandwidth. Inputs and outputs were reassuringly typical, though the disc input loading resisted our measurement technique. Performance results were generally adequate, though IM distortion, crosstalk and hum measurements were below average.

Tuner sensitivities were somewhat below average, a description which covers most of the measured parameters, though none gave particularly suspect results, and all may be considered quite acceptable in a tuner of this price class. Pilot filter and scale were marginally misaligned.

Subjective impressions

Listening test results were generally below average, though not entirely consistent, with descriptions of 'untidiness' and muddling, and with FM characterised as a bit 'thin'. In use the tuner showed the rather high muting threshold which also had a noisy action, and while it was clearly not a device for DX work, it was nevertheless competent. AM was very poor, with low sensitivity and high distortion on low level signals.

Conclusions

A competent and well-balanced performer at a reasonable price, our auditioning results make us wary of recommendation, though the units remain well worth considering, providing neither eye nor ear is offended.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 12 Hz–46kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 41/51/48 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 63/86/— Watts
Burst power 1kHz, 8/4/2 ohms ..... 79/115/74 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.6	?	?
Disc MC	—	—	—	
Tuner/aux	Phono	185	31k	
Tape	Phono	185	31k	

Disc overload 1kHz 36dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	320	3.9k
Headphones (8 ohms)	Jack	60	—

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −77dB
Aux ref volume ..... −73dB
Disc ref volume ..... −74dB

Other

Damping factor 66
THD performance ..... good
IMD performance ..... below average
Hum performance ..... well below average

TUNER

RF Performance

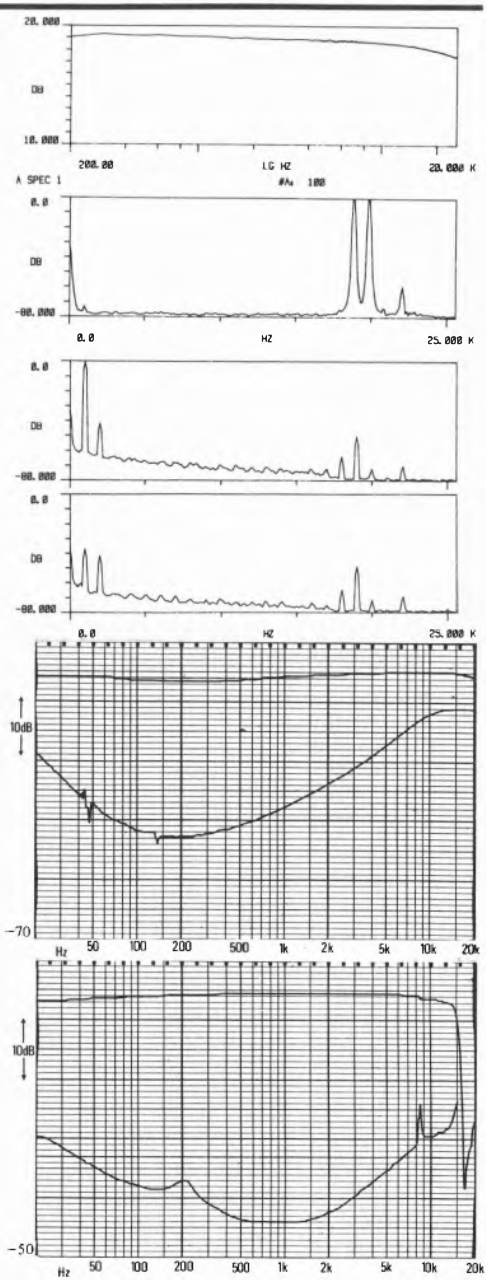
30dB S/N Ratio, mono sensitivity 2.0uV
50dB S/N Ratio, mono/stereo sensitivity 4.0/65uV
IHF 30dB S/N Ratio, mono 2.5uV
Muting level 10.0uV
Limiting level, −1dB 2.5uV
RFIM 59dB
Capture ratio 4.25uV
Selectivity 54dB
IF rejection 56dB
AM suppression 62dB
Image rejection 68dB

Audio Section

S/N ratio 1mV i/p, mono/stereo 73/68dB
Distortion, mono 20%/100% modulation 0.35/0.7%
Distortion, stereo 20%/100% modulation 0.35/0.45%
Pilot tone suppression ..... −46dB
Crosstalk, 1kHz ..... −36dB

GENERAL

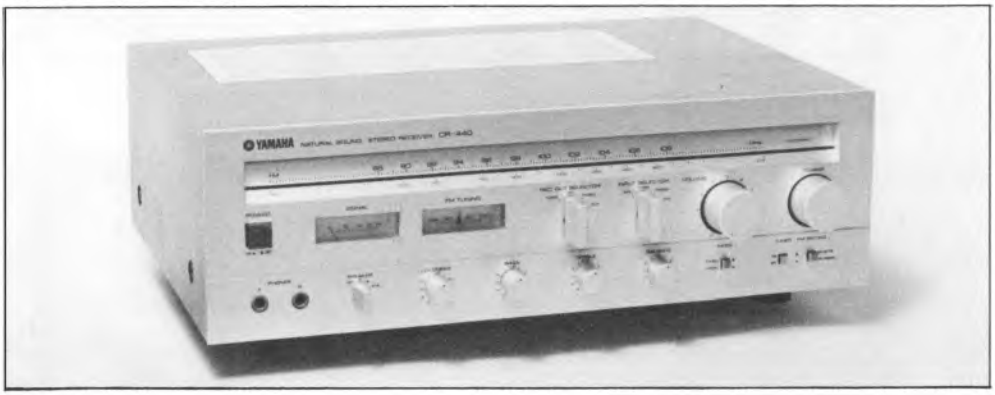
Total size (W x D x H) ..... 17(43) x 13½(34) x 9(23) in(cm)
Approximate weight 30lb
Typical retail price ..... £95+£75



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)*
1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Yamaha CR440

Natural Sound Systems Ltd., 10 Byron Road, Wealdstone, Harrow, Middlesex
Tel: (01) 863 8622



Presentation, facilities, etc.

Yamaha receivers have always had a distinctive air about them, with matt aluminium fascias refreshingly more restrained than most, and attractive wooden sleeving, both features of this new reasonably priced model. Facilities are quite comprehensive, rather more so than normally found on equipment in this class, including one or two uncommon capabilities that may suit certain applications.

Operating manually on FM and medium wave AM, a 75 ohm socket and 300 ohm terminals are provided plus a small self-adhesive detached ferrite aerial which may be connected to the AM terminals if it is to be used, and which offers considerable scope for optimum siting. Signal strength, centre-tune and stereo beacon indicators are provided, while switching operates between stereo-with-muting and mono-without. Normal tone controls are supplemented by a variable loudness function, and a 'record out' selector permits a tape recording to be made from any source independently of the chosen listening input. Stereo/mono and speaker switching plus two headphone outputs are also fitted, and all inputs are to phono standards. In all, this is an attractive well-finished unit with some unusual features for its price class, though it could be said that the ease of use has to some extent been compromised by the stylist.

Lab performance

The reasonable power output for the price showed good consistency between single and dual channel drive, and reasonable performance into low impedances, though rather curtailed into 2 ohms. The disc input showed a grossly excessive bandwidth and slight frequency response variation, though we could not measure the capacitance; other inputs and outputs should be fine. Noise, hum and harmonic distortion were all good, with IM distortion excellent.

Most of the tuner measurements were above average, with good noise, crosstalk, and pilot tone suppression, but below average AM rejection and capture ratio. Frequency response showed a gentle early bass rolloff.

Subjective impressions

With a slightly below average overall listening test result, consistent comments related a generally bright 'sheen', particularly when played loud, but generally a nice clean sound, if a little 'veiled' and 'soft'. FM was quite good, but lacked 'body' (frequency response?), and changed perspectives slightly. Although correctly aligned, the tuner was clearly not in the same league as the *840*, but with nice muting circuitry was nevertheless quite liked, though a bit 'gritty' on weak signals. AM was reasonable, with slightly below average sensitivity.

Conclusions

This receiver gave quite well-balanced technical results and reasonable listening test findings, which certainly makes it worth considering, though it was insufficiently exceptional in any area for full recommendation.

AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc)	10Hz–203kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist)	33/36/34 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist)	36/63/24 Watts
Burst power 1kHz, 8/4/2 ohms	42/72/57 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	3.0	47k	?
Disc MC	—	—	—	
Tuner/aux	Phono	145	65k	
Tape	Phono	145	65k	

Disc overload 1kHz	34dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	235	270
Headphones (8 ohms)	Jack	100	—

Noise (ref 1 Watt, 8 ohms)

Zero volume	−90dB
Aux ref volume	−81dB
Disc ref volume	−85dB

Other

Damping factor	71
THD performance	good
IMD performance	excellent
Hum performance	good

TUNER

RF Performance

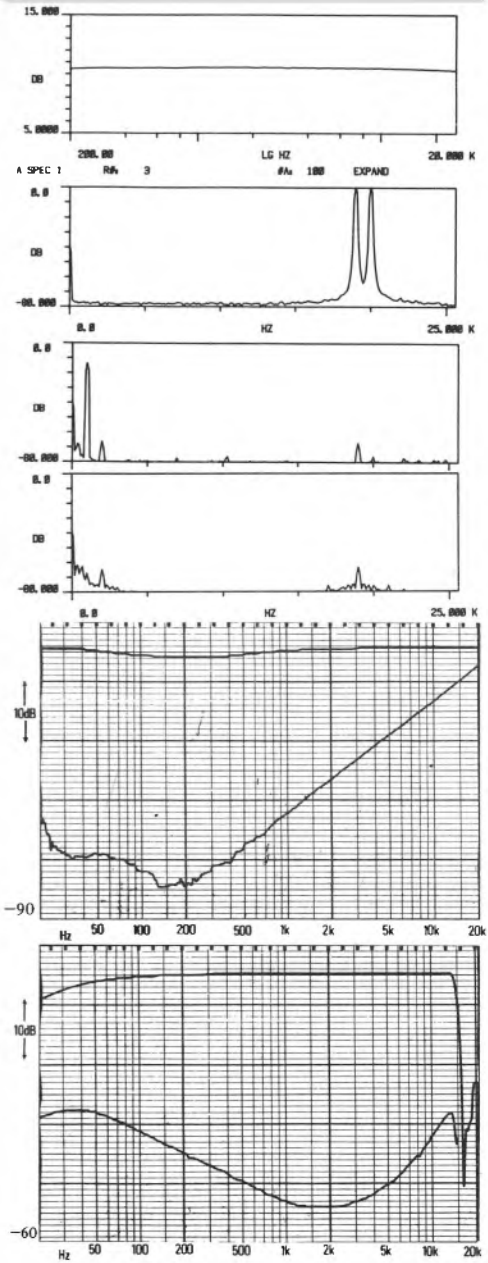
30dB S/N Ratio, mono sensitivity	1.00uV
50dB S/N Ratio, mono/stereo sensitivity	2.00/45uV
IHF 30dB S/N Ratio, mono	2.00uV
Muting level	1.5uV
Limiting level, −1dB	1.5uV
RFIM	62dB
Capture ratio	3.5dB
Selectivity	46dB
IF rejection	83dB
AM suppression	45dB
Image rejection	62dB

Audio Section

S/N ratio 1mV i/p, mono/stereo	75/71dB
Distortion, mono 20%/100% modulation	0.07/0.10%
Distortion, stereo 20%/100% modulation	0.20/0.70%
Pilot tone suppression	−52dB
Crosstalk, 1kHz	−53dB

GENERAL

Total size (W x D x H)	17¼(44) x 13(33) x 6(15) in(cm)
Approximate weight	18lb
Typical retail price	£170



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

RECOMMENDED

Yamaha CR840

Natural Sound Systems Ltd., 10 Byron Road, Wealdstone, Harrow, Middlesex
Tel: (01) 863 8622

Presentation, facilities, etc.
This large, heavy and imposing receiver is not quite the most expensive in Yamaha's receiver range, but it is currently the top model of the more recent *'40* series, and fairly bristles with all manner of features. Presentation is typical Yamaha – very matt aluminium plus a wooden sleeve – and is nicely restrained for such a large item.

The tuner section operates manually on FM and medium wave AM bands, with a 75 ohm socket, 300 ohm and AM terminals, the latter for either an external aerial or the neat ferrite provided, which with its self-adhesive backing pad may be sited for best results. Indicators are fitted for stereo, signal strength, 'centre-tune', plus a variety of 'extra' FM conditions including high frequency blend, local/DX and 'OTS'; these are controlled by two switches: the auto/local switch offers normal selectivity on 'local', but on 'auto' changes to 'narrow' for weak long-distance reception (DX); the other switch is labelled 'muting/OTS', and brings inter-station muting, automatic 'high-blend' and an AFC circuit into operation, the latter disengaging automatically when the tuning control is touched. The amplifier section has bass, treble, presence and variable loudness, switching for mono/stereo, high and low filters, speaker selection, and independent selection of input and 'record out' signals. Socketry is phono throughout, with two headphone jacks provided. In summary, an attractive but large receiver with comprehensive functions, lacking only any sort of preset operation.

Lab performance
Offering quite good power for the price, delivery showed a rather large single/dual channel difference, gave reasonable delivery into 4 ohms, but was very restricted into 2 ohms. The disc input bandwidth was rather wide, the frequency response not quite flat, and the capacitance a little on the high side for some arm/cartridge combinations; other inputs/outputs should be fine. There was a slight tendency to instability, with 20kHz oscillation, which is a little disturbing. Distortions were average or better, and hum performance below average.

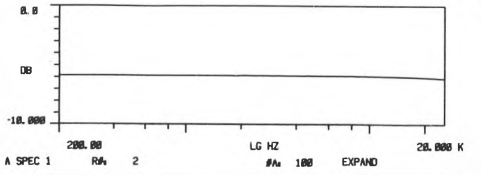
The sensitivity results should have been much better, and sadly were spoilt by poor alignment, though most of the other measurements apart from capture ratio were above average or better. Given proper alignment, the 50/85 selectivity option would have been useful.

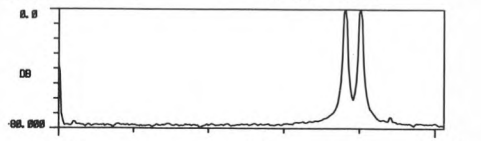
Subjective impressions
Listening tests placed this model a little below average overall, with criticisms of a rather 'thick' sound, lacking 'focus' and restricted on depth and ambience reproduction. Unusually it was preferred on FM, where it was rated one of the best on good signals, and described as reasonably 'open' and 'natural'. In use the alignment caused the main reservations (though improved by a mild 'tweak'), while the tuning indicator lacked 'brio'. AM gave reasonable frequency response when slightly detuned, and sensitivity with the special 'loop' aerial was slightly below average.

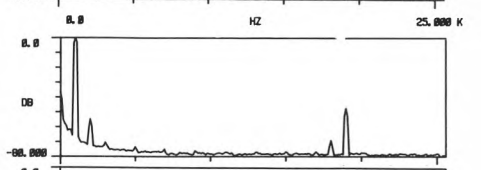
Conclusions
This receiver gave rather mixed results, though we have decided to recommend it on the basis of the potentially excellent FM section; spoilt by some misalignment on our sample, it was clearly well

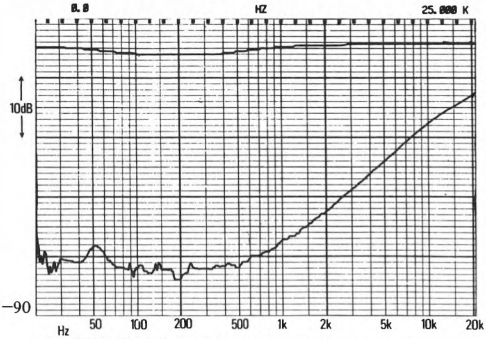
RECOMMENDED

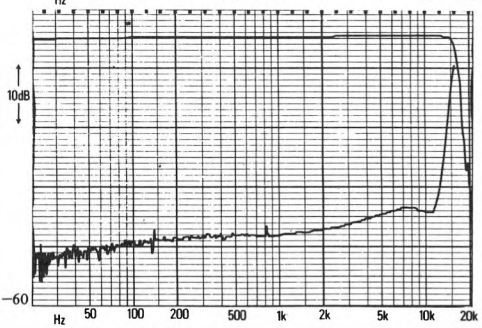
liked on sound quality and had copious facilities. There remain some doubts about the disc/amplifier performance nevertheless.











AMPLIFIER

Power

Bandwidth (−3dB ref max power, disc) 7Hz–134kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 65/65/64 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) .... 78/101/29 Watts
Burst power 1kHz, 8/4/2 ohms ..... 80/109/29 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	2.8	47k	200pF
Disc MC	—	—	—	
Tuner/aux	Phono	130	37k	
Tape	Phono	130	37k	

Disc overload 1kHz 36dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	240	230
Headphones (8 ohms)	Jack	100	—

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −89dB
Aux ref volume ..... −73dB
Disc ref volume ..... −80dB

Other

Damping factor 57
THD performance ..... good
IMD performance ..... average
Hum performance ..... below average

TUNER

RF Performance

30dB S/N Ratio, mono sensitivity 2.20uV
50dB S/N Ratio, mono/stereo sensitivity 7.0/75uV
IHF 30dB S/N Ratio, mono 11.00uV
Muting level 10.0uV
Limiting level, −1dB 10.0uV
RFIM 70dB
Capture ratio 5.0dB
Selectivity 85dB
IF rejection 83dB
AM suppression 57dB
Image rejection 63dB

Audio Section

S/N ratio 1mV i/p, mono/stereo 75/67dB
Distortion, mono 20%/100% modulation 0.05/0.10%
Distortion, stereo 20%/100% modulation 0.20/0.30%
Pilot tone suppression ..... −45dB
Crosstalk, 1kHz ..... −46dB

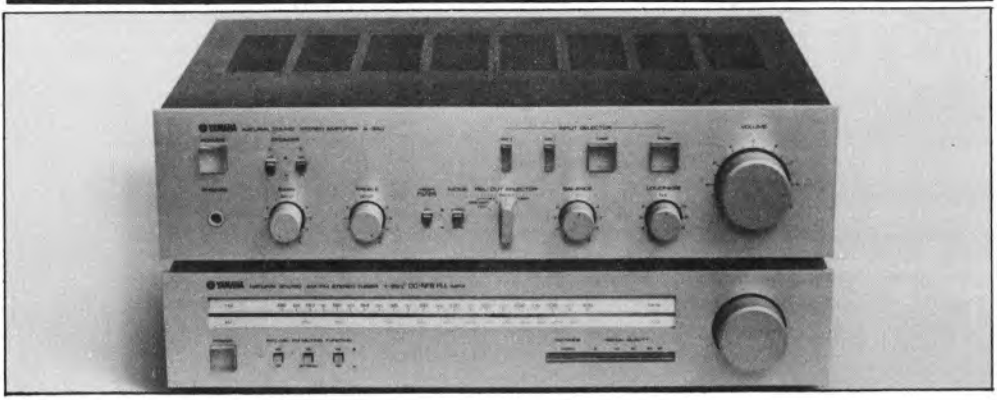
GENERAL

Total size (W x D x H) ..... 19½(49) x 15½(39) x 6(15) in(cm)
Approximate weight 28lb
Typical retail price £285

CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

Yamaha A550/T550

Natural Sound Systems Ltd., 10 Byron Road, Wealdstone, Harrow, Middlesex
Tel: (01) 863 8622



Presentation, facilities, etc.

These attractive slim separates are fairly discrete when switched off, with very matt aluminium fascias, but soft coloured lights incorporated in some of the push-buttons have a rather striking effect when the units are activated, though in the Yamaha tradition, the appearance is in the best of taste, despite the fact that these are amongst their cheaper models.

The tuner operates manually on FM and medium wave AM, with 75 ohm socket, and 300 ohm and external AM terminals; a ferrite ring is properly pivoted at the rear, and is detachable with sufficient cable for easy optimum siting. Indicators are provided for signal strength, centre-tuning and stereo, and switching for 'rec cal' and stereo-with-muting/mono-without. The amplifier has conventional tone controls with the centre position labelled 'defeat', a variable loudness control and a high filter. Switching selects speakers, mono/stereo and independent selection of the 'record out' signal from the main amplified signal. Phono socketry is provided throughout, apart from the front panel headphone jack. In summary, these are attractive and beautifully finished units, with more than adequate facilities, sensibly ordered, and therefore easy to use.

Lab performance

With reasonable power for the price, delivery was a little limited into low impedances, but was fine at the audio bandwidth extremes and the disc input was sensibly limited. Frequency responses were nearly flat, with crosstalk measurements good. Inputs and outputs are typical enough to suggest no matching problems, and the low disc input capacitance will enable any cartridge response to be optimised. Performance results were consistently good, though the curious 22kHz 'blip' on all the spectra appeared not to be signal related, and remains unexplained.

Sensitive, with low noise and good distortion results, and only AM rejection below average, the tuner as a whole clearly measured well above average, and consistently so.

Subjective impressions

On the listening tests, this combination scored about average overall, with consistent observations of a rather 'loose', 'plodding' bass quality, otherwise smooth and mellow if a little 'veiled', and with some sibillance exaggeration on FM. The tuner was much liked in use, with good results on weak signals, though the tuning meter was of little help here, and appeared not to correspond entirely with the signal strength meter. Muting level was a little high, and calibration accurate. Although far from good, with the usual over-restricted bandwidth, the AM performance was considered rather better than most.

Conclusions

This is an attractive well-balanced design with a fine tuner, which came close to recommendation, and definitely remains worth considering.

AMPLIFIER

Power

Bandwidth (−3 dB ref max power, disc) 13 Hz–34kHz
Both channels 20Hz/1kHz/20kHz (8 ohms, 0.1% dist) ... 48/49/48 Watts
Single channel 8/4/2 ohms (1kHz, 0.1% dist) ..... 58/58/5 Watts
Burst power 1kHz, 8/4/2 ohms ..... 71/81/6 Watts

Inputs	*Type*	*Sens (mV)*	*Imp (ohms)*	*Cap*
Disc MM	Phono	3.0	47k	30pF
Disc MC	—	—	—	
Tuner/aux	Phono	187	50k	
Tape	Phono	187	50k	

Disc overload 1kHz 37dB

Outputs (5mV disc)	*Type*	*Level (mV)*	*Imp (ohms)*
Tape	Phono	280	600
Headphones (8 ohms)	Jack	100	—

Noise (ref 1 Watt, 8 ohms)

Zero volume ..... −89dB
Aux ref volume ..... −79dB
Disc ref volume ..... −82dB

Other

Damping factor 69
THD performance ..... good
IMD performance ..... above average
Hum performance ..... excellent

TUNER

RF Performance

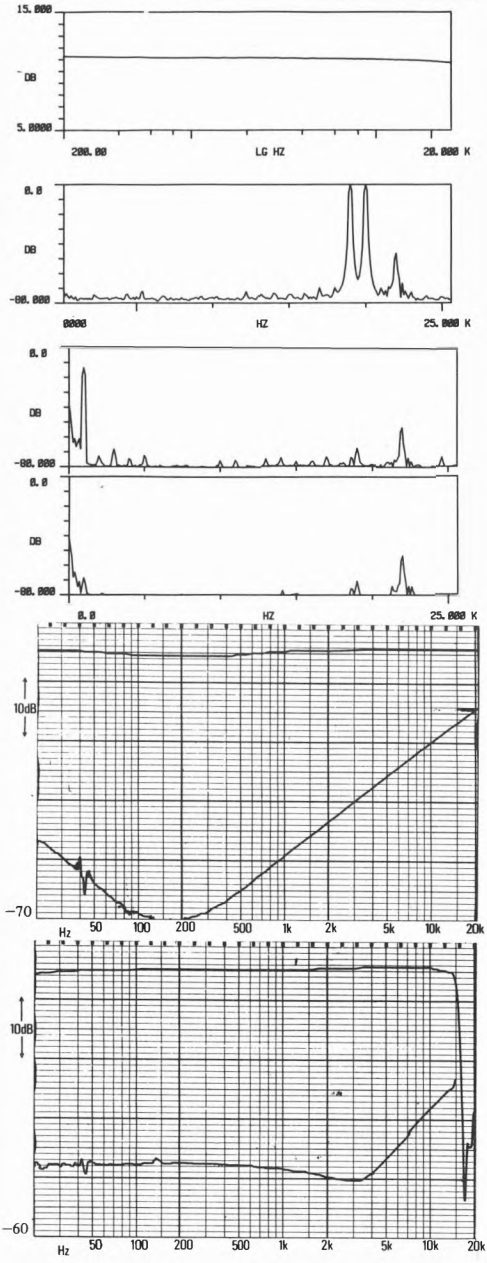
30dB S/N Ratio, mono sensitivity 0.80uV
50dB S/N Ratio, mono/stereo sensitivity 1.50/20uV
IHF 30dB S/N Ratio, mono 1.75uV
Muting level 6.0uV
Limiting level, −1dB 1.0uV
RFIM 70dB
Capture ratio 2.0dB
Selectivity 52dB
IF rejection 116dB
AM suppression 46dB
Image rejection 61dB

Audio Section

S/N ratio 1mV i/p, mono/stereo 76/74dB
Distortion, mono 20%/100% modulation 0.17/0.06%
Distortion, stereo 20%/100% modulation 0.10/0.07%
Pilot tone suppression ..... −54dB
Crosstalk, 1kHz ..... −56dB

GENERAL

Total size (W x D x H) ..... 17¼(44) x 13¼(34) x 7¼(20) in(cm)
Approximate weight 26lb
Typical retail price ..... £140+£125



CAPTIONS *(1–6 top to bottom rt. hand column, all at 1 watt/8 ohms)* 1) Aux i/p white noise frequency response. 2) IM distortion (19kHz, 20kHz aux i/p). 3) Tuner distortion (1kHz, 20% mod). 4) Tuner crosstalk distortion ref (3). 5) Disc i/p frequency response/crosstalk. 6) Tuner frequency response/crosstalk.

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Arriving at the end of a project such as this, there is inevitably a sense of anti-climax; some sorrow for the inadequacy of the job we have done, dissatisfaction with some of the things that we did do, and regrets for some of the things that we might have done. The fact remains that it is not possible to investigate a single product too deeply, though the cost and time required might prove prohibitive. To keep within the bounds of economics (and topicality these days), and provide the perspectives that only a project of this scale can hope to achieve, the scope of the tests has to be kept within some boundaries, which is somewhat frustrating.

Despite these reservations, we are reasonably happy with the findings. There remain one or two 'odd' measurements that will be discussed in due course, and of course the listening tests showed their inconsistencies, though the overall results here had some encouraging consistency nevertheless, often confirming opinions generally held amongst *cognoscenti*. We should point out that despite our efforts there will be some margin of error in the measurements as well as the listening tests. Please accept our findings as a fallible effort to give guidance, not a gospel to be adhered to at all costs.

Measurements are indicators, usually derived from simplified sources and carried out under strictly controlled conditions in order to have any meaning whatever. But in so designing the tests, one removes from the situation many of the elements that will be relevant in real use. They are nevertheless very important, often giving vital clues to the behaviour of a piece of equipment in particular respects. Their limitation is that they never examine the totality of the equipment under 'use' conditions. So as well as providing a 'skeleton' of lab results that help build the profile, we need to make careful listening tests to add a little 'flesh' to the picture.

LISTENING TESTS

Would that listening tests could be made more reliable, and would that we could be sure that they were fully representative! On the first point, I think matters are steadily improving, though there is still a long way to go. The second is much trickier: any piece of hi-fi equipment only functions as part of a system, and its value is only as part of that chain. So our results will be to some extent a function of the test techniques used (see *Technical Introduction*). In order to get any kind of reliable results we have to use pretty good ancillary apparatus, and it is certainly true that the more subtle differences between amplifiers can be masked, and their importance to some extent negated, by poor ancillary components; nevertheless the better amp will still be the better amp, and it will always make its contribution to the system sound.

Without wishing to claim total reliability, there was enough consistency to suggest that we have managed to get some idea of how the various units performed. From a good quality disc source there were few units that gave what we would regard as really satisfactory results, though compared to the similar-sized group of amplifiers assessed some 15 months previously, things certainly seemed to have improved, and very few models were considered downright bad or offensive-sounding. It was also interesting to note once again that the cheaper less pretentious units often auditioned as well or better than 'more sophisticated' components.

As before, the main areas of criticism were directed at the frequency extremes, with many models still sounding irritatingly 'brash', 'tizzy', or 'bright', while also often tending to be 'boomy' or with 'one note' exaggeration and lack of 'continuity' and 'authority' in the bass. Although most units made a quite respectable job of coping with simple electric multi-track pop material, handling the comparative complexity of a truly coherent recording of a lively orchestra was too much for many, if not practically all. On too many occasions the net result was a generalised and rather vague 'splodge' of sound, with the spatial perspectives and separation between instruments seriously blurred.

Aside from the aforementioned balance/emphasis problems, most of the amplifiers could be characterised as 'lively', 'dull' or 'somewhere in between'! By this I mean that the lively ones were felt to be potentially exciting performers, but tended to lack control and sound untidy; a practical problem in such cases is that if used with a poor signal source, there is the very real danger that these might be less pleasant to live with than a 'duller' amplifier. These 'duller' models tended to give a smooth, inoffensive, but rather bland sound, 'rounding off' the important 'sharp edges' in the music, but at the same time sounding generally well under control. Although ultimately less satisfying, there is no doubt that this type of sound may well prove a more satisfactory match with the majority of today's commercial components.

There was also plenty of criticism of units when

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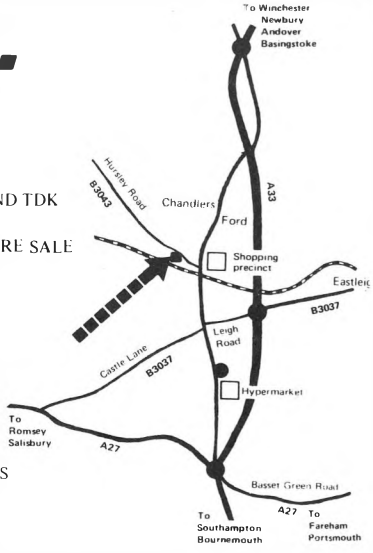

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they were being driven loud, shortcomings appearing more obvious, and extra aggressiveness common. It is a sad fact of life that in order to listen at 2 or 3 watts power it is necessary to provide twenty or thirty watts of capability. So to really use the benefits of an amplifier's rated power the overload behaviour needs to be as controlled as possible. Where an amplifier is found to clip 'nicely', the loudness attainable without undue fatigue can be greater than for units which measure as much more powerful. Indeed it could be said that one hallmark of a good amplifier is that it is almost impossible to detect when it *is* actually going into clipping (overload).

Although we consider that ascribing particular cause/effect relationships between listening results and measurements can be dangerous and misleading, a couple of observations do suggest that the disc stages of pre-amps leave something to be desired. Several of the units were preferred *via* FM when the disc source was fed *via* a high quality 'audiophile' pre-amp to an FM encoder and thence to the tuner and amplifier, rather than directly into the disc input! This is perhaps due to the band-limiting imposed by the 'FM route'. One unit which gave pre-amp compatibility problems with the Supex *901* cartridge was then tried by feeding the disc signal *via* the same special pre-amp into its aux. input; results were felt to be the equal of practically anything in the survey!

We did of course assess FM subjectively, both off-air and *via* a signal encoder, and with the provisos mentioned above, there is little doubt in our mind that it is less musically satisfying and informative than a good disc source, perhaps because of the more limited bandwidth. This limitation does seem to provide benefits in some instances, and can help to produce a controlled and smooth overall sound, though, it would appear, with less 'excitement potential'. We were hampered in our evaluations by the absence of live music from the BBC during the musicians' union strike; if and when this returns, FM will remain a source of great pleasure to many people, particularly lovers of classical music, not the least because of the skill and subtlety of the BBC engineers' microphone techniques.

MEASUREMENTS: THE AMPLIFIER

Power

The matrix of power measurements that we compile give plenty of information about the power behaviour of the amplifiers. A possible explanation of our occasional preference for the cheaper amplifiers is that the implied lower power ratings are easier to control; certainly a great many designs show significant differences between single and dual channel drive capabilities, which is evidence of a lack of independence between the two stereo channels, *via* the power supply, suggesting that a heavy demand on one channel might affect the signal in the other.

Most amplifiers offer a reasonable increase in power into 4 ohms, and continue to deliver power of some kind into 2 ohms. The theoretical 'ideal' of 'voltage source' drive should double power for each halving of impedance, and only the Meridian *105* under 'burst' conditions, comes close. How necessary this is remains a matter of some debate, and it is certainly expensive to provide. There are clear benefits to be gained from providing reasonable steady state power into 4 ohms, to cope with the impedance characteristics of many loudspeakers. It has also been postulated theoretically that loudspeaker impedances under dynamic drive conditions may be very much more variable than is revealed under 'steady' sine-wave drive (the normal measure); if this is so then good low impedance 'burst' capabilities are likely to be worthwhile.

Though we do not recommend driving more than one pair of loudspeakers at once, to do so with most amplifiers will require good low impedance drive capabilities. The Sony models are optimised to 8 ohm impedance, and dual speaker connection is arranged in series rather than parallel to avoid this problem; however connecting speakers in this way raises a variety of other problems. We remain apprehensive of the 'current source' drive characteristics produced by the Sonys, because of the abovementioned uncertainties and practical variations in loudspeaker impedances.

Disc input matching

The normal moving magnet cartridges often require correctly 'tuned' capacitance loading to give optimum performance. For most cartridges this lies in the range 150–350pF, though certain Shure and Ortofon models, for example, are designed to work best at around 450pF. Optimum loading requirements for about 80 cartridge types are to be found in our companion volume *Cartridges and Headphones*. The cartridge loading is made up of one component from the turntable/arm, plus a second provided by the amplifier/receiver input. Details concerning the former may be found in

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Turntables and Tonearms, where some values below 100pF were recorded, but many as high as 250pF. Where an amplifier/receiver offers a capacitance of more than 150pF, there is clearly some possibility of incompatibility; too *low* a capacitance can be easily rectified by using add-on units, which are often plug/socket units that plug directly into the back of the amplifier, and accept the turntable signal leads.

Moving-coil cartridges

Moving-coil cartridges are becoming increasingly popular, yet there is no common standard to make it easy for amplifier designers to offer a 'universal' input for low output models. Most of the amplifier sections in this survey equipped for low output m-cs had a sensitivity of 0.2mV, which is fine for many models, but on the low side for the lowest output types (*eg* Ortofon, Fidelity Research). We would prefer to see a sensitivity of 0.1mV, with, say, 100 ohms impedance, though the alternative impedance switching provided on the Sony '55 amplifier will be some help in matching. At the present time, the 'module replacement' system offered by Meridian is maybe the best bet.

It is surprising how few models had a moving-coil option fitted; without one, those wishing to use such cartridges will have to pay around £50 or more for an appropriate step-up device, yet building one into an amplifier costs comparatively little. Though they are operating in a fairly specialist area of the market, it is an interesting fact that Nytech, whose receiver offers m-m or m-c matching options ex-factory, find that two-thirds of their orders are for the m-c version.

Cartridge matching options to us represent probably the most useful of the facilities offered on amplifiers and receivers, yet they are often merely an afterthought fitted only on more expensive models. It is an area where the specialist manufacturers have been quite responsive (*eg* A&R, Audio Pro, Meridian), though the larger manufacturers still concentrate on 'power' meters, 'loudness', filters, tape-dubbing *ad nauseum*, particularly in their receiver ranges. Happily this is beginning to change, and Sony should be congratulated on offering good flexibility at quite modest cost on their new integrated '55 amplifier.

Disc input bandwidth

It is our opinion that cartridges can produce signal-dependent output up to a frequency of about 50kHz, but may generate plenty of unwanted 'muck' at still higher frequencies. It therefore follows that the high frequency end of the disc input should begin to be curtailed at about 50kHz, to get the most of the signal and the least of the muck. Similarly in our view there is little justification for risking extending the LF bandwidth below 10Hz either, though the highish IEC rolloff has been criticised by some listeners. Nevertheless as far as practical products in the marketplace are concerned, a well-curtailed bandwidth will make the amplifier's task easier – and anything that makes the amplifier's job a little easier has got to be worthwhile!

In the end there are no absolute rights and wrongs in this area, the situation being complicated because there are a whole variety of bass and treble rolloffs at every stage of the recording and reproducing chain, and to some extent these will tend to interact, either beneficially or prejudicially, and unpredictably. In the playback chain a few manufacturers have tried to design complete systems where rolloffs and bandwidths are matched and controlled (*eg* B&O, Linn/Naim), though these remain the exception rather than the rule, and naturally rule out flexibility in customer choice, though they remain a very valid route to high fidelity, with a number of intrinsic advantages.

Other inputs/outputs

Few if any problems are likely to be encountered connecting up with other pieces of apparatus. Possible compatibility problems have been indicated in the reviews where appropriate, but really the only thing to watch for is the odd model which uses DIN-type socketry to phono-type standards (mostly the small British companies, see reviews).

Performance parameters, etc.

General amplifier performance parameters gave little cause for complaint. Certainly some models measured better than others in this and that respect, but by and large there was little to seize upon as a source of strong criticism. Hum performance is one area where there is room for improvement in some cases, though this is an area which is almost as 'environmentally sensitive' as RF performance, and certainly isn't entirely predictable. Harmonic distortion performance gave no cause for complaint, though intermodulation (IM) was occasionally a little suspect (see spectrograms). With only the odd exception disc overload margins suggested no problems, and though damping factor varied across a wide range, there was no cause for alarm with any of the measured results.

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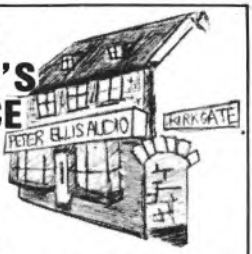

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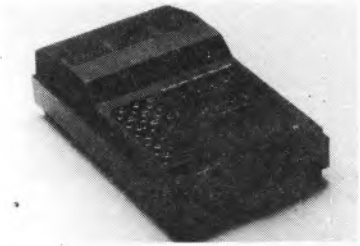

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Few indications of either crossover distortion or slew limiting were found, and the latter usually was only detectable in rare instances at high frequencies and high powers.

Frequency response, etc.

Though the majority of amplifier sections showed a flat disc frequency response, it was surprising the number that showed sufficient variation to affect the tonal balance of the sound, often significantly exaggerating the slight lower-mid depression and/or treble plateau introduced by our inverse RIAA network (see *Technical Introduction).* To what extent this is responsible for the results of listening tests is impossible to say, and one cannot modify the response without introducing some other variable. Certainly it will influence results, though at the same time there are other mechanisms at work which play their part. When commenting on the sound quality we have tried to take account of measured frequency response anomalies, though this is not always easy, and the anomaly is of course all part and parcel of the perceived result. With cartridges measuring as flat as they do nowadays, and even speakers getting pretty close in some cases, it is surprising that flatter results were not encountered (component tolerances must probably take part of the blame). Crosstalk was generally adequate (though not always inspired), meeting the 'minimum criteria' derived from that which can be achieved by a good disc source, *ie* about 40dB midband, 25–30dB at frequency extremes.

MEASUREMENTS: THE TUNER SECTION

The tuner measurements were generally evidence of very competent design, marred with monotonous regularity by mis-alignment problems. In the examination of the individual models commonsense has forced us to take a lenient view, because it is obvious that this is frequently a sample problem. But at the same time it is also clearly widespread amongst the products that reach the shops. If manufacturers are to create consumer confidence and market credibility, there must be greater efforts to avoid the sometimes quite serious problems our measurements indicate. The conscientious dealer should perhaps equip himself with enough basic apparatus to make a rudimentary alignment check, so that at least the 'duff' ones get sent back to the distributor if re-alignment cannot be attempted on site .

Sensitivity

The least impressive tuner section in this survey, on the end of a half decent outside aerial may pick up more signals better than the best in the survey if this is trying to work from an inferior indoor aerial. There is absolutely no point in spending a lot of money on a very sensitive tuner, unless you spend a little on the aerial used to 'drive' it.

A number of designs gave 'ultimate' sensitivities which were better than the theoretical maxima, though they are included for consistency's sake. Much more useful is the signal required for a reasonable S/N ratio in stereo (50dB) and the IHF 30dB noise + distortion result. (See Technical Introduction for further comment.) Here there were again some excellent results, and sufficient of a spread to suggest that those in weak signal strength areas would do well to take care in their choice; here again, alas, alignment problems were very obvious.

AM rejection

This is quite an important parameter, particularly for those who live in urban areas (and those who have no intention of using a proper outside aerial no matter what we say). It effectively measures the relative 'immunity' of the tuner to a number of interference effects, including multipath distortions, and electrical interference (usually worse at street level than at roof level). Figures of 40dB are adequate, but the city dweller might find 50 or 60 more satisfactory.

IF and Image rejections, RFIM

The 'mechanics' of the tuning process, with internal oscillators and the like, and the need to cope with signals of very different strengths, imply a certain sensitivity to other unwanted breakthroughs into the tuner 'front-end'. Results for these parameters are normally very good (IF in particular), and easier to achieve than AM rejection, so it is reasonable to expect minima of 60dB. RFIM may again be more important in dense urban areas, where the front-end can be overloaded by many strong signals. Likewise, low image rejection, particularly if coupled to poor AM rejection could bring problems of interference in busy areas from public service broadcasts.

Capture ratio

Capture ratio is a parameter which examines what happens when the tuner receives two stations operating on the same frequency, because a good FM tuner will automatically 'block' the weaker signal. The capture ratio is a small figure (the smaller the better) which relates how much stronger the strong signal must be than the weak

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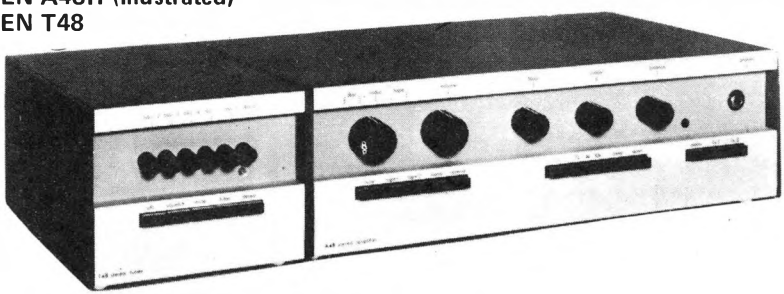

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one in order to achieve a particular degree of 'blocking'. Obviously the 'busier' the airwaves the more important a good capture ratio will be. Many tuners gave good figures below 2dB, and plenty should be quite acceptable with up to 4 or 5dB, though there are one or two 'rogues' which gave poorer results.

Distortion

The results of our audio distortion measurements give no cause for alarm whatever, with most of the results below reasonable audibility. The patterns showed an occasional increase between mono and stereo (*eg* Grundig *T1000,* Rogers) which might indicate some decoder problem. The spectrograms show that some models have significant distortion products in the crosstalk channel; this is slightly suspect, and leaves room for improvement.

Pilot tone suppression

Though there is no definite rule that says that the pilot tone accompanying FM must be suppressed, there is little point in having it hang around with the chance that it may get in the way, after its usefulness is exhausted (in the stereo decoder). So while it makes good sense to get rid of it, there is quite a big variation in the extent to which this is done, with the better results between 40 and 60dB, but with a number of models, notably from Technics, JVC and Mitsubishi, where the figure is only about 20dB. This is not a disaster by any means, but it just might give compatibility problems with a few tape/cassette decks, and we remain of the opinion that effective filtering is a good thing. A possible argument against pilot tone filtering is that the sharp filter required has its own undesirable effect upon the sound. There may be an element of truth in this, though we are inclined to feel that a more cogent argument against filtering is the difficulty in maintaining tight enough quality control on the components which (usually) comprise the filter; if these are not correct within quite close tolerances, the overall frequency response in the treble can be adversely affected, which is more serious than the presence of either the pilot tone itself *or* the filter to remove it.

Although there were some instances of frequency response anomalies, mostly concerned with 'wrinkles' at high frequencies, by and large there was little of which to complain. Likewise the crosstalk results cause little complaint, apart from one or two cases, though naturally there is some benefit in having a good crosstalk performance, well maintained across the frequency band.

Selectivity

Selectivity is a rather difficult parameter to summarise, as the 'single figure of merit' is not really sufficient to analyse the shape of the IF filter, which is what one needs to establish. A high selectivity figure, which a number of models show, will certainly be of value when trying to pick weak signals out from a band crowded with strong ones. However high selectivity does tend to compromise audio quality, so a choice of selectivities is sometimes available (*cf* Yamaha *CR840,* Aiwa *9700*). Dual sensitivities are usually split 50/80 or thereabouts, so those with a strong interest in long-distance reception from an urban area should perhaps choose from the higher selectivity tuners, while those primarily interested in the best sound quality from local stations might opt for a somewhat lower figure.

AM radio

Our 'AM consultant' Norman McLeod has contributed a few thoughts on this subject and on the behaviour of the test receivers/tuners at the end of the *Technical Introduction.* Basically this goes to show that the AM performance of one's supposedly 'hi-fi' tuner is likely to be as bad or worse than an average transistor radio. (Worse perhaps because a lot of them have fixed orientation ferrite aerials, and its easier to turn the 'tranny' round for best signal than the high fidelity installation.) With a handful of (scarcely) honourable exceptions, bandwidths were very tightly limited, a technique that pays dividends in selectivity for evening reception but does nothing for daytime audio quality. Poor sensitivity and low level signal distortions were also rife.

The only AM section which generated any enthusiasm was the one on the JVC *RS-7,* which is medium wave only, while the Philips, Pye, Yamaha (*840* and *440*), Dual and Optonica also received some plaudits; the comparison with the fabled Quad AM tuner of a couple of decades ago with its variable selectivity brought a lump to the throat. It is perhaps a pity that no specialist manufacturer has considered it worthwhile to produce a tuner with good and versatile AM in addition to 'hi-fi' FM, if only to emphasise the too-easy-to-forget hi-fi truism, that it is the programme that matters more than its reproduction; now we no longer have parallel broadcasting on AM and FM, the need for half-decent AM becomes very apparent.

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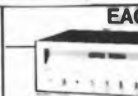

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Technics RSM17	£129.95
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Trio KT 530	£ 69.95
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Tradition demands that *Hi-Fi Choice* selects 'best buys' and 'recommended' models from amongst the tested items each issue, but as editor, and on this occasion co-author, I freely admit this is my least favourite part of the book, and the section that gives most qualms in composition.

These arise for a number of reasons. We are basing our judgements on an (admittedly very detailed) examination of a single sample, which is clearly dangerous ground when a significant part of the performance of, say, a tuner depends upon the accuracy with which it has been aligned. Obviously a persistent alignment problem from a manufacturer needs to be taken into account, but an isolated instance on a 'prestige' model (*cf* Marantz, Yamaha) is most unlikely to be representative, and in my view requires the imaginative exercise of judgement, rather than simple condemnation. (We do of course try to check second samples where possible, but with late arrivals of product and schedules to keep, this cannot always be managed.)

Moreover it is arrogant to assume that our judgement on a product will necessarily be the same as the reader's. We may have more experience and be able to generate considerable data to make the choice 'logical'. But it remains a choice, an attempt to compare and weigh up compromises that cannot be directly compared. A degree of subjectivity and whimsy is inevitable (though I'd rather that than allow a computer to make the decisions!)

A major source of worry is that the magazine might become regarded as an alternative or replacement for the hi-fi dealer. While its true that the advice herein is likely to be sounder than that imparted by certain hi-fi emporia, there is no possibility that the one-way communication of a magazine, with its 'from the pulpit' lecturing, can ever replace a proper dialogue with an experienced person with local knowledge (important for radio).

The hi-fi market is currently in a rather peculiar state. The recession in consumer spending has left unsold stocks of 'last year's models' in dealer and warehouse, while 'this year's models' are coming in at cheaper or similar prices (currency fluctuations). This means that a lot of hi-fi is becoming available at unpredictable and even 'silly' prices. (Note that our value judgements *are based on the price as printed;* more than that we cannot do.) Though this sounds like a lovely position for the consumer, it in fact means that the dealer faces shrinking margins, turnover, and possibly volume, so his 'real' profit on any single item will shrink, with the result that service must become the major sufferer. Indeed the profit generated from the sale of budget imported equipment is unlikely to do much more than pay the interest on the stockholding, so any attempt to give comparative demonstrations, let alone home installations, and all the sorts of things that make the good dealer really useful if not indispensable, may begin to go by the board; a sacrifice on the altar of consumerism.

To take an example, the results of this survey show that at least 10% of tuners tested suffer from quite serious mis-alignment. So it is likely that at least 10% of those who buy sealed brown cardboard boxes purely on the basis of this book will suffer similarly. Yet with the sort of margins offered by the current consumerism, few dealers will pursue the sort of policy adopted by the co-author in his shop (and by other dealers no doubt), whereby necessarily expensive Sound Technology equipment and engineering ability is available to check and re-align where necessary. One can almost regard the 'proper' retail margin as stake money for gambling on the factory-set alignment, and its stability in transit!

Enough of misgivings! Let the consumer gamble his discount stake money if he so desires. But I fervently hope that enough purchasers and dealers will recognise that the value of service is very real, and that its disappearance is unlikely to further the cause of enjoying music in the home.

In deciding which models should be singled out for recommendation, we have tried first and foremost to look for well-balanced results for the price on both subjective and objective tests. The problem comes when encountering, for example, a receiver with a fairly mediocre amplifier, but exceptional tuner; in fact in summing up different strengths and weaknesses that will have varying appeal to different users. We found few if any models which didn't show some areas of weakness, either in the 'fixed' receivers or the 'fixed-styling' separates, so it is easy to understand why putting together carefully chosen separates is popular amongst enthusiasts. Going through the reviews one sees all sorts of possibilities, like matching the Revox tuner section with the Meridian *105,* or the Marantz *1000* tuner section with the NAD amplifier, etc., etc.

It is less easy to see why 'factory-matched' separates offer any particular advantage over (usually cheaper) receivers. The advantages that

HOMESOUND

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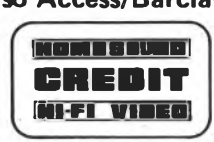

Other makes of equipment include
Denon, Thorens, Ariston, JBE, Ortofon, IMF, Glanz, Omar, Audiomaster, Monitor Audio, JPW, Grado Signet, Dynavector, Uher, Klipsch, Nightingale, Nakamichi, Harbeth, AR and many more.

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the separates seemed to possess, which tended to make up for their slight price penalty, was generally a rather better amplifier section. When one takes into account that all the signals must pass through the amplifier, not only the radio, and it therefore has a particular role in determining the total system quality, it is not surprising that our recommendations are spread fairly evenly, though personally we perhaps still relish the third alternative of forgetting the visuals and mixing and matching the separates.

Dividing the units into price bands of below £200, £200–£400, and over £400, the following units were classed: as 'Best Buys', for having a good overall performance for the price, plus a little bit 'extra' in price or performance; as 'Recommended', which usually means we were a little less enthusiastic about certain of our findings, while wishing to spotlight something a bit special that they offered; and as 'worth considering', where again there was something special, or some area of weakness, which we feel you will have to evaluate for yourself (classy styling, clever ergonomics, etc.).

'BEST BUYS' UNDER £200

Pye 6692 (£109). Good ergonomics, nice styling, generally well balanced performance at a very reasonable price.
Eagle R7200 (£137). Well-balanced technically, with promising listening test results for the price.
NAD 3020/4020 (£86+£86). Well above average amplifier with quite good auditioning results; tuner quite respectable.

'RECOMMENDED' MODELS UNDER £200

Rotel RX300 (£85). Respectable amplifier at a very reasonable price, fitted with a tuner suitable for uncritical local reception.
Marantz SR1000L (£125). Very sensitive/selective tuner with good performance, plus an amplifier that didn't particularly excite us; guaranteed to impress *non-cognoscenti* friends.
Scott 430A/510TL (£90+£65). A generally liked, lively, powerful amplifier, marred by a distinctly below average tuner.
JVC AS3/TV3L (£85+£90). Neat separates that gave well-balanced results, with promising though not consistent listening results.
JVC RS-7 (£160). Generally respectable results with some promising listening results, plenty of power, and impressive medium wave AM.

'WORTH CONSIDERING' MODELS UNDER £200

Rotel RX1000L (£150). Attractive competent receiver (probable slight misalignment); usefully (?) unaggressive sound quality.
Rotel RX604 (£160). Good performance, reasonable power, and mixed listening results, plus the possibility of bargain prices.
Tensai TA2350/TT3345 (£95+£75). Smart combination with average tuner and quite lusty amplifier; promising but inconsistent audition.
Yamaha 440 CR440 (£170). Attractive style and finish, with generally competent results throughout for the price.

'BEST BUYS' £200–£400

Grundig R3000 (£226). Good tuner performance, adequate power and good auditioning at a very reasonable price.
Sansui AU217II/TU217 (£121+£107). Well-liked amplifier and competent tuner, with good listening results.
A&R A60/T21 (£190+£173). Well-balanced, with impressive subjective and objective findings for the price.

'RECOMMENDED' MODELS £200–£400

Technics SU-V2/STS-1L (£125+£95). Impressive technical performance and promising though inconsistent auditioning.
Optonica SM5100/ST5100 (£115+£115). Attractive well-liked combination with promising subjective results; tuner measurements affected by probable misalignment.
Sony STR-V45L (£230). Attractive, with useful ergonomics, competent performance, and promising audition; needs careful speaker selection.
Yamaha CR840 (£285). Attractive bulky receiver with potentially exceptional tuner performance (some misalignment), though amplifier generated less enthusiasm.
Nytech CTA252XDII (£299). Limited power, but very good, well-balanced results; unusual ergonomics that we like (but we're probably biased anyway!)

Hi-Fi Connections

Offers a comprehensive range of equipment featured in this guide.
We will willingly demonstrate amplifiers, tuners, or receivers from J.V.C. Optonica, Pioneer, Lux, Quad, Sansui, and of course the excellent Sugden A4811 and T4811 (featured).

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'WORTH CONSIDERING' £200–£400

Philips 103/305 (£117+£118). Well-liked ergonomically with promising audition; reasonable measurement marred by mis-alignment.
Sony STR-V55 (£255). No real problems – we just preferred the cheaper *V45L*, which has long wave thrown in extra.
Eagle A7400/T7400 (£123+£137). Good tuner and reasonable amplifier gave promising though inconsistent audition.
Yamaha A550/T550 (£140+£140). Attractive technically well-balanced combination, with reasonable but inconsistent audition.
B&O Beomaster 1900-2 (£279). Attractive if extravagant ergonomics and styling, promising listening results, limited power, but technically good (except for tuner alignment).
Aurex SC-M12/SY-C12/ST-T10L (£110+£136+£115). Unusual and attractive, tiny, with limited power, but with good technical and listening results.
Rogers A75III/T75II (£220+£155). All-round competence with solidity and good facilities.

'RECOMMENDED' MODELS OVER £400

Sugden A48/T48 (£253+£150). Unusual attractive finish, solid, with consistently good results all round; well-liked in use.
Marantz PM700/ST600 (£199+£249). Good auditioning and power marred by tuner (sample?) misalignment; lots to play with.
Rogers A100/T75II (£320+£155). Promising auditioning, overall competence and good balance, plus 'solidity'.
Meridian 101/104/105 (£612+£225). Splendid amplifier, very respectable tuner (for the right location). Very pretty.
Revox B780 (£1000). Splendid tuner, very respectable amplifier (for the right loudspeakers). Very solid.

'WORTH CONSIDERING' OVER £400

Sugden C51/P51/R51 (£138+£161+£161). On a par with, though different to its cheaper stablemate; unusual appearance/ergonomics.
Dual CR1780 (£529). Promising though inconsistent audition, very competent technical performance; powerful.
Meridian 101/103D/104 (£493+£225). Very good auditioning but expensive for limited power, very pretty.

AMPLIFIER SECTION	POWER				COMPATIBILITY		
	Both channels 8 ohms, .1% dist		'Burst' 8/4/2 ohms (watts)	Disc cap (pF) (*=MC)	TAPE mV/kohm		
					INPUT	OUTPUTS	
	Watts	dB ref 1W/8 ohms			Sens	Phono	DIN
Aiwa AR7800	64	18.1	90/143/157	216	160/1000		35/80
Aiwa AA8700/AT9700	84	19.1	133/189/179	var*	170/50	250/2	30/80
A&R A60/T21	36	15.4	57/92/29	var	100/48		165/50
Audio Pro TD150	77	18.7	101/154/19	67*	200/43		150/.85*
Aurex SB-A10/ST-T10L	19	13.0	21/45/51	20	160/27	250/5	
Aurex SC-M12/SY-C12/ST-T10L	35	15.3	45/59/42	300	120/39	215/5	
B&O 1700	20	13.0	24/39/42	?	250/?		48/?
B&O 1900-2	27	14.2	36/57/19	?	250/89		30/?
Dual CR1780	109	20.3	168/78/37	170	215/460	400/3	50/80
Eagle R7200	26	14.2	41/61/29	240	220/73	240/8	45/23
Eagle A7400/T7400	41	16.0	72/69/36	90	170/85	200/6	32/80
Grundig R3000	36	15.4	42/72/98	?	140/420	100/9	20/1000
Grundig V2000/T1000	39	16.0	49/78/116	100	230/180	300/8	14/1000
JVC AS3/TV3L	26	14.2	36/45/37	140	160/46	310/.45	74/53
JVC JRS55L	46	16.5	63/92/136	400	170/40	280/.047	200/76
JVC RS-7	66	18.2	87/135/168	350	180/68	350/.075	45/76
JVC JRS201L	45	16.4	59/84/74	180	170/56	320/.45	40/76
Marantz SR1000L	31	15.0	52/78/86	?	250/20	300/.47	
Marantz SR4000L	64	18.1	83/123/15	185	200/13	290/.47	
Marantz PM700/ST600	88	19.4	97/154/168	325	175/32	250/.46	65/59
Mitsubishi DA-R430	27	14.2	39/62/67	150	160/80	240/.8	130/105
Mitsubishi DA-U630/DA-F630	55	17.3	75/110/94	260	160/150	260/.75	125/100
Meridian 101/103/104	43	16.2	59/102/60	125*	950/32		205/6*
Meridian 101/103D/104	52	17.0	63/102/60	125*	950/32		205/6*
Meridian 101/105/104	106	20.2	160/289/475	125*	950/32		205/6*
Nytech CTA252 XDII	25	13.8	36/52/20	?	80/90		300/4*
NAD 3020/4020	28	14.4	42/67/16	60	230/15	200/6	55/70
Onkyo TX20	36	15.4	45/62/51	80	190/100	210/2	
Optonica SM5100/ST5100	38	15.8	47/78/106	140	160/55	260/.98	30/77
Philips 602	28	14.2	33/31/15	110	210/400	250/2	50/480
Philips 604	66	18.2	83/47/15	?	175/445	260/2	50/450
Philips 103/305	51	16.8	—/—/—	?	150/100	250/2	50/480
Pye 6692	32	15.0	43/54/5	120	275/68	320/2	25/247
Revox B780	102	20.0	156/246/45	115	190/53	200/2	70/?
Rogers A75II/T75II	42	16.0	66/109/89	?	130/50	225/.1	120/81
Rogers A100/T75II	53	17.0	75/116/107	var	110/50	280/.46	150/82
Rotel RX300	20	13.0	24/41/36	180	165/60	300/.05	60/88
Rotel RX1000L	38	15.5	52/72/90	200	160/48	250/1	100/90
Rotel RX604	44	16.3	59/95/106	200	140/40	290/.56	60/89
Sansui AU217II/TU217	41	16.0	52/83/107	70	210/150	260/2	
Scott 430A/510TL	57	17.4	66/116/47	240	190/40	240/4	35/79
Sony STR-V45	58	17.4	64/32/13	120	150/46	165/7	
Sony STR-V55	78	18.8	101/102/19	250*	170/45	190/6	
Sony TA-F35/ST-A35L	59	17.6	93/116/82	100*	200/100	190/6	
Sony TA-F55/ST-J55	76	18.6	81/131/29	var*	170/50	200/6	
Sugden A48/T48	41	16.0	52/78/90	?	170/150		100/46
Sugden C51/P51/R51	50	16.8	56/85/100	?	210/150	345/.2*	16/31
Technics SA202L	34	15.3	52/73/47	190	200/50	260/.37	29/80
Technics SA303L	46	16.6	59/90/67	160	200/30	230/2	30/78
Technics SU V2/ST S1L	47	16.6	61/96/151	130	210/80	280/.48	32/80
Technics SU V4/ST S3	66	18.2	92/138/126	200*	200/80	300/32	25/78
Tensai TA2350/TT3345	51	16.8	79/115/74	?	185/31	320/3.9	
Yamaha CR440	36	15.4	47/72/57	?	145/63	235/.27	
Yamaha CR840	65	18.0	80/109/29	200	130/37	280/.23	
Yamaha A550/T550	49	17.0	71/81/6	30	187/50	280/.6	

Overall Comparison Chart

SENSITIVITY (uV)			Front-end REJECTIONS (dB)							Pilot		TUNER SECTION
50dB stereo	IHF 30dB mono	Stereo S/N (dB)	IF	AM	Image	Capture ratio (dB)	RFIM (dB)	Selectivity	Dist. stereo 20% mod (%)	tone suppression (dB)	Cross-talk (dB)	
22	1.30	71	101	58	101	2.50	60	65	.18	53	48	Aiwa AR7800
25	0.8	72	75	62	110	1.2	83	83	.13	50	40	Aiwa AA8700/AT9700
25	2.0	71	107	61	78	1.5	79	48	.55	55	42	A&R A60/T21
10	1.5	67	87	45	70	.75	72	64	.12	50	30	Audio Pro TD150
30	3.0	65	73	47	35	3.75	66	62	.56	45	42	Aurex SB-A10/ST-T10L
30	3.0	65	73	47	35	3.75	66	62	.56	45	42	Aurex SC-M12/SY-C12/ST-T10L
18	2.25	77	75	60	93	3.0	60	45	.07	48	40	B&O 1700
20	14.0	68	88	52	70	11.0	59	47	.07	40	45	B&O 1900-2
35	1.9	70	80	49	110	2.0	60	78	.30	50	30	Dual CR1780
45	2.25	69	87	60	60	1.25	60	48	.1	60	40	Eagle R7200
30	2.0	70	66	51	63	1.0	70	55	.12	60	45	Eagle A7400/T7400
13	1.25	74	115	59	88	6.0	64	69	.30	55	30	Grundig R3000
35	2.5	72	110	40	41	6.0	70	41	.80	28	35	Grundig V2000/T1000
4	1.4	78	78	54		2.0	60	46	.30	20	35	JVC AS3/TV3L
23	2.9	65	80	55		2.0	62	57	.24	20	57	JVC JRS55L
	1.5	70	96	60	71	2.0	62	52	.19	17	45	JVC RS-7
50	3.5	68	98	60	70	3.5	49	63	.12	50	40	JVC JRS201L
17	1.0	70	92	56	54	1.75	53	83	.10	52	52	Marantz SR1000L
17	1.5	71	92	54	58	2.0	65	86	.12	48	59	Marantz SR4000L
170	25.0	60	85	59	60	2.75	58	67	.17	58	40	Marantz PM700/ST600
45	4.0	64	94	48	60	1.5	69	55	.10	22	31	Mitsubishi DA-R430
50	5.0	63	101	63	105	1.5	74	53	.10	22	40	Mitsubishi DA-U630/DA-F630
23	1.1	67	98	54	74	1.6	54	35	0.1	53	43	Meridian 101/103/104
23	1.1	67	98	54	74	1.6	54	35	0.1	53	43	Meridian 101/103D/104
23	1.1	67	98	54	74	1.6	54	35	0.1	53	43	Meridian 101/105/104
80	3.2	69	95	40	67	1.25	76	56	0.09	57	28	Nytech CTA252 XDII
32	1.5	69	80	56	52	1.5	70	70	.63	53	35	NAD 3020/4020
45	7.0	70	90	52	67	5.5	80	85	0.3	20	44	Onkyo TX20
50	5.0	60	79	57	81	1.0	72	68	0.3	53	48	Optonica SM5100/ST5100
35	4.0	68	53	35	52	11.0	63		0.5	45	30	Philips 602
80	4.5	68	47	52	43	6.0	74	39	0.5	50	35	Philips 604
150	2.0	66	55	45	42	6.0	79	62	0.4	48	45	Philips 103/305
50	1.0	73	90	58	61	2.0	63	51	0.45	47	36	Pye 6692
15	1.0	71	110	61	110	2.0	75	67	0.1	50	40	Revox B780
19	1.25	64	85	57	88	1.0	56	60	0.17	52	32	Rogers A75III/T75II
19	1.25	64	85	57	88	1.0	56	60	0.17	52	32	Rogers A100/T75II
100	12.0	68	58	66	50	5.0	58	42	0.3	22	36	Rotel RX300
80	5.0	57	77	53	51	1.75	49	70	0.4	20	38	Rotel RX1000L
22	1.5	66	93	50	42	2.25	59	68	0.43	42	50	Rotel RX604
60	3.5	66	85	45	55	2.0	54	43	0.05	47	47	Sansui AU217II/TU217
125	12.5	64	90	64	44	4.0	51	30	0.5	46	30	Scott 430A/510TL
30	2.5	70	89	47	83	3.0	75	76	0.08	51	37	Sony STR-V45
40	2.5	69	81	56	76	2.25	77	75	0.45	53	40	Sony STR-V55
65	6.0	71	100	58	100	4.25	55	80	0.24	55	43	Sony TA-F35/ST-A35L
30	3.5	70	88	51	79	3.0	78	80	0.19	49	60	Sony TA-F55/ST-J55
22	1.5	66	71	50	110	4.0	57	45	0.17	47	22	Sugden A48/T48
25	1.5	66	82	55	110	2.0	62	50	0.09	54	29	Sugden C51/P51/R51
37	1.5	60	83	55	55	1.0	66	52	0.05	20	42	Technics SA202L
22	1.75	70	89	57	68	1.5	59	58	0.08	20	42	Technics SA303L
40	1.25	70	93	37	70	2.5	63	76	0.08	18	47	Technics SU V2/ST S1L
21	1.5	70	110	43	78	2.0	59	76	0.05	20	40	Technics SU V4/ST S3
65	2.5	68	56	62	68	4.25	59	54	0.35	46	36	Tensai TA2350/TT3345
45	2.0	71	83	45	62	3.5	62	46	0.2	52	53	Yamaha CR440
75	11.0	67	83	57	63	5.0	70	85	0.2	45	46	Yamaha CR840
20	1.75	74	116	46	61	2.0	70	52	0.1	54	56	Yamaha A550/T550

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AFC: Automatic Frequency Correction; a special circuit that compensates for slight mis-tuning or tuning drift.

AM: Amplitude modulation; a form of radio transmission appropriate nowadays to information rather than hi-fi music (see *MW, LW, SW*).

AM rejection: Ability of an FM tuner to discriminate against unwanted AM interference signals.

Amplitude: Size or magnitude, and hence level or loudness of a signal, for example.

Bandwidth: A range of frequencies with presumed defined upper and lower limits.

'Birdies': A form of FM radio interference.

Capacitance: An element of electrical impedance that is particularly important when matching pickup cartridge, arm leads and amplifier input characteristics to achieve a flat frequency response from discs.

Capture ratio: The ability of a tuner to reject an unwanted station in favour of a slightly stronger wanted one on the same broadcast frequency.

Clipping: This is the state reached when a circuit is overloaded and overdriven, resulting in bad waveform distortion and audibly unpleasant effects.

Coloration: A general term used to describe the audible effects of distortions, particularly in loudspeakers and record players. These are usually caused by frequency response irregularities and/or resonances.

Crosstalk: The leakage from one channel to the other in a two channel stereo system.

dB: Decibel.

DIN: German standards body, responsible amongst other things for a popular range of standard plugs and socket specifications.

Decibel: A logarithmic unit used in audio to indicate the relative intensity of a sound or the relative strength of a signal.

Decoder: The circuit in a tuner which separates the left and right signals from an FM multiplexed (stereo) transmission.

Distortion: The total percentage of unwanted signal present in a wanted signal.

DX (DX-ing): Code/jargon to describe long-distance radio reception.

Equalisation: The deliberate modification of frequency response, usually in response to some engineering limitation or deficiency in the component (*eg* loudspeakers) or the information medium (*eg* disc and tape).

FM: Frequency modulation; the technique used to encode audio information for transmission with good fidelity using very high frequency (VHF) transmission.

Ferrite rod: A short rod type aerial used for AM reception; may be fitted internally or externally to tuner or receiver.

Filter: A circuit (normally) used to restrict the bandwidth of a system; may be fixed or switchable.

Frequency: The rate of a cyclic (repeated) vibration.

Frequency response: Abbreviated from amplitude/frequency response, this prime graphical measurement examines whether all frequencies across the spectrum are reproduced or generated at the same relative level.

HF: High Frequencies; the treble end of the audio band, musically consisting largely of harmonics.

Hz: Hertz=cycles per second; the measure of frequency.

Harmonic: Harmonics are the whole number multiples of a base frequency called the *fundamental.*

Harmonic distortion: The addition of unwanted harmonics to a signal. Because the structure of music is already rich in harmonics, the audible effects of moderate levels of harmonic distortion are rarely objectionable, but may be evidence of engineering limitations.

Hum: Self explanatory and onamatapoeic; caused by interference of mains frequency or harmonics (50Hz etc in UK), perhaps as a result of poor earthing arrangements.

IHF: American Institute of High Fidelity, an important standards body, many of whose recommendations on measurement techniques have been adopted in this book.

IM: Intermodulation. Interference between two or more single frequency tones can cause non-harmonic distortion components such as sum, and difference frequency signals to occur.

Impedance: The measure of an electrical load when using alternating currents as in audio, combining resistance, capacitance and inductance.

Jack plug/socket: Post Office style plug/socket standard, widely used for headphone and microphone connections both in mono and stereo formats.

Kilo- (k-): Prefix for units meaning $\times 1000$ (*eg* 1kHz= 1000Hz).

LED: Light Emitting Diode; an indicator light.

LF: Low frequencies; the bass end of the audio frequency range.

LW: Long wave; a poor quality AM transmission band; UK Radio 4 is sometimes only obtainable on LW during the daytime!

'Loudness': An equalisation circuit frequency switchable on amplifiers which is designed to compensate for presumed hearing characteristics at low listening levels by boosting bass and treble.

Medium wave: An AM transmission band incapable of high fidelity signals.

Micro- (u-): Prefix for units meaning one millionth of (*eg* seconds, farads).

Midrange: The middle part of the audio frequency band.

Milli- (m-): Prefix for units meaning one thousandth of (*eg* volts, etc.).

Modulation: An alternating (*eg* audio) signal.

Moving-coil (m-c): Type of transducer, used in some cartridges and widely in loudspeaker drive units.

Moving-magnet (m-m): Type of transducer widely used in cartridges.

Multiplex: An encoding system that allows the transmission of two or more separate signals on a single carrier, whereby stereo FM broadcasts are transmitted; a *multiplex filter* removes the pilot tones after decoding to avoid frequency interference.

Muting: Muting circuitry is fitted to FM tuners to cut out interstation hiss and weak stations, making it easier to find the strong signals which come through above the *muting threshold.*

Noise: Random unwanted low level signals generated fundamentally through thermal excitation on the molecular

level. Poor system design may make it intrusive.

Ohm (also *eg* kohm): measure of the load presented by a device to an electrical source.

Phono: The most commonly used plug/socket combination in audio components.

Pilot tone: The 19kHz signal in a stereo FM broadcast which activates the stereo decoder; carries L—R signal.

Power amplifier: The part of an amplifier that provides power to drive the loudspeakers; usually integrated it is sometimes a separate component.

Pre-amplifier: The part of an amplifier that accepts the input signals, sorts them, applies any necessary equalisation, and then passes the signal to the (normally integral) power amplifiers.

Pre-emphasis: A form of equalisation applied to a source signal which is then de-emphasised by the signal source, consequently improving the S/N ratio.

Presence: Area of frequency band in upper mid/lower treble which emphasises any forward quality in the human voice.

RF: Radio Frequencies.

RFIM: Radio Frequency Intermodulation can be caused by closely-spaced strong aerial signals creating 'ghost' stations in the tuner front-end.

Selectivity: The ability of a tuner to discriminate against unwanted signals transmitting on frequencies near to a wanted one. Increasing selectivity beyond a certain point degrades the audio quality, so the more sophisticated designs sometimes offer different degrees of switchable sensitivity.

Sensitivity: The amount of signal input required to generate a specified signal level output, or *vice-versa*.

Signal-to-noise, signal/noise, S/N: The difference in total output when an applied signal is removed.

Transient: Signal of very short duration.

VHF: Very High Frequencies; may refer to audio band or more usually radio frequencies.

Volt: A measure of the amplitude of a signal in electrical form.

Watt: A measure of electrical power, combining the voltage (amplitude) with the current required to drive the 'motor' of a loudspeaker.

Weighting: Derived from psycho-acoustic or engineering considerations, this is a bias applied to a test method to improve its subjective relevance (hence also *unweighted*).

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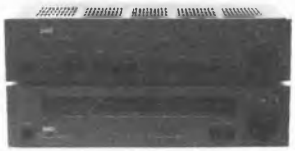

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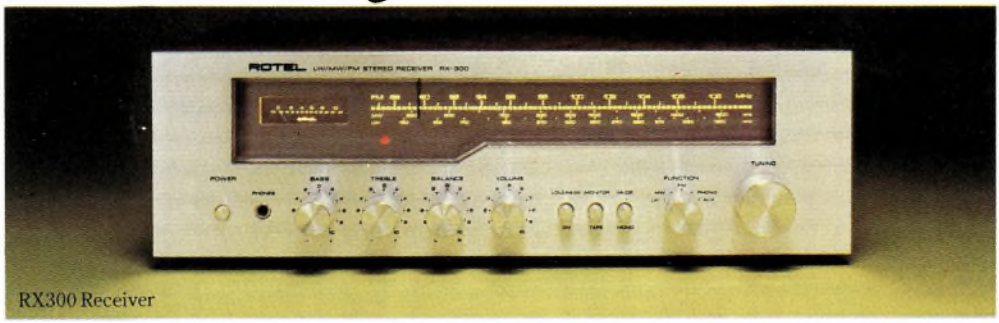

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