



# KEF's smaller, smarter sub

AT AROUND 25CM ON EACH SIDE, THE LATEST KEF ACTIVE SUBWOOFER IS TRULY TINY, BUT MARTIN COLLOMS DISCOVERS THAT ITS COMPACT DIMENSIONS CONTAIN SOMETHING REALLY RATHER SPECIAL

**Without question, at £1399 KEF's attractively compact KC62 subwoofer is a most clever box of tricks, but is it just too small for its own good? Are two reaction-cancelled 6.5in/14cm bass units enough, whether they be long throw high excursion types or not? An indication of just how hard they might need to labour is the provision of 500 watts for each driver of necessarily efficient D Class amplification. Such massive available power poses all kinds of questions, including just how intelligently this design manages programme demands, in respect of its own natural physical limits for acoustic output over frequency. Certainly, physics will not help it get from a mid-bass frequency of 50Hz at a steady sound level down to a genuinely low 25 Hz. This seemingly simple requirement actually requires that the two pistonic bass driver elements move four times as much by 25Hz.**

It is worth noting that this seemingly small lowering in numeric frequency comprises a complete, potentially informative musical octave, and should not be dismissed as just '25Hz extension' of a nominal 20,000Hz audible spectrum. And helpfully, that theoretically required increase in cone movement will be tempered by a measure of room power gain, the latter generally increasing with reducing frequency, thus ameliorating that

otherwise daunting theoretical acoustic power demand which is defined for 'free space' operation – no room and thus no boundaries.

At this point we raise a question about purpose: do you want a floor-shaking kick-in-the-chest 'thumper' to rock your boat for home theatre, or something more subtle and sophisticated, aiming to improve the overall sound quality of your system, perhaps to include classic stereo? For a home

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theatre set up the low frequency ‘effects’ feed, the LFE, is a processed percussive ‘signal’ designed to surprise and shock, a key part of the scripted drama. But where a sub is intended as an enhancement to a higher quality audio system, it needs to be good enough in terms of dynamic range and distortion not to degrade the inherent sound quality of the main stereo pair.

Extant published reviews have concentrated on just how loud the compact KC62 design will play for its size, but seem not to be so concerned as to what contribution it could make to system sound quality. So many sub woofers add noise harmonic distortion and coloration to their low frequency output, and can bounce and vibrate the floor – some so much so that they may ‘walk’ across the room much like an out of balance washing machine. Such self-generated and unwanted noise is just another kind of distortion, and who wants a subwoofer exhibiting such behaviour?

#### Low noise, low distortion

By contrast, key aspects of the KC62 design are directed to low noise and low distortion, and for a start this quality makes the audible location of the sub almost undetectable. Good quality low frequencies are felt as more of pressure filling the space, rather than freely propagating soundwaves which might be located by ear. That short distance between our ears is a limiting factor in this low frequency ranging ability which progressively reduces below 500Hz.

However as higher frequencies are reached, and where some upper harmonics and distortion might be present in a hard working sub’s output, then its location may no longer be indeterminate. Stereo imaging may be affected depending on whether such ‘noise’ may be located aurally, marring the image from the main stereo pair, never mind the added coloration.

Fortunately the dynamically balanced, opposed drivers of the KC62 deliver minimal mechanical reaction forces, and thus suffer from negligible vibration. In addition, the KEF distortion control technology suggests that higher harmonics will hardly be present, and thus the low frequency timbre for the system as a whole should remain neutral. As such, if the goal that the sub cannot be located by ear alone is achieved, then the primary stereo image will remain undisturbed.

Now we are in a position to consider potential audiophile benefits, which rely absolutely on the sub not increasing noise and distortion, with its inclusion aimed at improving the overall uniformity of power over frequency and thus the quality envelope in the room. By adding a firmer low frequency foundation to the music, even for a string orchestra, there may be a better sense of scale, and frequently better bass speed and tune playing, even if that augmentation is so subtle that it does not seem directly audible.

All of that might be expected of a modern ‘intelligent’ sub such as this dense, compact cube, approximately 10in/25cm on each side. It has versatile connectivity, and is configured in what I consider an ideal formation: push-push, back-to-back, force cancelling and thus anti-vibration, and anti-rocking. A vast range of install possibilities, voicing and matching adjustments are possible with this subwoofer to help optimise the performance in a given loudspeaker installation, both with KEF and other loudspeaker designs. And of course, there is radiation coupling gain with this summed pair of drivers, so the equivalent unit driver size is actually rather closer to a long throw 10inch 250mm driver. So, it is not quite so ‘small’ after all.

And there’s more. Belying its modest size and cost, this sub is nonetheless highly sophisticated, employing many advanced technologies to deliver a performance well beyond its size and price. It will be seen as a natural pairing for the LSX and LS50 series including the LS50W II also reviewed in this issue – and indeed there’s even an optional wireless connection module for use with these speakers, the KW1, selling for £180 – but it will also find service in many other situations.

This is a sealed box design with low self-noise, this helping to make its more aurally invisible, an important factor. At such low frequencies it is totally non-directional thus easing placement and orientation. With a total of a 1000W of efficient drive power, amplifier clipping is avoided, with intelligent overload control to avoid significant audible distortion). Bass driver motion is mapped electronically, over power and frequency, such that audible overload cannot be reached even with heavy input signal overdrive. If it were present,

## REVIEW

significant distortion can mask deeper bass tones, even to the point of an audible droning coloration. Low distortion bass may be less obvious, but when you hear it you soon appreciate how musically right it really is. And in this design the overload problem is circumvented.

With such low distortion bass on offer there is no 'harmonicky' accompaniment, but instead, an almost pure bass output. Certainly boomy exaggerated low frequencies would disfigure and mask the output from a good stereo loudspeaker pair. In addition to the heroic magnet design of the KC62 which helps to control distortion, the voice coil current is monitored and then corrected in advance by using an electronic map of the driver's mechanical performance limits. Where necessary the amplifier output is then dynamically preconditioned to minimise distortion.

5.0% distortion and more is common with subwoofers and as such is mildly audible. This is because the resulting harmonics are present in the higher frequency range and are thus more aurally obvious. KEF engineers have fashioned their active distortion control so well that with the absence of higher frequency signals, the pure low frequency bass tones are in the famous tradition, 'felt rather than heard'. In this case the physical source of such pure, long wavelength, low frequency bass cannot be identified, while the resulting pressure field drives the room space, aiding that sense of power, envelopment and excitement.

Seemingly impossible considering its small size, the free field low frequency limit is claimed as an improbably low 11Hz -3dB. We will find out whether this is true, but before you look forward to earthquake style bass observe that the purpose of this design limit is more subtle than it looks. Firstly there will be lowered power needs with reducing frequency, both from the naturally reducing power envelope of programme, to the increasing room gain with frequency from pressure loading: that 11Hz limit will hardly be exercised at high power. And you still get the bonus of improved time coherence from the increased low frequency bandwidth for the connected system, even if this sub is not intended to produce full 'Home Theatre' power at the lowest frequencies.

### Installation

The KC62 has comprehensive facilities to match almost any conceivable setting and installation. On the control panel there is the expansion socket (for fitting the optional palm sized wireless module for remote connection and control, also effective for the connection and the coordination of multiple subs), and then we have a miniature array of four switches labelled 'HPF' high pass filter, to set the low frequency



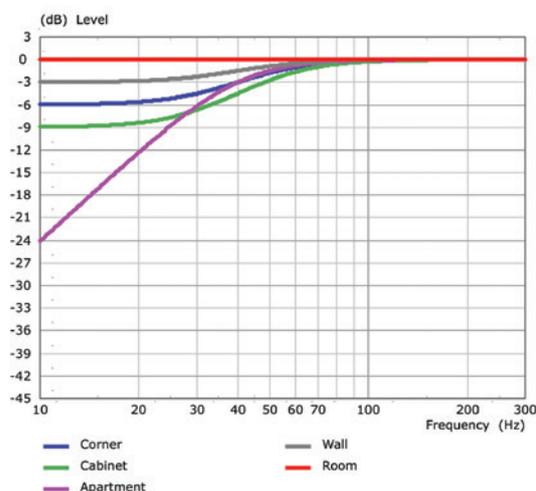
limit. Using these you might wish to optimise the sub for best mid-bass 'punch' for a movie installation, rather than for the deepest audiophile bass. Alternatively set it for best frequency extension and phase response at more modest sound level e.g. for a classical music application or jazz.

The control, is for absolute phase: ie 'correct' or 'inverted' (-180deg), to help integration with the phase of the low frequency range of the partnering audio installation, which could be bass reflex or sealed box – either of which might suggest a different phase setting according to the crossover frequency best suited to that installation.

'EQ': KEF offers five preset equalisations, captioned *room, wall, corner, cabinet, and apartment*, three of them offer shelving rather than a continued rolloff. These comprise:

'Room': Here KEF indicates placement near the TV, somewhat off-centre between the stereo loudspeaker pair near the front wall. This is for an essentially neutral or 'flat' setting, where the frequency response at normal volume settings is flat across the working range, extending down to 10Hz -3dB at normal sound levels.

'Wall': Designed for subwoofer placement on a side wall of the room, 1/3 along. Now the low frequencies are stepped down, shelved below 50 Hz to -3dB at 20Hz.



The KEF preset equalisations

### KEF's Jack Oclee-Brown on using multiple KC62s

Noting Floyd Toole's inclusion of multiple smaller subwoofer arrangements to achieve more uniform bass in the room space in his book *Sound Reproduction*, KEF scientist Jack Oclee-Brown commented. 'Martin, I'm glad you picked up on the idea of using these small subs in "Welti/ Devantier/ Toole" configurations.'

Jack continued, "Multiple subwoofer configurations were absolutely one of the reasons that we started to consider doing a very small but genuinely high-performance subwoofer. I think that the KC62 could open the possibility of multiple configurations: or even the improvement offered by two as stereo subwoofers, particularly for people who couldn't fit in typically sized subwoofers". REF: *Low-Frequency Optimization Using Multiple Subwoofers*: Todd Welti, Allan Devantier, published 2006: Journal of The Audio Engineering Society)



'Corner': when placed in a rear corner behind the seating, or, for a diagonal TV arrangement placed in the front corner behind the AV set up. Here the bass shelves down 6dB by 20Hz

'Cabinet': similar to *Room* but where this small is sub located on the A/V shelf unit. Now its output is cut 9dB by 20Hz in view of the nominal 3dB gain expected per additional boundary

'Apartment': here the sub 'impact' is intendedly moderated because low frequency sound can travel through walls and be heard in adjacent rooms. Now the -6dB point is set a bit higher at 30Hz, while the lower frequencies are no longer shelved, but continue to roll off more steeply to -24 dB by 10Hz.

#### LFE, crossover and level controls

Further controls include selection of *LFE* mode for home theatre (*Low Frequency Effects*: e.g. for a mono feed from a receiver, of summed and conditioned bass signals for movie set-ups). This line level signal will be preconditioned to Dolby specifications and needs no further frequency tailoring.

Then a calibrated rotary control sets the frequency range of the sub, which dial ranges upwards from a nominal 20Hz. You can set the working upper limit continuously from 40Hz up to 140Hz, the scale calibrated at nominal 20 Hz intervals. Finally this upper row is completed by the volume/level control for the sub and some calibrations would have been helpful here for setting up and for revisiting settings.

The lower row comprises the three pin IEC 13A socket for power, a rocker switch for power 'on', a small two-channel wire clip input for speaker level feed, in conjunction with a matching plug – which if used needs care so as not to leave bare wires to avoid shorting the supplying stereo power amplifier.

Now, on the home straight at last, we have four phono sockets, the first two being line-level inputs for left and right channels, and the second pair the 'high pass filtered' line out, left and right, for the

stereo amplifier feeding the main stereo speakers. Here the lowest frequency signals are filtered out while the stereo speakers now become the 'satellites'. With the bass workload taken from the satellites there will be a consequential improvement in power handling, distortion and maximum sound level. In the case of pairing with the LS50 WII, the latter has its own sophisticated electronic controls for the high-pass filters which aid best matching to the sub, potentially raising the combined performance to a new level.

A subwoofer installation needs planning for the best results: first for the sub or multiple sub location(s), and to facilitate the cable routing, noting that there are several ways of installing a versatile sub such as this one in a given system. Several trials may be required.

The stereo loudspeaker system, if active as in the case of the LS50W pairing, may already have matching settings for using a subwoofer so that no further cable links or settings are required to define low and high pass matching. For placement, this sub has a resilient, bonded anti-vibration pad on which it sits, so carpet, hard floors or shelves are suitable, and of course the non-directional radiation of low frequency bass means the sub's physical orientation is essentially uncritical.

#### Technology

The aluminium alloy casing is hard anodised, 'silver' for our sample, or alternatively available in 'carbon black', and machined from a sturdy curvilinear aluminium extrusion, making it almost impervious to flexure or resonance. Yes, you can hide it away, but the tidy industrial design allows it to be placed in plain sight if desired.

Despite the compact dimensions useful deep bass is available thanks to four design features, here beginning with the double cone, back-to-back unitary bass driver assembly, which is reaction-force-cancelled, and built on a massive die-cast alloy frame. This Uni-Core™ technology is patent-pending and employs almost concentric coaxial motor coils, folded into a high flux double element ceramic magnet system, this reduction in drive unit size allowing the enclosure volume to be reduced by a third.

The subject of a further patent application, the bass drivers' novel 'P-Flex' surround has a complex geometry with two benefits: a longer throw compared with the usual 'half-roll', and better behaviour in the face of the exceptionally high back pressure which occurs within this enclosure. This is achieved with a unique pleated design inspired by origami paper folding techniques, and even that's not the end of the proprietary technology: yet another patent application in

progress covers the constant measurement of the KC62 drivers' voice coil currents, facilitating the correction of non-linear distortions by computed comparison with the 'perfect' drive signal. This form of motional feedback substantially reduces the total harmonic distortion (THD) at higher sound levels and lowers the colouration which results from such distortion into the bargain.

### Mapping the driver limits

Further signal processing is present in the form of dynamic performance mapping of driver limits with a subtle level control, providing momentary soft limiting of maximum bass power over frequency. This prevents excess driver excursion, thus generally avoiding audible overload events.

The final piece of this size/performance puzzle is the amplification: so how much power do you need to get a quart of bass out of a pint pot? Here the KC62 has power in abundance, the drivers each enjoying a rated short term 500W RMS of custom-designed high-efficiency Class D power.

### Sound quality

The KC62's colouration and distortion levels, within the sensible working dynamic range, were so low that I could try it out in number of situations. Perhaps the most improbable was with my massive Magico S5 II floor standers. These are closed box, all-aluminium cased and costly powerhouses with twin 10inch, 250mm bass drivers a side, so I might have might have expected that, at just a fifteenth the size of one Magico, the KC62 would have almost no perceptible effect.

It did: applied in small doses it added definition and clarity, better tune playing and a useful 'direct coupled' percussive crispness. At such low frequencies sound power from several sources sums well in a room, and until I set the volume near maximum for this powerful audio system as a whole, it was surprising that the KEF kept pace.

Given that, you might speculate that two or more KC62s, well located, would be even better at smoothing the usual room dips at low frequencies. It seemed that it was not that the bass definition was better than the Magico alone but rather that this precision sub was able to contribute constructively to the room drive party. For realistic home theatre effects in such a large room you would need several KC62, and logically would then purchase much larger subs. But for precision stereo replay of high-quality music feed this was an interesting and musically rewarding experiment in an otherwise incompatible high-end system. Used in a more typical set up, with the KEF LS50W II, the connectivity was straightforward. Trying the reliable wired connection – the accessory wireless

adaptor wasn't supplied – the sub-augmented LS50W II took on the scale and bandwidth of a much larger loudspeaker design.

Considering the relatively small bass-mid driver of the LS50W II, which is nevertheless surprisingly effective, diverting the lowest frequencies to the sub frees up the stereo pair to sound faster, more dynamic and more expressive, belying their compact visual footprint. This was powerful sound on a larger scale, combined with high quality upbeat bass: there is a particular quality to a bass driver when direct coupled to a power amplifier, as in this case, and it unquestionably adds value.

### Conclusion

Here KEF engineers have mastered the subtle balancing of features, engineering and sound quality to deliver substantially clean extended bass from an improbably compact, versatile and attractive high tech enclosure. The KC62 subwoofer is a Best Buy.

### Lab report

Because bass is omnidirectional at such low frequencies the measurement mic can be close, essentially avoiding the influence of room reflections on the measurements. There was ample input sensitivity for almost any set up. At moderate loudness nearfield measurement resulted in the following set of responses with level, showing the nominal '11Hz' limit, seen here as -10dB relative to the passband level at 50 Hz, but still a remarkable bandwidth. With the level raised 20dB, there is the beginning of curtailment at 10Hz, now reading -14 dB at 11 Hz, as the operational safe limit envelope is in control

Distortion was surprisingly low regardless of the size. Flat out at 30 Hz it was clean subjectively with a fine -27dB of 2<sup>nd</sup> and 3<sup>rd</sup> with 4<sup>th</sup> at -39dB. Further increase engages the auto limiter. The level was referenced to 96dB, 0.5m floor plane. It will play 11Hz, essentially silent pressure waves only revealed by a gentle hum from the faintly audible 5th harmonic at 55Hz! It can be driven to full excursion limit at 11Hz, so I regard the seemingly impossible claim as largely met.

Flat out at 11Hz, second and third harmonics were fine at about -22dB, and by 20 Hz – here at full power – it was coming on song with negligible distortion, audibly silent 2<sup>nd</sup> -28dB, 3<sup>rd</sup> -27 dB 4<sup>th</sup> -40dB etc. And at 100Hz the were no worries about distortion encroaching on the bass lines from the stereo pair, 2<sup>nd</sup> was just 0.35% , third 0.28%. Clearly the advanced distortion control mechanisms are effective, resulting in one of the lowest distortion subwoofers anywhere near this size and price.



### HIFICRITIC Review Specifications

#### KEF KC62 sub-woofer

Design Uni-Core force cancelled combination drive unit with 2 x 140mm alloy piston radiators

Frequency response 11Hz – 200Hz (±3dB) nominally -3dB at 11Hz

Max output 105dB/m (free field, mid band)

Amplifier type Class D Amplifier, with active driver performance envelope control and feedback

Power amplifiers 500W RMS per bass driver, built in

Variable low pass filter 40Hz – 140Hz, plus pre-set room EQ curves

Inputs LFE Input, RCA phono sockets, Speaker Level inputs

Line output RCA phono sockets, also high pass filter

High pass filter 40Hz – 120Hz, plus bypass

Power requirements universal 100-240 V ~ 50/60 Hz 13A IEC

Power consumption 1000W max, typical 5-10W

Weight 14kg (30.9 lbs)

Dimensions (H x W x D) with rear panel and feet:

24.6 x 25.6 x 24.8 cm (9.68 x 10.07 x 9.76 inches)

Colour Anodised alloy, silver or black satin finish

Wireless connection interface Optional KW1 kit £180

Price £1399

kef.com