



*Those who would audition their audio equipment for the effects of dielectric material in the coupling capacitors and oxygen in their speaker cables have long been ridiculed by the rest of us who merely use our hi-fi to listen to the music. Ultra-sensitive audio measuring instrumentation seems to provide evidence that the golden ears brigade might be right after all. Audio consultant **Ben Duncan** reports.*

# PROOF FOR THE GOLDEN EARS HYPOTHESIS?

**A**udio Precision, a US company founded by ex-Tektronix engineers, presently makes some of the world's most advanced audio test equipment.

Highly dependent on complex digital signal processing to produce its results, AP's recent software update has introduced challenging

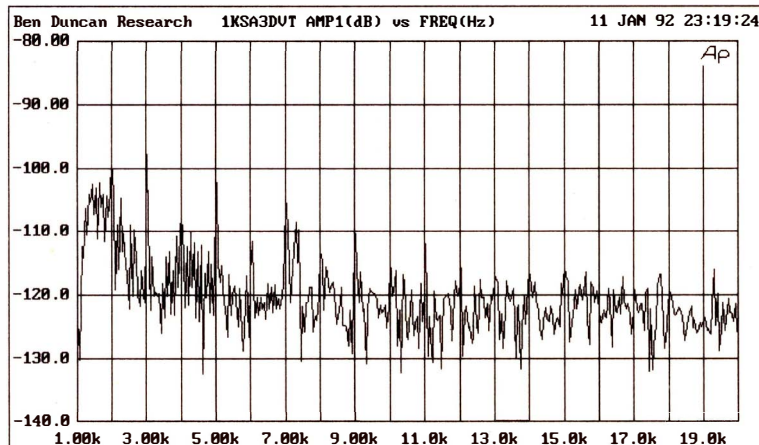
new tests for analogue audio, using DSP sampling at up to 192kHz. This can eke error signals out of the noise through steep but fast settling filtering with a degree of precision not previously possible.

One of the new tests enables individual harmonics up to the 10th to be plotted against fre-

quency, down to some 0.00006% (60ppm). The other prods the DUT with a tone, typically 1kHz, which it cancels to  $<-130\text{dB}$ , and plots the resulting spectra. This shows both harmonics and intermod products. The sensitivity of the new tests is producing seemingly objective evidence of effects previously held to be utter rubbish by hard line objectivists.

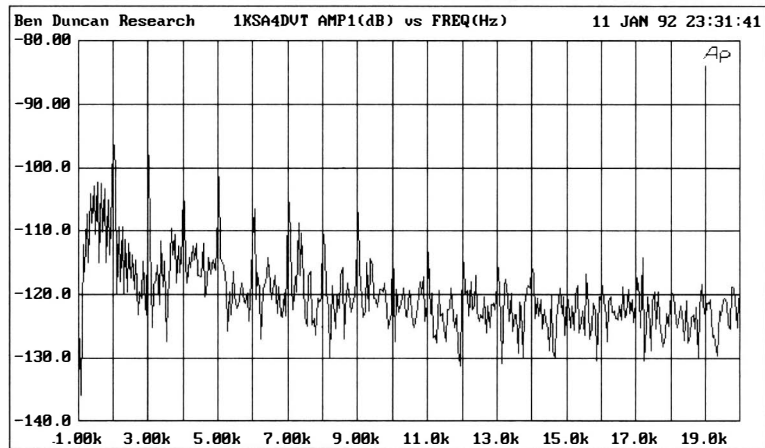
**Figure 1** shows the output spectra of a Rauch DVT-50s professional power amp at 13dB below clip into 8 $\Omega$ . Under these conditions, odd harmonics dominate. In **Fig. 2**, the 100 $\mu\text{F}$  DC blocking capacitor in the grounding arm of the amplifier negative feedback loop has been changed for back-to-back elcaps totalling 165 $\mu\text{F}$ . The sonic benefits of doing this have long been recognised. All other conditions remain the same.

**Figure 2** clearly documents differences that corroborate the audible change. Looking carefully, one can see that the reversible elcap increases all the even harmonics up to the 8th, making them almost dominant. It also changes the residue so the odd harmonics above the 9th slope off monotonically. The full effect of



**Fig. 1** Before the capacitor change. The output spectra of a Rauch DVT-50s professional power amp at 13dB below clip into 8 $\Omega$ . Under these conditions, odd harmonics dominate.

Fig. 2. And afterwards... the 100 $\mu$ F DC blocking capacitor in the grounding arm of the amplifier negative feedback loop has been changed for back-to-back elcaps totalling 165 $\mu$ F. Looking carefully, one can see that the reversible elcap increases all the even harmonics up to the 8th, making them almost dominant. It also changes the residue so the odd harmonics above the 9th slope off monotonically.

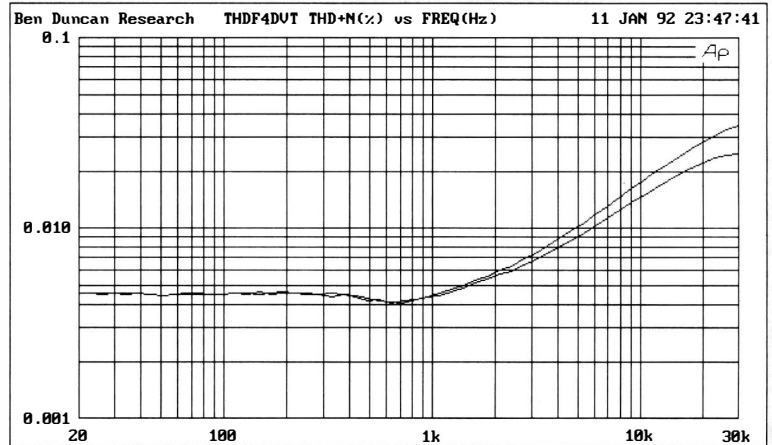


this change can be more fully appreciated by overlaying psychoacoustic weighting<sup>1</sup>, but the principle is clear enough. Figure 3 shows how a traditional THD+N vs frequency measurement misses the point; THD in the modified unit (upper plot) appears to be unchanged below 1kHz and slightly higher above 1kHz, leading to false conclusions. The new tests are so sensitive that the effects of changing and upgrading individual components can be seen.

#### Reference

1. J.R.Stuart, *Psychoacoustic models for evaluating errors in audio systems*, Proc IOA Vol. 13 Pt.7, 1991.

Fig. 3 shows how a traditional THD+N vs frequency measurement misses the point: THD in the modified unit (upper plot) appears to be unchanged below 1kHz and slightly higher above 1kHz. Even so, general opinion holds that the modified amplifier with the apparently higher THD levels sounds better.



Many Radio Amateurs and SWL's are puzzled. Just what are all those strange signals you can hear but not identify on the Short Wave Bands? A few of them such as CW, RTTY, Packet and Amtor you'll know - but what about the many other signals?

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- Morse - Manual/Auto speed follow. On screen WPM indicator
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- Sitor - CCIR 625/476-4, ARQ, SBRS/CBRS FEC, NAVTEX etc
- AX25 Packet with selective call/sign monitoring, 300 Baud
- Facsimile, all RPM/IOC (up to 16 shades at 1024x768 pixels)
- Autospec - Mk's I and II with all known interleaves
- DUP-ARQ Artrac - 125 Baud Simplex ARQ
- Twinplex - 100 Baud F7BC Simplex ARQ
- ASCII - CCITT 5, variable character lengths/parity

- ARQ6-90/98 - 200 Baud Simplex ARQ
- SH-ARQ/ARQ-S - ARQ 1000 simplex
- SWED-ARQ/ARQ-SWE - CCIR 518 variant
- ARQ-E/ARQ1000 Duplex
- ARQ-N - ARQ1000 Duplex variant
- ARQ-E3 - CCIR 519 variant
- POL-ARQ - 100 baud Duplex ARQ
- TDM242/ARQ-242 - CCIR 242 with 1/2/4 channels
- TDM342/ARQ-M2/4 - CCIR 342-2 with 1/2/4 channels

- FEC-A - FEC 100A/FEC101
- FEC-S - FEC1000 Simplex
- Press DPA - 300 Baud ASCII F7BC
- Wirtschaftsdienst - 300 Baud ASCII F7BC
- Sports info. - 300 Baud ASCII F7BC
- Hellsreiber - Synch./Asynch
- Sitor RAW - (Normal Sitor but without synchronisation)
- F7 BBN - 2 channel FDM RTTY

All the above modes are preset with the most commonly seen baudrate setting and number of channels which can be easily changed at will whilst decoding. Multi-channel systems display ALL channels on screen at the same time. Split screen with one window continually displaying channel control signal status e.g. Idle Alphas/Beta/RQ's etc., along with all system parameter settings e.g. Unshift on space, *Shift on Space*, multiple carriage returns inhibit, auto receiver drift compensation, printer on, system sub-mode. Any transmitted error correction information is used to minimise received errors. Baudot and Sitor both react correctly to third shift signals (e.g. Cyrillic) to generate ungarbled text unlike some other decoders which get 'stuck' in figures mode! Six Options are currently available extra to the above standard specification as follows: 1) Oscilloscope. Displays frequency against time. Split screen storage/real time. Great for tuning and analysis. £29. 2) Piccolo Mk 6. British multi-tone system that only we can decode with a PCI £59. 3) Ascii Storage. Save to disc any decoded ascii text for later processing. £29. 4) Coquelet - French multi-tone system, again only on offer from Hoka! £59. 5) 4 Special ARQ and FEC systems i.e. TORG-10/11, ROU-FEC/RUM-FEC, HC-ARQ (ICRC) and HNG-FEC. £69. 6) Auto-classification. Why not let the PC tell YOU what the keying system is? £59.

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