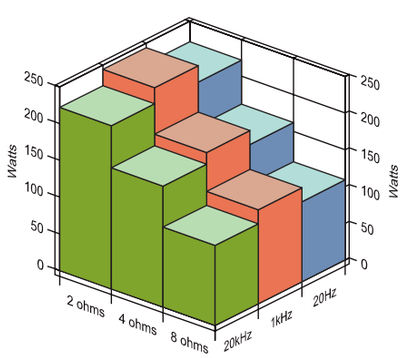
T+A

CD1230R CD Player & PA1230R Integrated Amplifier



Power Output: Single channel driven into 8Ω, 4Ω and 2Ω non-inductive loads at 20Hz, 1kHz and 20kHz.

Stop smirking. It stands for 'Theorie und Anwendung' or, in English, 'Theory and Application' and the (obviously!) German company behind the brand has been designing and manufacturing superior audio equipment in its factory in Herford, Westphalia, since 1978. It's one of Germany's largest high-end manufacturers, with more than 100 employees, 60 of whom are directly involved in production and between them build more than 5,000 pairs of loudspeakers and 6,000 electronic components every year.

Like almost all T+A's products, the understated appearance of the CD1230R CD player belies its exceptional performance and the unique circuitry hidden inside. Significantly, T+A programs its own DSP processors: it doesn't use 'off-the-shelf' hardware processors as do most CD player manufacturers. This also allows T+A to provide users with a choice of several different digital filter types. The CD1230R lets you choose between five different filters, so you can optimise its analogue output to suit the music you play and your listening preferences as well as to ensure the best match with the other components in your system.

The same is true of the T+A PA1230R integrated amplifier. It uses output devices of extraordinary bandwidth (to 400kHz) yet still delivers 100-watts per channel (8Ω) from a very slim chassis.

CD Filter Choice

The standard 'long finite impulse response' or 'Long-FIR' filters used in almost all CD players always deliver extremely flat and extended frequency responses when tested using the continuous sine waves found on test CDs, but unfortunately add pre and post-echoes to actual sounds when playing back music signals, which are anything but continuous. And it's these two echoes that cause the music played back from compact discs to sound less natural than live music, leaving them unable to imbue a stereo image with a true sense of height, width and depth. Although the CD1230R incorporates a standard 'Long-FIR' filter option, it also offers a 'Short-FIR' filter that improves stereo imaging but does not remove the echoes that cause unnatural sound.

Instead, T+A achieves complete echo removal with the use of a proprietary Bezier Polynomial Interpolator (BPI) filter function that T+A says '*offers an impressive blend of*

T+A

Brand: T+A
Models: CD1230R & PA1230R
Category: CD Player & Integrated Amplifier
RRP: $3,999/$3,749
Warranty: Three Years
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naturalness, good dynamics and accuracy.' However, even this is not the perfect solution, because this particular filter rolls off high frequencies a little early, and results in slightly-increased high-frequency noise. T+A provides yet another filter that removes the high-frequency noise with a special noise-shaper, but the use of the noise-shaper itself affects the digital-to-analogue conversion process, resulting in slightly less precision at very low recorded levels, which in turn affects very low-level sounds.

Perhaps the most interesting filter function that's offered on the CD1230R is one that simulates the 'ringing' effect of analogue sound, as would be heard when playing an LP. T+A achieves this effect by using an 8th-order IIR (infinite impulse response) filter to remove the digital pre-echo whilst leaving the post-echo intact. Fortuitously, the frequency response of this particular filter also mimics the typical rising frequency response of a moving-coil phono cartridge. By default the T+A switches on with the BPI filter in circuit, but you can quickly and easily cycle through the various different filter options by pressing the 'Filter' button provided on the front panel. The filter in use at any time is displayed in the front panel display except if you're using the standard filter, in which case there's no display. You can also alter the absolute phase of the analogue output signal (in the digital domain) via a front panel switch.

T+A is able to offer all these different functions because it implements its filters via software, using a programmable 8× oversampling, 56-bit DSP chip, which is fed by a pair of single-bit 356.8Hz/24-bit Sigma-Delta converters in a dual differential configuration. The DSP IC in the CD1230 provided to *Australian HI-FI Magazine* for evaluation was running Version 5.30 of T+A's software. Obviously, this software can be upgraded at any time, but because there is no RS232 input on the rear of the CD1230, this would be a job for your dealer, rather than a DIY task over the Internet.

Operationally T+A's CD1230R offers all the usual CD transport functions, including A–B repeat, but the track programming memory accommodates only twenty tracks rather than the more usual 32 or so, and the 'Repeat' and 'Random' replay functions if activated will continue indefinitely until cancelled manually, rather than ceasing after a certain number of replay cycles. The brightness of the front panel display can be altered between its usual fairly bright setting ('Normal'), a much duller version ('Darkened') and 'Off.'

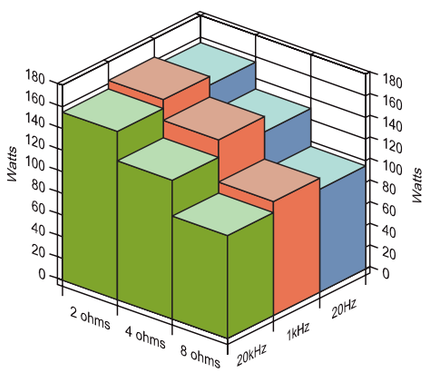
The rear of the unit has the usual RCA analogue outputs, and a Toslink digital output, but no co-axial digital output. There are also custom 'RLink' and 'RC-In' for 'smart' linking to other T+A components.

PA1230R Integrated Amplifier

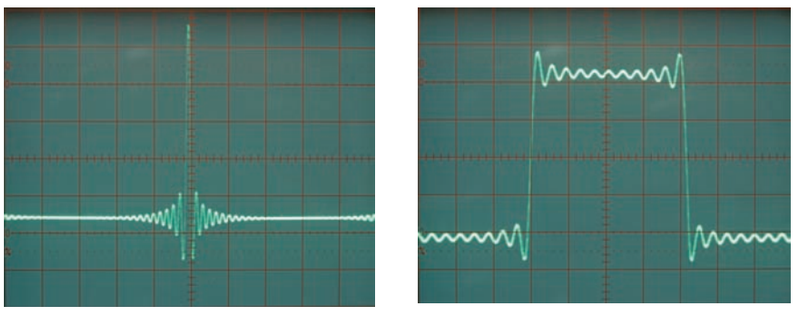
At a time when many manufacturers are using microprocessor technology to bury functions below several software layers so you need to have an owners' manual close at hand if you want to access them, T+A has delivered an amplifier where each function has its own control, properly and clearly labelled, on the front panel. This necessarily means there are quite a few knobs and buttons, but rarely has an amplifier been so easy to use. This is especially the case because the PA1230R is one of the very few amplifiers available that allows you to adjust bass and treble individually for the left and right channels.

The necessity of having tone controls separate for each channel is overlooked by most manufacturers, yet it's actually essential, because rarely are both speakers in a stereo system equally acoustically loaded: one will inevitably be positioned closer to a couch or chair than the other (which will tend to absorb bass energy) or closer to a hard surface than the other (which will increase treble energy), so a slight 'tweak' to the frequency response of one channel is necessary to get it to more precisely match that of the other channel.

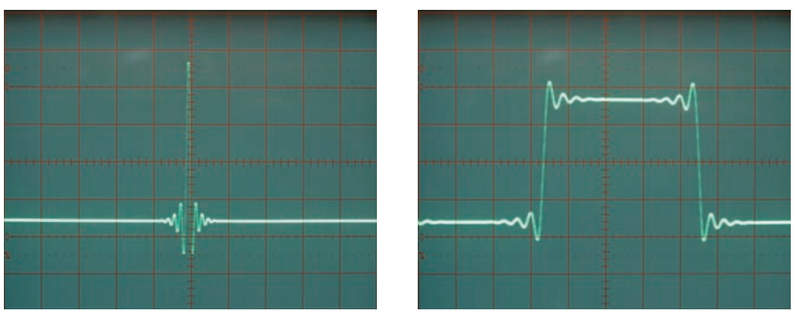
Perhaps the most interesting filter function that's offered on the CD1230R is one that simulates the 'ringing' effect of analogue sound, as would be heard when playing an LP. T+A achieves this effect by using an 8th-order IIR (infinite impulse response) filter



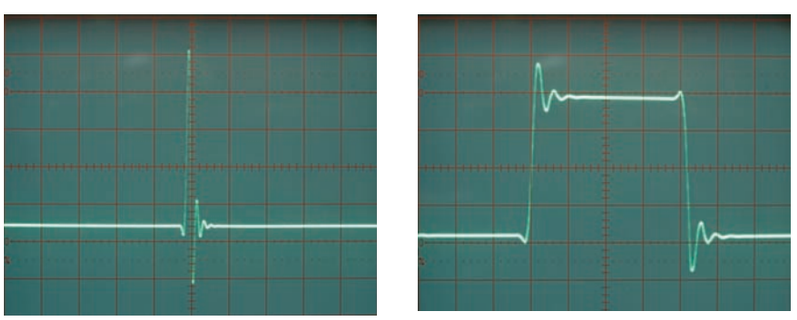
Power Output: Both channels driven into 8Ω, 4Ω and 2Ω non-inductive loads at 20Hz, 1kHz and 20kHz.



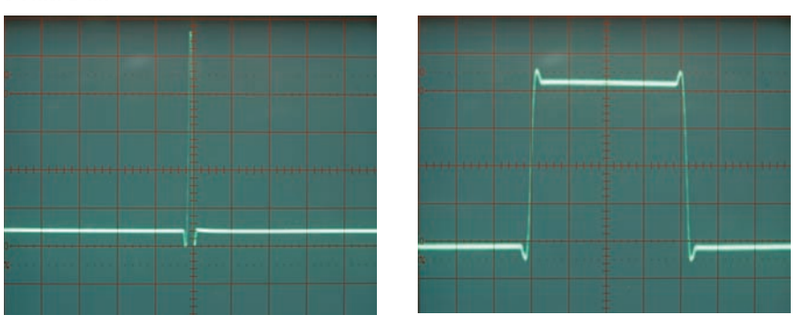
a) Standard Filter (Long FIR)



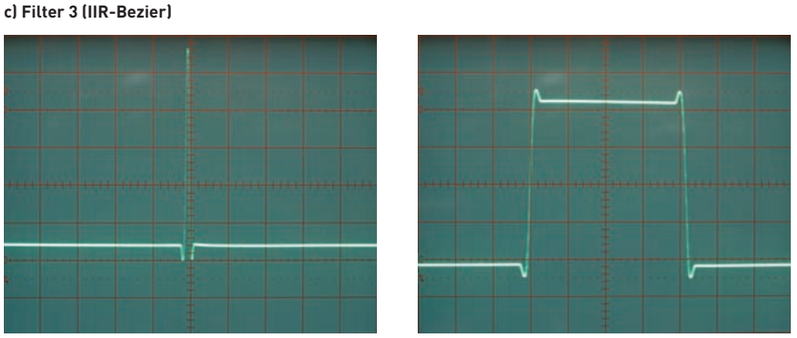
b) Filter 1 (Short FIR)



c) Filter 2 (IIR)



c) Filter 3 (IIR-Bezier)



d) Filter 4 (Pure Bezier)

This shows the differences in performance between the five different filters available in the T+A CD1230R CD Player when tested with an impulse (left column) and with a 1kHz square wave (right column).

One function on the PA1230R that isn't immediately obvious is a 'Sleep Timer' that will power-down automatically after a preset time (up to 60 minutes in ten-minute increments). Yet another that is not at all obvious is that the loudness control's action is automatically linked to the volume control setting, so the further the volume control is rotated to the right, the less bass and treble boost is added by the loudness control. (This is actually what *should* happen, but rarely does!) Interestingly, the front-panel 'Flat' function, which defeats the tone control settings, has no effect on the loudness function.

One thing that is missing from the front panel is a phono button. For those who want a phono circuit, the 'Aux2' input can be optionally fitted with an MM or MC phono module. Both modules have DIP switches that allow you to set their input impedance and sensitivity to best suit a specific cartridge. You can also option in a balanced preamplifier output, where XLR sockets replace the unbalanced RCA cinch pins that are fitted to the standard version.

Internally, the T+A is beautifully laid out, with the various PCBs populated exclusively with state-of-the-art components, including Vishay 0.1% tolerance metal film resistors, Wima FKP polypropylene capacitors, BNC mica capacitors and Elna Cerafine capacitors. All components are linked by PCB tracks made not from copper, like most PCBs, but from a mixture of copper and silver. The single large dual-wound toroidal transformer feeds separate discrete diode bridges whose output is smoothed by two banks of four 63V, 4,700µF capacitors. All switching is managed by relays. A centrally-mounted heatsink is home to two pairs of 2SC3263/2SA1294 output transistors. The heatsink on which these and their drivers are located sits above a hole in the base of the chassis, to make use of convection-cooling, but air inside the chassis is exhausted by a miniature fan fixed to the rear panel.

Use and Listening Sessions

As is always the case with superior audio components, this T+A CD1230R/PA1230R pair reproduced music so naturally and effortlessly that it was very hard to concentrate on the reviewing process. Time and again I found myself just becoming

immersed in the music only to find myself sitting in silence when the CD had finished, staring at a notebook that was completely bereft of commentary. Indeed at the end of the first evening, the only single comment I'd noted was that I wasn't overly keen on the industrial design of the remote control, which was a tad too large and 'angular' for my liking, though I would be the first to admit it was easy to use, worked perfectly every time and had an extraordinary range.

For my next session, I concentrated my efforts on establishing which of the five filter settings I preferred on the CD player. A few CDs later I realised I'd set myself an impossible task, because there was no single 'best' filter—from what I could hear, the best one varied from CD to CD. I actually quite liked Filter 4 when playing back 'audiophile' CDs from the likes of Sheffield, Reference Recordings *et al*, unless the music was classical, in which case I usually preferred Filter 3. Ordinary mainstream commercial CDs were usually best-served with Filter 2, though if a synthesiser was one of the instruments being played, I often found Filter 1 gave me slightly superior sound. Tellingly, the filter I found the least useful was the standard one, though it did perform well with some of my oldest CDs that date back to the early '80s. I ended up sticking Post-It labels to CD cases, so I'd know what filters to use when hitting the 'serious' listening sessions that were to follow, but if I owned a CD1230R I think I'd use a colour-coding system, and stick small coloured 'dots' to each CD case, with a specific colour dot to indicate the best filter setting for each.

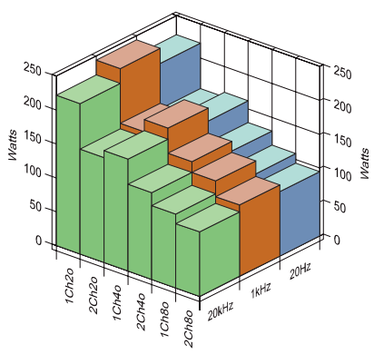
By the time I'd got around the third session, I was completely familiar with the performance of this T+A duo and ready to start getting picky with its performance. However, no matter what CD I played, or whether I played the music at levels so faint I could barely hear it, or so loudly as to be painfully loud, I could not fault the sound, so in the end there was nothing to be picky about. I found the sound was always sparklingly clean and beautifully detailed. There was not even a hint of distortion at maximum output, and at whisper-quiet listening levels, I could not hear any low-frequency hum or high-frequency hiss from the speakers, even with my ear up close to the grilles, or any distortion. The amplifier is also silent when switching sources, and during turn-on and turn-off, with no unwelcome thumps. I spent some time trying to get the fan to switch on while playing music, but with no success, so it appears the passive heat-sink cooling is very efficient on its own. I finally forced the fan to operate by connecting two pairs of speakers (to get the impedance down low) and putting a 1kHz test track from a CD on repeat. In the process I discovered that fan is a variable speed type that's very quiet at low rpm, but can get quite loud at high rpm. However, for the fan to reach high rpm, the music would be so loud that you would not be able to hear the fan over the music in any case. More importantly, when connecting the second pair of speakers, I discovered that the 'B' speaker terminals are so difficult to connect using bare wire that banana plugs would be almost mandatory.

I was impressed not only by the sound quality of this T&A duo, but also by the 'look and feel' of the components. This factor is somewhat elusive to describe, but it's a combination of attributes, including the solidity of the components, the obviously tight-tolerance engineering visible at all the joins in the metalwork, and where buttons and knobs protrude through the front panel, the 'feel' of those knobs and buttons as they're turned and pushed, and the action of the CD tray, amongst others. Individually, they're all small things, but when you take them as a whole, you realise that T+A's workmanship is truly superior.

Conclusion

I really could not have had a more impressive introduction to T+A's equipment than this pairing of the CD1230R and PA1230R. They sound superb, are beautifully engineered in every respect, and T+A is an authentic 'original voice' in terms of electronic design, rather than just being another 'me-too' manufacturer—a very welcome trait that is clearly evident in the uniqueness of the sound of the CD1230R in particular, with its innovative approach to filtering. My only regret is that T+A hasn't previously been available in Australia, so I can only say it's not before time, and that I'm looking forward to more.

greg borrowman



Power Output: Single and both channels driven into 8Ω, 4Ω and 2Ω non-inductive loads at 20Hz, 1kHz and 20kHz.

LAB REPORT

Readers interested in a full technical appraisal of the performance of the T+A CD1230R Player and T+A PA1230R Integrated Amplifier should continue on and read the LABORATORY REPORT published on the following pages. All readers should note that the results mentioned in the report, tabulated in performance charts and/or displayed using graphs and/or photographs should be construed as applying only to the specific sample tested.

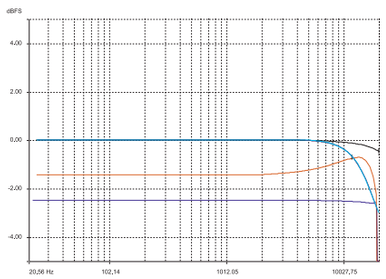
Test Results: T+A CD1230R CD Player

T+A's CD1230R player performed brilliantly on the bench, returning some of the lowest distortion and noise figures I have ever seen. The A-weighted signal-to-noise ratio, for example, measured 112dB, so the CD player will be quieter than quite a few power amplifiers, and overall THD was a vanishingly small 0.007%. Very significantly, the T+A was the first CD player I have seen that has been able to deliver low distortion at low recorded levels irrespective of whether the signal was dithered or not. I have included two spectrograms demonstrating this. You can see the noise levels are almost identical, as is the level of second harmonic distortion. The only real difference is the presence of a third harmonic at –100dB that isn't in the output when the CD player is decoding a dithered signal.

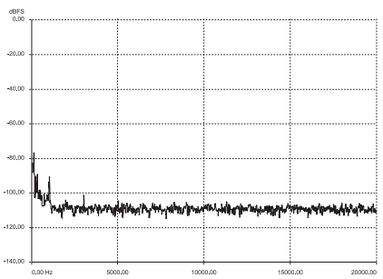
The various filters have a significant effect on the CD1230R's frequency response, as you can see in the appropriate spectrogram. The black trace that mostly runs across the 0dB line is the 'Standard' filter. The blue trace that tracks this line before peeling away from it at 6kHz and rolling off to be 3dB down at 20kHz, is the response for both Filter 3 and Filter 4. The red trace immediately below, with the rising high-frequency response, is that for Filter 2. At the bottom of the graph is the (purple) trace for Filter 1, which is very linear but cuts off a little before 20kHz. Note that all the levels are as reproduced, (there's been no scaling) so when you switch from the 'Standard' filter to Filter 1, for example, the player's output level will drop by nearly 3dB, which would be immediately noticeable if for no other reason than the difference in level. Bear this fact in mind if you are conducting A–B comparisons between filters, because psychoacoustic testing has shown that subjects always tend to prefer the louder of two sounds.

T+A CD1230R CD Player		
Test	**Result**	**Unit/Comment**
Output Voltage	2.6101/2.6115	volts (Left/Right)
Frequency Response:	+0.0/-0.4	dB (20Hz-20kHz)
Channel Separation:	110/114/107dB	16Hz/1kHz/20kHz
THD:	0.007%	@ 1kHz @ 0dBFS
Channel Balance:	0.004	dB @ 1kHz
Channel Phase:	0.03/0.01/0.15	16Hz/1kHz/20kHz (degrees)
Group Delay	-3.52/+5.40	degrees (1k-20k/20k-1k)
S/N Ratio (No Pre/emp)	104dB/112dB	dB (unweighted/weighted)
S/N Ratio (Pre-Emp)	104dB/112dB	dB (unweighted/weighted)
De-Emphasis Error	0.61/0.86/0.63 dB	(1kHz/4kHz/16kHz)
Linearity Error @ –60.00dB/–70.00dB	0.03/0.00	dB (Not Dithered)
Linearity Error @ –80.59dB/–85.24dB	0.09/0.14	dB (Not Dithered)
Linearity Error @ –89.46dB/–91.24dB	0.12/0.19	dB (Not Dithered)
Linearity Error @ –80.70dB/–90.31dB	0.02/0.11	dB (Dithered)
Power Consumption	2.46/13.38 watts	Standby/On
Mains Voltage During Test	241/244 volts	Max/Min
Digital Carrier Amplitude	4.89V	Audioband
	4.92V/9.78V	Differential/Common Mode
Audioband Jitter	0.8	(nS p–p)
Data Jitter	0.9	(nS p–p)
Deviation	+43.8 ppm	ppm
Frame Rate	44101.931	
Eye-Narrowing (Zero Cross)	0.0	(nS p–p)
Eye-Narrowing (200mV)	0.0	(nS p–p)
Absolute Phase	Normal+Inverted	Normal/Inverted
Bit Activity	23	At Digital O/P

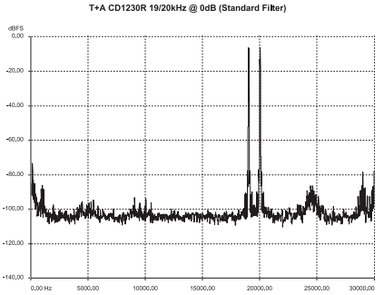
T+A CD1230R CD Player Frequency Response at 0dB With Diff Filters



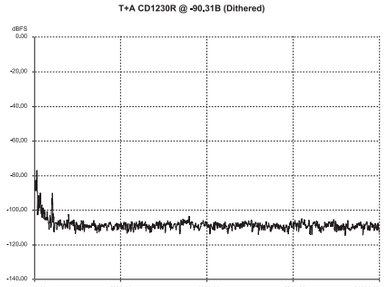
T+A CD1230R @ -90.24dB (No Dither)



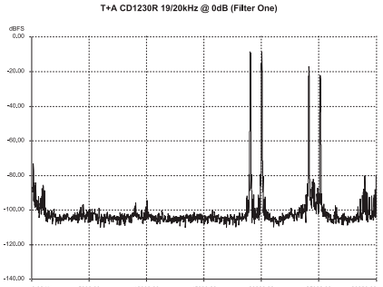
T+A CD1230R 19/20kHz @ 0dB (Standard Filter)



T+A CD1230R @ -90,31B (Dithered)



T+A CD1230R 19/20kHz @ 0dB (Filter One)

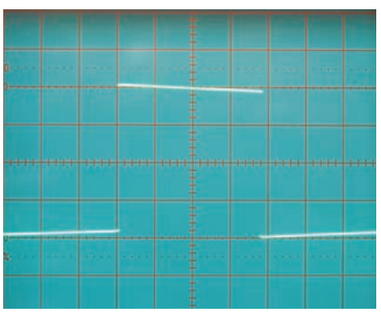


The differences between the filters are also immediately apparent when viewing square wave and impulse waveforms. The slight remnants of ringing on filter settings 3 and 4 stem from the digital encoding process, not the decoding process. Using any of the filters except for the 'Standard' filter means that sampling by-products will be in the output, as is evidenced by the two spectrograms of twin-tone IMD that show performance with a Standard Filter and with Filter 1. You can see the 'Standard filter' eliminates everything above 20kHz, whereas with Filter 1 there are high-level IMD products at 24kHz and 25kHz. Look carefully at the Filter 3 and Filter 4 square waves. The shape of the waves is identical, but you can see that there's a lot more noise in the output when using Filter 3 than there is when using Filter 4. (The horizontal tops and bottoms of the waves look blurry—that's the noise.)

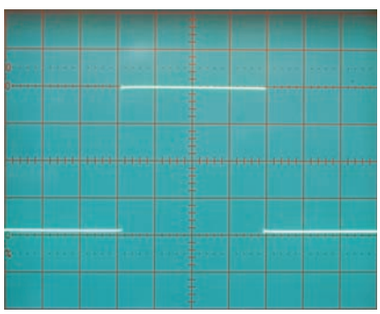
Test Results: PA1230R Integrated Amplifier

The T+A PA1230R proved to be an extraordinarily wideband amplifier, with *Newport Test Laboratories* measuring the –1dB down-points at 1.8Hz and 210kHz and the –3dB down-points at 1Hz and 339kHz. This puts the relative frequency response at 1.8Hz to 210kHz ±0.5dB, so it'd be ideal for any of the new super-audio formats. There is some tiny low-frequency attenuation (around 0.1dB below 500Hz) if you leave the tone controls in circuit (but at their detent zero position), so for the most accurate sound, it's better to have the tone defeat button engaged. The tone controls do not have a particularly wide range of action (around ±8dB) and have a small but measurable (and audible) effect on midband sound. Perhaps most importantly, there is almost no change in frequency response when the PA1230R is driving a real loudspeaker load, rather than a standard non-inductive 8Ω test load. You can see on the graph that the response into a simulated speaker load tracks the response into a non-inductive load extremely closely, with two minor variations centred at 250Hz and 5kHz. You can see exactly how tiny these variations are by carefully observing the scale at the left of the graph—each vertical division is just 0.1dB!

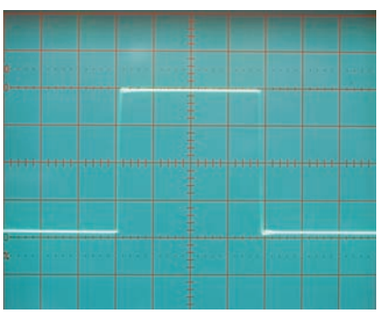
Power output was high, but the amplifier delivered its rated output of 100-watts into 8Ω right across the audio frequency band only when a single channel was driven. When both channels were driven into 8Ω loads, the PA1230R delivered 105-watts at 1kHz and other mid-frequencies, but



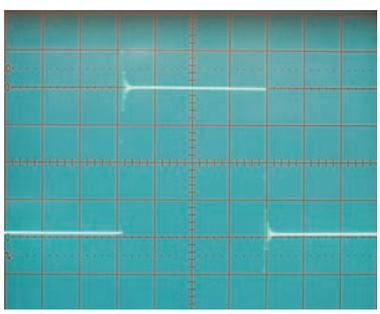
100Hz Square Wave (8Ω resistive load)



1kHz Square Wave (8Ω resistive load)



10kHz Square Wave (8Ω resistive load)



1kHz Square Wave (8Ω//2µF capacitive load)

only 95-watts per channel at the frequency extremes (20Hz and 20kHz). A similar pattern was noted when driving 4Ω loads, though this time the amplifier delivered its rated output only into a single channel, falling very slightly short (144-watts) when driving both channels at 1kHz.

T+A does not rate the amplifier's output into 2Ω loads, but it proved able to drive 2Ω loads quite comfortably, delivering more than 200-watts with just a single channel driven, and around 150-watts per channel with both channels driven into 2Ω. The fan switched on during all the power output tests, which was quite unusual. It transpired that this occurred because instead of being linked to a heat sensor like most such fans, the fan control circuit monitors the voltage across the speaker terminals, so the fan blades begin to turn slowly when the voltage reaches 7-volts, then gradually increase speed with increasing output voltage.

Channel separation was excellent right across the audio band, attaining a best of 90dB at 1kHz. Channel balance was also excellent, at an imperceptible 0.012dB, and inter-channel phase accuracy was perfect at all test frequencies. Total harmonic distortion was vanishingly low, just 0.0042% at an output of 1-watt and 0.0019% at rated output. You can see from the spectrograms that the distortion was primarily low-order. At one-watt output, the 2nd, 3rd and 4th harmonics are all more than 110dB down, irrespective of whether the amplifier is driving either 8Ω or 4Ω loads. At rated output, distortion increases a little, but all the distortion components remain at more than 100dB down, so each constitutes a contribution to the total of less than 0.0001%.

I was particularly intrigued by the T+A's performance with a twin-tone (19kHz/20kHz) IMD test signal. Not only is the noise floor very, very low, but there is also no signal regenerated at 1kHz (or it could be the tiny blip at –112dB, in which case it'd be completely insignificant anyway). This is the best result I have ever seen for any amplifier, irrespective of cost, size or design, and serves to show that it *can* be done. There are two IMD sidebands—one at 18kHz, the other at 21kHz—but at more than 105dB down, these are of no importance.

Signal-to-noise ratios were absolutely first-class, as you can see from the tabulated results, with the T+A delivering 94dB A-weighted referenced to one-watt output and 110dB A-weighted referred to rated output. Damping factor was also extraordinarily good. *Newport Test Laboratories* measured it at 1kHz,

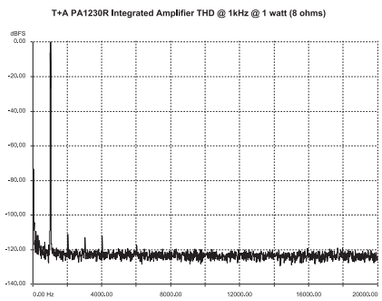
T+A PA1230R Integrated Amplifier - Power Output

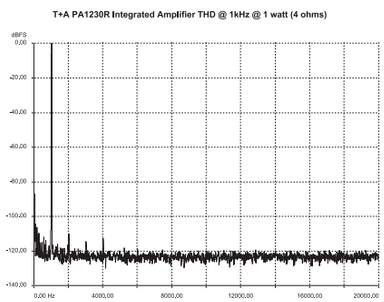
Channel	Load (Ω)	20Hz (watts)	20Hz (dBW)	1kHz (watts)	1kHz (dBW)	20kHz (watts)	20kHz (dBW)
1	8Ω	109	20.4	128	21.1	109	20.4
2	8Ω	95	19.8	105	20.2	95	19.8
1	4Ω	162	22.0	181	22.6	165	22.2
2	4Ω	130	21.1	144	21.6	128	21.1
1	2Ω	222	23.5	244	23.9	222	23.5
2	2Ω	155	21.9	163	22.1	155	21.9

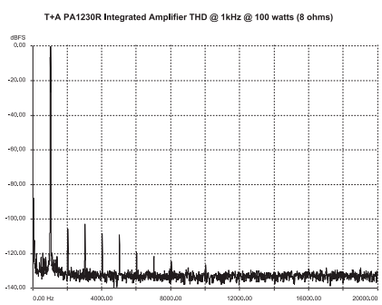
Note: Figures in the dBW column represent the output level, in decibels, referred to one watt output.

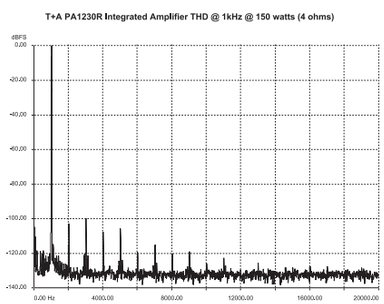
T+A PA1230R Integrated Amplifier - Test Results

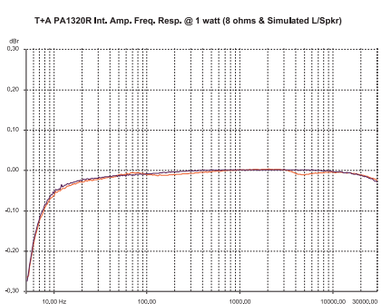
Test	Measured Result	Units/Comment
Frequency Response @ 1 watt	1.8Hz–210kHz	–1dB
Frequency Response @ 1 watt	1.0Hz–339kHz	–3dB
Channel Separation	82dB/90dB/64dB	(20Hz/1kHz/20kHz)
Channel Balance	0.012dB	@ 1kHz
Interchannel Phase	0.0/0.0/0.0	deg (20Hz/1k/20k)
THD+N	0.0042% / 0.0019%	1 watt/rated o/p
S/N Ratio (unweighted/weighted)	88dB/94dB	dB re 1 watt output
S/N Ratio (unweighted/weighted)	103dB/110dB	dB re rated output
Input Sensitivity (CD input)	19.3mV/193mV	(1 watt/rated o/p)
Output Impedance	0.0121Ω	OC = 2.8292V
Damping Factor	657	@ 1kHz
Power Consumption	0.8/38.2 watts	Standby/On
Power Consumption	67.7 watts /385 watts	1-watt/Rated op
Mains Voltage Variation	240–248 volts	Min–Max

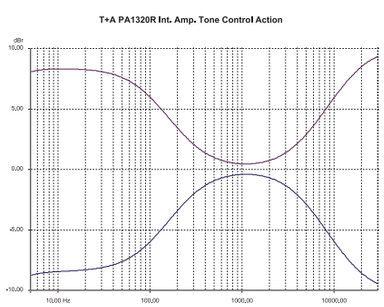


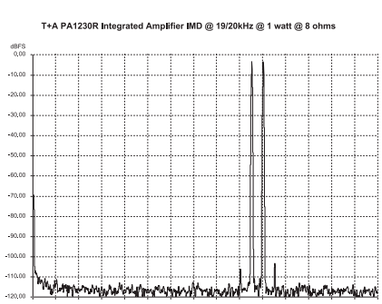


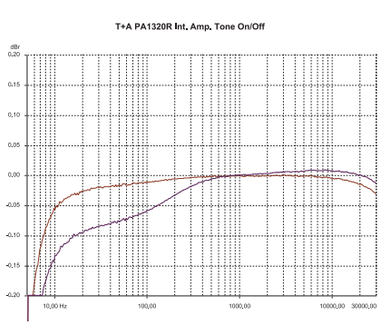












and recorded a result of 657! The amplifier's CD input proved quite sensitive, requiring only 19.3mV to produce one watt into 8Ω and just 193mV to produce 100-watts into 8Ω. This means that any CD player (or any source component with a typical line-level output) will be able to satisfactorily drive the T+A PA1230R to rated output.

The amplifier is not particularly power-hungry, drawing only 38.2-watts from your mains supply when it's switched on, but with no music playing. The power demand will increase to around 70–100-watts when playing back music at moderate levels, and will reach 385-watts at full volume (which is highly unlikely to be possible, given the T+A's high power output, unless you have very inefficient loudspeakers). Post-analysis of the mains voltage showed that supply did not drop below 240 volts at any time during the testing process.

An impressive performance, by any measure.

Steve Holding