

ATC SCM20A Pro active monitors

ATC's new SCM20A PRO monitors represent a breakthrough in low distortion monitoring. Greg Simmons investigates...

British acoustic engineers ATC hand-build the most accurate professional reference loudspeakers in the world." So says the opening paragraph of ATC's sales brochure. It's a lofty claim, and one that is made by many manufacturers. The trouble with claims of accuracy is that they actually mean very little unless you know how the manufacturer interprets the concept of accuracy, and you understand their design philosophy. So before looking at the SCM20A PRO, let's take a look at ATC and some of their key design philosophies.

Background

ATC was formed in 1974 by driver designer Bill Woodman, and are one of very few manufacturers whose speakers are revered by audiophiles and recording engineers alike. Much of this reverence is due to a single-minded pursuit of accuracy in speaker design. In Woodman's world, there are no compromises, no half-measures, and no such thing as 'almost accurate' speakers. To quote, "Either a loudspeaker is accurate, or it is not".

Design philosophies

ATC's design philosophies go beyond the acoustic testing laboratory, and consider the bigger picture of how a monitor interacts with the room it is placed in. Fundamental to the design of all ATC monitors is the belief that a monitor must excite the reverberant field evenly. To this end, it needs broad and even dispersion throughout the entire frequency spectrum.

This is easy to achieve for low frequencies, because their wavelengths are large compared to the dimensions of the speaker cone. It's also easy to achieve for high frequencies, through the use of dome tweeters. But it's difficult to achieve for midrange frequencies, because the

dimensions of the speaker cone become significant and tend to focus the energy in the forward direction. To achieve proper dispersion, ATC pioneered the development of the soft dome midrange driver.

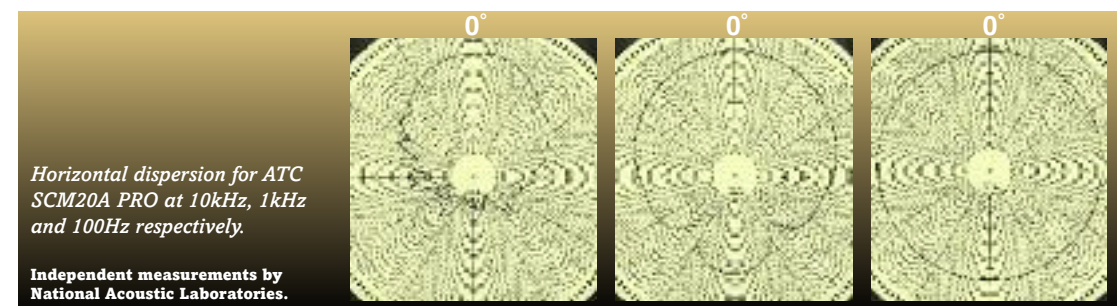
ATC have also spent many years isolating driver distortions and minimising their audibility. Their latest research focussed on eddy current distortion (a form of electromagnetic distortion found in every moving coil driver) and lead to the development of their low distortion Super Linear (SL) technology. Which leads us to the subject of this review...

The SCM20A PRO

The SCM20A is a member of ATC's PRO series monitors, which take advantage of their new SL technology. It also represents a significant departure from its predecessor, the passive SCM20.

Like the larger models in the PRO range, the SCM20A is an active monitor with built-in electronic crossover, power amplifiers and protection circuitry. Unlike other ATC monitors, it features an acoustically shaped die-cast aluminium enclosure complete with cooling fins and a carrying handle. The result looks and feels like it's designed for heavy-duty military applications. Built-in universal Omnimount fixings are included for flying or wall mounting, but you'll need a solid wall. At 33kg each, these monitors are deceptively heavy and need proper stands. Don't even think about sitting them on your console's meter bridge!

The enclosure is supported on three feet – the optimum number for stability. There are two rubber feet at the front, and a single height-adjustable ball-joint foot at the rear which allows the monitor to be tilted up or down. A nice touch. All three feet are fixed in place with threaded screws, and could be replaced with alternative supports if desired.



Technology

The SCM20A is a two-way design, crossing over at 2.8kHz. Frequencies up to this point are reproduced by ATC's 150mm low/mid driver, a short voice coil/long gap design incorporating a low frequency driver with a 75mm soft dome in the centre for broad midrange dispersion. Frequencies above 2.8kHz are reproduced by a 25mm soft dome tweeter manufactured by Vifa to ATC's specifications. Collectively, these drivers produce a useable frequency response from 60Hz to 20kHz, remaining within a ± 2 dB window from 80Hz to 12kHz.

The electronic crossover is a fourth order (24dB/octave) critically damped design, individually aligned and phase corrected at the factory. There's a 250W amplifier for the low/mid driver, and a 50W amplifier for the tweeter. Both amplifiers are Class AB designs operating considerably in Class A to minimise crossover distortion. This combination of electronics and drivers produces a maximum continuous SPL of 108dB at one metre, and it stays clean.

Built-in driver protection is included in the form of momentary gain reduction and thermal tweeter protection circuits. A green 'power on' LED, situated below the low/mid driver, glows red when the protection circuitry steps in.

The majority of the rear panel is taken up with the cooling fins – in fact, the entire enclosure gets nice and warm after a few hours of use. Beneath the cooling fins is a protruding panel containing an AC power inlet and on/off switch, a five-way rotary switch offering from 0dB to 6dB of boost at 40Hz, and a balanced XLR input socket. The input sensitivity is rated at one volt RMS, but an input trim control on the rear panel offers ± 6 dB of adjustment, so operating levels from 0.5 volts up to two volts RMS can be accepted.

Super Linear technology

The SCM20A benefits from ATC's research into an elusive form of third harmonic distortion that's inherent in all moving coil loudspeakers, and is due to the non-linear effects of magnetic hysteresis and eddy currents. This research led to the development and use of SLMM (Super Linear Magnetic Material) in many of their drivers, and a corresponding 10dB to 15dB decrease in third harmonic distortion.

That's a significant reduction. With third harmonic distortion now as low as -60dB (equivalent to 0.1%), the SLMM drivers have distortion figures more akin to power amplifiers than speakers. (For further information on ATC's SL technology, read the following interview with Bill Woodman.)

How do they sound?

The SCM20As have all the sonic characteristics of the ATC range, including the superbly detailed midrange and the tight, well-defined bass. In comparison to their passive predecessors, the SCM20A's low frequency performance is notably stronger and warmer. These terms may seem at odds with the concept of accuracy, which is why it's important to understand how a manufacturer interprets that concept.

ATC's design philosophy of exciting the reverberant field evenly, and their corresponding development and use of soft dome midrange drivers, were mentioned earlier in this review. To listeners who are unfamiliar with these concepts, ATC monitors initially sound bass shy – the result of a perceived increase in overall midrange energy combined with ATC's characteristic highly damped bass performance. This is especially the case when comparing ATC monitors against other brands. But if you agree with ATC's philosophies, you'll quickly realise that the midrange is actually in its proper direct and reverberant relationship to the lows and highs – something many monitors have a hard time achieving. A

few minutes listening to well-recorded performances of acoustic music will confirm this.

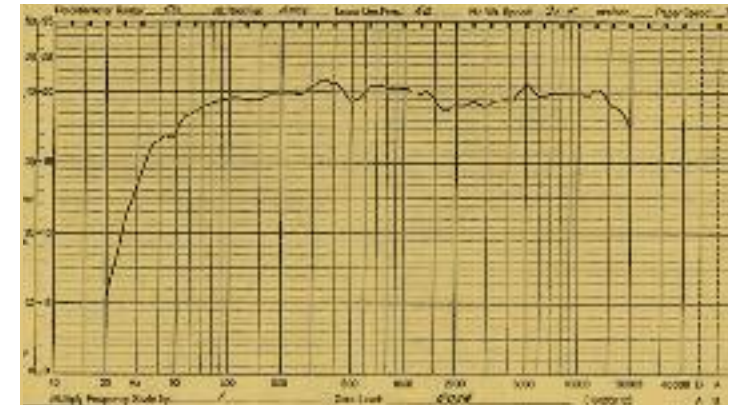
The benefits of ATC's Super Linear technology are clearly audible – the SCM20As have a remarkable clarity, precision, neutrality and attention to detail about them. Their ruthless commitment to accuracy reveals every detail of each sound played through them, for better or worse. Tracking with the SCM20As is an absolute pleasure, and provides a great way to make sure you're capturing good sounds from the very beginning – whether you're fine tuning the position of a microphone, modifying a synth sound, or cleaning up a sample. Mixing is also a pleasure, for the same reasons. As an added bonus, their ultra-low distortion figures mean you can concentrate on the sound for extended periods of time without feeling fatigued.

But there's a side to the SCM20As that can be quite disturbing, because they clearly reveal the sound of your equipment itself – sound that is often buried beneath the non-linearities of lesser monitors. Unpleasant harmonic distortions generated by low cost circuitry, phase problems related to EQ, even the 'sound' of different

cables. If that level of detail is going to upset you, stay away from these monitors – as Jack Nicholson said in *A Few Good Men*, "You can't handle the truth!". Alternatively, you could consider the SCM20As as an upgrade to your hearing!

Conclusion

Whether you agree with ATC's philosophies or not, one thing cannot be denied. If you're looking for absolute accuracy in a small monitor, I doubt there are any on the market that will show these up. There may be some equals, but that depends on your definition of accuracy. I personally agree with ATC's philosophies, and this particular pair of SCM20As will not be going back to the distributor. In fact, they've become my new reference for recording, mixing and reviewing equipment. They're going to cost me an arm and a leg, but my ears reckon they're worth it.



Frequency response: 90dB SPL @ 1m; vertical scale = 1dB/division; max scale = 100dB SPL, min scale = 50dB SPL.

Distributed by

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Price

• RRP: \$10,995

Greg Simmons talks with ATC's founder, Bill Woodman, about eddy currents, resistive polymers, and hernias.



Greg Simmons: When was the problem of eddy current distortion discovered?

Bill Woodman: It was first documented in papers from Bell Laboratories, when loudspeaker design began back in the late '20s, early '30s. They described it as a 'distortion mechanism', but no one has described the cause. So we made a practical working model of it and performed some tests. It was two years later, after analysing the test results and mathematics, that we were able to establish what those distortion mechanisms really were.

GS: Surely the problem isn't only limited to speakers?

BW: No, not at all. It's also a problem in communications transformers, and the techniques for limiting it in those applications involve the use of a powdered iron core, which offers reasonable magnetic performance and low conductivity. But it's not magnetically suitable for use in a loudspeaker's permanent magnetic circuit.

GS: They also use laminated iron cores in

transformers to reduce eddy currents. Would that approach work for speakers?

BW: Theoretically, you could use laminations in the loudspeaker's magnetic circuit, but the cost of making the components is such that it's non-viable. You can't hold the tolerances required for the air gap, and the assembly techniques are just horrendous.

GS: So you knew the cause of the problem, and you knew how the effects had been limited in other applications. How did you find the right material?

BW: About three years ago, we discovered the material that we now use in the SL drivers. It's a powdered pure iron with an oxide coating, which stops it from conducting. It's formed into whatever shape you want, like a ceramic material, except it's bonded with a resin rather than the individual particles being fused together. It's done under extremely high pressure, then heat treated to cure the resin. Finally, because it's a porous material, it's coated with PTFE to prevent corrosion.

GS: PTFE? Like Teflon?

BW: Yes. The result is a resistive polymer that we call SLMM - Super Linear Magnetic Material. The key to it is that the oxide and the resin are insulators, so it has very low conductivity. But because it contains pure iron, which has exceptional magnetic performance, SLMM ends up having magnetic characteristics that are only about 20% worse than the mild steel normally used in magnetic circuits. It's also a good heat conductor, which is important in these applications.

GS: Won't that 20% decrease affect the driver's performance?

BW: The 20% decrease in performance of the SLMM has been compensated for in the

design of the magnetic structure and, because there's only a small amount of SLMM used on either side of the voice coil, the change in overall magnetic performance is small. There's a layer on the pole piece and one on the front plate, and they're both eight millimetres thick. If that was just mild steel, the eddy currents would form in the first half millimetre depth of the material, as a consequence of skin effect. But with the SLMM, the eddy currents penetrate the full depth, the whole eight millimetres. The eddy currents are the same, but now they're spread out over a larger area.

GS: Does that mean there are less eddy currents in close proximity to the voice coil, and therefore less eddy current distortion induced back into it?

BW: Well, no... the levels of distortion induced by eddy currents remain basically the same. But because the eddy currents in the SLMM are spread over a larger area, they generate less opposition to the voice coil's magnetic field. As a consequence, the impedance of the voice coil increases, and therefore the fundamental signal voltage across it also increases – but the induced distortion voltage remains the same. So the difference between the signal voltage and the induced distortion voltage increases. Our measurements show reductions of 10dB to 15dB in third harmonic distortion, from 100Hz to 3kHz.

GS: It's mostly third harmonic distortion?

BW: Predominantly, yes. If you compare it to the fundamental signal, the distortion generated as a consequence of eddy currents is almost entirely third harmonic. That's because the effect is controlled by hysteresis of the magnetic material, which is a non-linear characteristic. Third harmonic distortion is quite obtrusive, really. It used to

show up at a very low level on the passive SCM20, you would hear it in things like the transients of a piano. But the most important thing now, with the Super Linear models, is that you hear more ambient information, and the low level overtones from things like cello and human voice are there. It just provides a truer tonal character to any sound.

GS: This form of distortion is obviously an inherent part of the sound produced by any moving coil speaker design, which probably explains my initial reaction to the SCM20A PROs...

BW: Which was?

GS: When they arrived in my studio, I immediately AB'd them against their predecessors, a pair of passive SCM20s. After listening to the passives for some time, I switched to the active PROs. The very first impression I had was that the passives had suddenly disappeared – as if someone had quickly removed them and left the bare speaker wires in their place, and the sound was now pouring out the ends of the wires. It was very weird...

BW: I'm sure that's related to removing those distortion flaws, and of course the benefits of being an active system... There's a couple of other interesting side effects that have come out of this, which we didn't anticipate. When you lower that distortion floor, and it's gone from -45dB down to -60dB, you get the impression of there being more low frequency.

GS: That's unusual for harmonic distortion. Anyone who's ever played with a synthesiser or a decent low pass filter would know that as you remove the harmonics, the subjective level of the fundamental decreases...

BW: Well, I don't quite understand it, I still have trouble seeing it absolutely clearly. But the subjective effect is that, although the 6dB

down point of the speaker's low frequency response is very similar, they sound like there's a lot more low frequency.

GS: The SCM20A PROs do have significantly better low frequency performance than the passive SCM20s. Is that purely a result of the reduction in distortion?

BW: No, the presence of the SLMM and the re-designed voice coil also changed the Q of the drive unit slightly. They're still critically damped, but in comparison, the passive models were overdamped. Oh, and did you



Super Linear Magnetic Material on front plate.

Cross-sectional view of SCM20A PRO low/mid driver.

know that the active box is actually only 15 litres? Less volume in the enclosure, less damping, and better low frequencies.

GS: Speaking of the enclosure, I'm particularly intrigued by your use of die-cast aluminium...

BW: What prompted that was two-fold. Firstly, it removes the problems of having a rectangular box when you're dealing with wood, where it's difficult to make complex shapes. And secondly, we wanted to engineer the cost out of the box. When you make something active, you always end up with this huge aluminium plate and a great big heatsink, all bolted onto the back of a wooden box. If you could make the box and the heatsink as one, then you remove a layer of cost. It was those two things that motivated us to look at aluminium die-casting. It's also extraordinarily robust, from a user's point of view.

GS: Does it introduce any resonance or ringing problems?

BW: A huge amount of the cabinet's damping comes from the front baffle, which is 50mm thick and machined from solid MDF. When you bolt that onto the aluminium enclosure, it damps it completely. We also put bitumastic damping pads on the inside panels, of course, but it's the mass of the front baffle that really damps any tendency of the enclosure to ring.

GS: What about the weight? At 33kg each, these 'portable' speakers are deceptively heavy for their size. Most sound engineers I know of don't do weights...

BW: (Laughs). We've had some terrible faxes through – a very good friend of mine in California sent me a fax asking if we'd pay for his hernia! The weight is a problem, but nonetheless, they're still portable – it's not completely out of the question. We're considering the possibility of putting a neodymium magnet on the bass driver, and changing the power supply, because we need to lose about four to six kilos. But, as you know, we always go for performance-lead designs. We'll go after the performance first, and then