DALI

OBERON C

WHITE PAPER

POWER.

PAIR.

PLAY.

DALI

IN ADMIRATION OF MUSIC

1. OBERON C - The Active Choice

Our world is increasingly one in which wireless technology is the norm. We're familiar with the idea and appreciate the convenience of consumer electronic hardware that no longer requires a physical connection; printers, headphones, desktop speakers, telephones, and even room thermostats for example. Hi-Fi speakers are similarly undergoing a wireless revolution and DALI has played a pioneering role with the RUBICON C and CALLISTO C series.

Now, with the addition of the new VOKAL C, the OBERON C series gets its own active wireless centre-channel speaker. The stage is set for true wireless multi-channel audio, comfortably outperforming equivalent passive systems, and within the reach of many more fans of great sound – whether in-home cinema, music or games.

At the same time as providing a more cost-effective and seamlessly integrated wireless Hi-Fi option, the OBERON C series, with the SOUND HUB and SOUND HUB COMPACT wireless preamplifiers, are perfectly configured for contemporary home media installations where Bluetooth devices and smart TVs are the primary audio sources.

The OBERON C and the two DALI SOUND HUBS major simultaneously on simplicity in installation and operation, and genuine audiophile sound quality in use. Music lovers, movie fans and audiophiles no longer have to choose between incredible sound quality and convenient integration with their contemporary Bluetooth and smart TV-centred lifestyles. The OBERON C series and SOUND HUBS deliver both.

Presenting the OBERON C Series

The OBERON C series comprises the four, two-way, wireless active speakers derived from the renowned OBERON passive series and utilising the wireless technology developed for the CALLISTO C series. The compact, stand or shelf-mount OBERON 1 C, the floor-standing OBERON 7 C, the compact, low profile wall-mount OBERON ON-WALL C, and now also the centre-channel speaker OBERON VOKAL C. The OBERON C series is for use with the SOUND HUB and the SOUND HUB COMPACT wireless audio preamplifiers.

OBERON 1 C

The OBERON 1 C is the compact speaker of the series. Sporting a 29mm ultra-lightweight soft dome tweeter, and a 5.25" wood fibre cone SMC bass/midrange driver, its rear reflex-loaded cabinet offers an optimal balance between internal volume for bass performance and compact dimensions for small rooms. The OBERON 1 C can be used with the DALI CONNECT Stand E- 600, installed within furniture units or on shelves, or wall-mounted directly via rear panel keyhole slots.

OBERON 7 C

The slender proportioned, floor-standing and rear reflex-loaded OBERON 7 C sports twin, 7" DALI wood fibre cone SMC bass/mid drivers, and the same DALI ultra-lightweight 29mm soft dome tweeter as the OBERON 1 C. Despite its size, the OBERON 7 C is a subtle performer and impresses with its ability to render any style of music naturally and lifelike, even at low volume levels. The OBERON 7 C incorporates an integral die-cast plinth fitted with attachment points for floor spikes or compatible feet.

OBERON ON-WALL C

The slim and discreet OBERON ON-WALL C comprises a compact, low profile, rear reflexloaded cabinet fitted with a 5.25" DALI wood fibre cone SMC bass/mid driver, and a DALI ultralightweight 29mm soft dome tweeter. The OBERON ON-WALL C was designed with TV audio very much in mind and despite its compact dimensions, the combination of DALI technologies employed endow it with performance comparable to significantly larger speakers. The OBERON ON-WALL C is designed specifically for direct wall mounting via rear panel keyhole slots. Portrait and landscape orientations are both accommodated.

OBERON VOKAL C

The new OBERON VOKAL C is intended primarily as a centre-channel speaker and is designed to be the perfect match for any of the speakers in the OBERON C series for a complete surround system. It houses a 29 mm ultra-lightweight soft dome tweeter and 2 x 5.25" SMC based wood fibre woofers, resulting in a speaker that renders audio like a much larger model.

All four OBERON C speakers incorporate wireless interface, digital signal processing (DSP) and Class D power amplification electronics in a module located on their rear panels. The twochannel amplification in each OBERON model provides 50 Watts for the individual bass/mid and high-frequency drivers. Crossover functions within the OBERON C electronics are implemented through DSP running at 24 bit/96 kHz resolution

OBERON C - Overview

OBERON 1 C | OBERON 7 C | OBERON ON-WALL C | OBERON VOKAL C

OBERON C FINISHES

OBERON C speakers are available in four high-quality laminate cabinet finishes and are supplied with a contrasting grey fabric grille attached with conventional grille pegs. The use of grilles is entirely optional.

The four OBERON C laminate finishes: matt white, light oak, dark walnut and black ash, were chosen specifically to provide options that cover the full range of colour tones and themes found most commonly in homes throughout the world. At the same time, the laminate tones work with the grille fabric and aesthetic detail of the speakers to reinforce the traditional DALI values of sensitive and stylish Danish design.

White

Light oak

Dark walnut

Black ash

DALI SOUND HUB & SOUND HUB COMPACT

The DALI SOUND HUB and SOUND HUB COMPACT are the brains of every OBERON C system. They provide both Bluetooth and a variety of wired audio inputs and transmit audio to OBERON C speakers using a proprietary 30-bit wireless protocol. Audio transmission latency from input to speaker is typically less than 15mS, and inter-speaker timing is accurate to the single sample period of the broadcast audio data. All this with Hi-Res audio at 24 Bits/96 kHz resolution (24Bits/48kHz when used for multi-channel surround).

THE DALI SOUND HUB COMPACT

With five discrete audio inputs available, including HDMI and Bluetooth, the SOUND HUB COMPACT can connect to almost any audio device. For example, there are no less than four ways to connect a TV and transmit its audio to OBERON C speakers, but there are also ample possibilities to connect music streaming or conventional audio devices. The SOUND HUB COMPACT can transmit stereo audio and has a wired subwoofer output. Using the DALI WSR (Wireless Subwoofer Module), any subwoofer can receive wireless audio from the SOUND HUB COMPACT, making for a powerful, wireless 2.1 stereo speaker setup. A maximum of 10 speakers (5 pairs) can be connected to the SOUND HUB COMPACT.

With its slim form and modest size, the SOUND HUB COMPACT is easily hidden away behind a flat-screen TV.

THE DALI SOUND HUB

The SOUND HUB adds S/PDIF and 3.5mm analogue inputs, and is equipped with facilities for future expansion and upgrade. For example, with its optional NPM-2 BluOS module installed, the SOUND HUB can provide MQA certified high-resolution music streaming and multiroom functionality, as well as supporting Spotify Connect® and Apple AirPlay 2®. With the HDMI module installed, the SOUND HUB can broadcast up to 7.1 multi-channel home theatre audio. Wireless transmission to a subwoofer is possible using the DALI WSR (Wireless Subwoofer Module)

A maximum of 10 speakers in various configurations can be connected to a single SOUND HUB. As an example, a 7.1 surround setup could be enhanced with an extra centre-channel speaker for large screens.

See the SOUND HUB whitepaper for much more on the SOUND HUB, SOUND HUB COMPACT, NPM-2 BluOS and HDMI modules, as well as the WSR.

NPM-2 BluOS

DALI HDMI

DALI WSR

2. Choosing and Using OBERON C

The four OBERON C wireless active speaker models are each designed to suit and appeal to different applications and users.

OBERON 1 C

The OBERON 1 C is intended for smaller rooms where space is a precious commodity and volume levels are relatively modest. Music lovers and audiophiles who prefer the style and sound of stand-mounted speakers will be drawn towards the OBERON 1 C. At the same time, its modest size makes the OBERON 1 C ideal for use as a side/rear speaker in a multi-channel setup or as a front speaker in a compact stereo TV setup.

OBERON 7 C

The OBERON 7 C is intended for more expansive homes where music has space to breathe and can be played at higher volume levels. It will suit more ambitious music lovers and audiophiles, keen to make a grander statement with their audio system. With more space and speaker positioning options available in larger rooms, the OBERON 7 C also makes a powerful front speaker in stereo or multichannel home cinema setups.

OBERON ON-WALL C

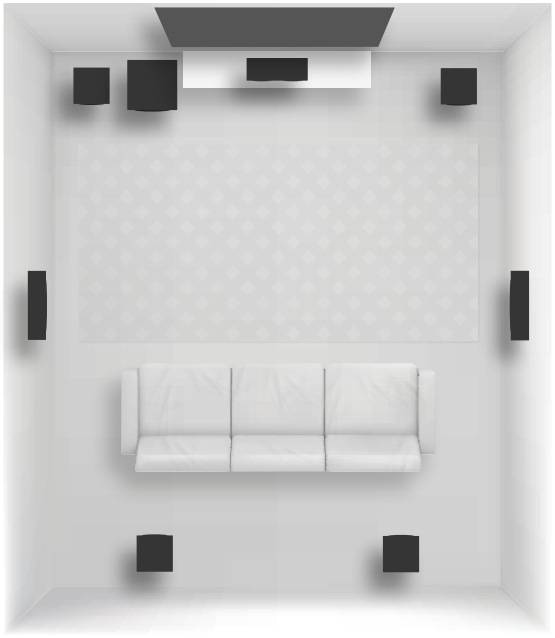
The OBERON ON-WALL C is intended to find a role in any room, large or small, that includes a wall-mounted TV with space for a speaker on either side. In contrast to the OBERON 1 C and OBERON 7 C, the OBERON ON-WALL C is designed specifically to suit wall-mounted TV audio applications, where it will almost certainly produce more satisfying results than a TV soundbar. With its space-saving design, the OBERON ON-WALL C could take on the role of front, centre, rear, and side speaker in any multichannel home cinema setup.

OBERON VOKAL C

The OBERON VOKAL C is primarily intended to be used in the centre-channel role in multichannel home theatre systems. It can potentially also be used in both front and surround channel roles, as it is quite a capable speaker in itself.

WIRELESS SURROUND SOUND

With an HDMI-module installed, the SOUNDHUB enables a completely wireless active surround sound setup of OBERON C speakers.



3. Technology In The Service of Music

DALI is driven by the philosophy that better music in the home is a force for good, and the technologies that enable the OBERON C series and DALI SOUNDHUBS to perform to such an exceptional level are no more than means to that end.

3.1 OBERON C

The temptation for many Hi-Fi manufacturers when developing active speakers is to believe that active amplification and digital signal processing can compensate for the use of less technologically sophisticated, and perhaps less expensive, drivers and electro-acoustic engineering. At DALI we know that this simply isn't true, and, in some technical respects such as the distortion effects that can arise from the driver magnet and voice-coil system, active amplification makes greater demands on performance than passive amplification. Furthermore, with the drivers effectively connected directly, while there is minimal loss from passive crossover components, the amplifiers are required to drive more dynamic loads, so care has to be taken to ensure the amplifiers and drivers are matched appropriately.

So, with the OBERON C series, rather than seeing active amplification and DSP 'horsepower ' as an opportunity to simplify or down-spec the drivers, we committed early in the development process to using the same technologically advanced units that perform so spectacularly in the passive OBERON series. Matching these exceptional drivers with active amplification and DSP filter technology made it possible to create in the OBERON C speakers a level of performance significantly higher than their passive speaker counterparts.

NOTE

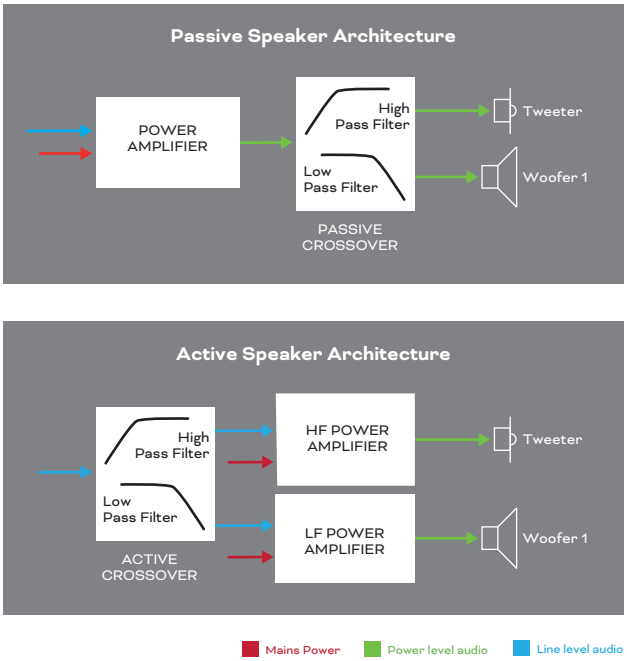
THE ACTIVE DIFFERENCE

The difference between active and passive speakers is not simply that active speakers require a mains power supply. There is a fundamental advance in the 'architecture 'of an active speaker that should, in theory, result in significant performance advantages over a similar passive design. In a passive speaker, a single power amplifier output channel is connected to a passive crossover network that divides the signal between the two (or sometimes more) drivers. Because the crossover network is positioned downstream of the power amplifier, the inductive and capacitive components that create its filters need to be of high values and power ratings, and that means they tend to be both relatively "lossy" and to have their own sonic signature. Passive crossover networks are also affected by the impedance of the downstream drivers, and if that changes, as voice-coil temperature rises, for example, the frequency response of the crossover filters will also change.

In an active speaker, each driver is connected directly to a dedicated power amplifier, with the crossover dividing the signal located before the power amplifier inputs. This immediately means that, firstly, the amplifiers have much-improved control over the drivers, and secondly that driver impedance changes don't affect frequency response. A further advantage is that if one amplifier reaches its power limits and clips the signal, the other amplifier (or amplifiers) will not be affected. With the crossover network now working on a line-level, rather than a power-level, signal, its filters can be generated through the use of low value and very low loss capacitors combined with high precision transistors. But active crossovers don't only achieve a level of precision and consistency that passive crossovers can't ever hope to match, they can also be designed to have much steeper filter slopes. For example, a steep, fourth-order filter with 24dB/octave slopes is problematical in a passive crossover – the likely component losses and sensitivity to downstream driver impedance are just about at the limit of feasibility. A fourth-order active filter however is in principle no less feasible to implement than a first-order filter. Even eighth order (48dB/octave) filter slopes are not unknown in active speakers. Such a steep slope would be all but impossible to implement in a passive filter.

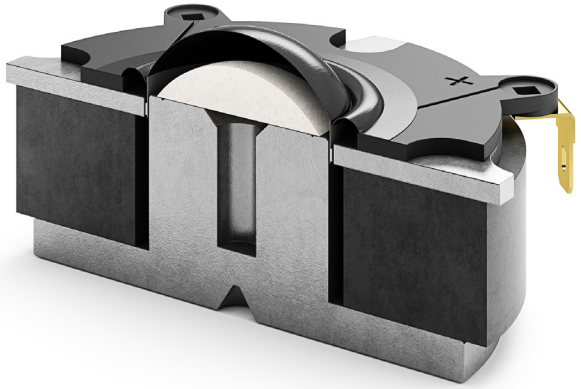
In the paragraph above we've described active crossovers in the analogue domain but in the OBERON C series, the concept of an active crossover has been taken one step further by positioning it even before the digital-to-analogue conversion stage. The crossover is implemented entirely within the digital signal processing DSP, so now there's not even any capacitors or transistors involved in creating the filter slopes. Everything is done in the digital domain through immensely fast binary processing.

PASSIVE AND ACTIVE SPEAKER ARCHITECTURE



BASS/MID DRIVER

OBERON C bass/mid drivers feature our proprietary paper pulp and wood fibre composite diaphragm materials, advanced copper-coated aluminium voice-coil wire and, in particular, our unique SMC (Soft Magnet Compound) magnet technology. By introducing electrically nonconductive elements to the magnet structure, SMC significantly reduces the effect of a variety of distortion-producing mechanisms inherent to moving-coil driver architecture. For example, SMC minimises eddy current effects, increases flux linearity, reduces magnetic hysteresis and minimises the variation of voice-coil inductance with its position. Taken together, these benefits make SMC equipped drivers particularly suited to active amplification.



HIGH FREQUENCY DRIVER

The OBERON C high-frequency driver is a damped textile dome tweeter featuring an unusually light diaphragm and a larger than typical, 29mm diaphragm and voice coil. The light diaphragm means that the upper-frequency response of the driver is unusually extended before its mass limited roll-off, while the large diameter diaphragm and voice-coil increases sensitivity and power handling, reduces distortion, and enables the driver to operate to lower frequencies than is the case with smaller tweeters, which helps provide more latitude in the crossover design. Further increasing power handling, and significantly reducing signal compression as the voicecoil temperature rises with increased volume, the driver is equipped with ferrofluid in its voicecoil gap.

CABINET CONSTRUCTION

OBERON C cabinets are constructed from CNC-machined high strength MDF panels and finished with a variety of wood-effect or matt white laminates. The cabinets are engineered for optimum rigidity to minimise panel resonance, with corner fillets and, in the case of the larger OBERON 7 C, strategic internal cross-bracing. Corner fillets have become increasingly unusual in contemporary speaker cabinet construction but at DALI we believe they play an important role in ensuring rigidity. OBERON C internal cabinet damping materials are selected and positioned strategically to maximise midrange energy attenuation without degrading bass transient response and bandwidth, as so often the case with reflex-loaded speakers.

The OBERON 1 C and OBERON 7 C are fitted with unusually large diameter rear panel dualflare reflex ports that are engineered to minimise port turbulence, distortion and compression, while also factoring in the potential proximity of the rear wall. Flaring on the port entrance, as well as on the exit, delays the onset of airflow turbulence as volume level rises, and helps ensure that bass performance remains consistent at all volume levels. Rear-mounting the reflex ports has the great advantage of directing any midrange energy emitted from inside the cabinet away from the listening position.

The OBERON ON-WALL C also incorporates dual, rear panel reflex ports but they are configured to exit in parallel alignment with the rear wall and to incorporate the wall and the rear panel of the speaker in their operation. The ON-WALL C reflex port is a uniquely innovative solution that plays a significant role in enabling the speaker's unusually shallow depth dimension.

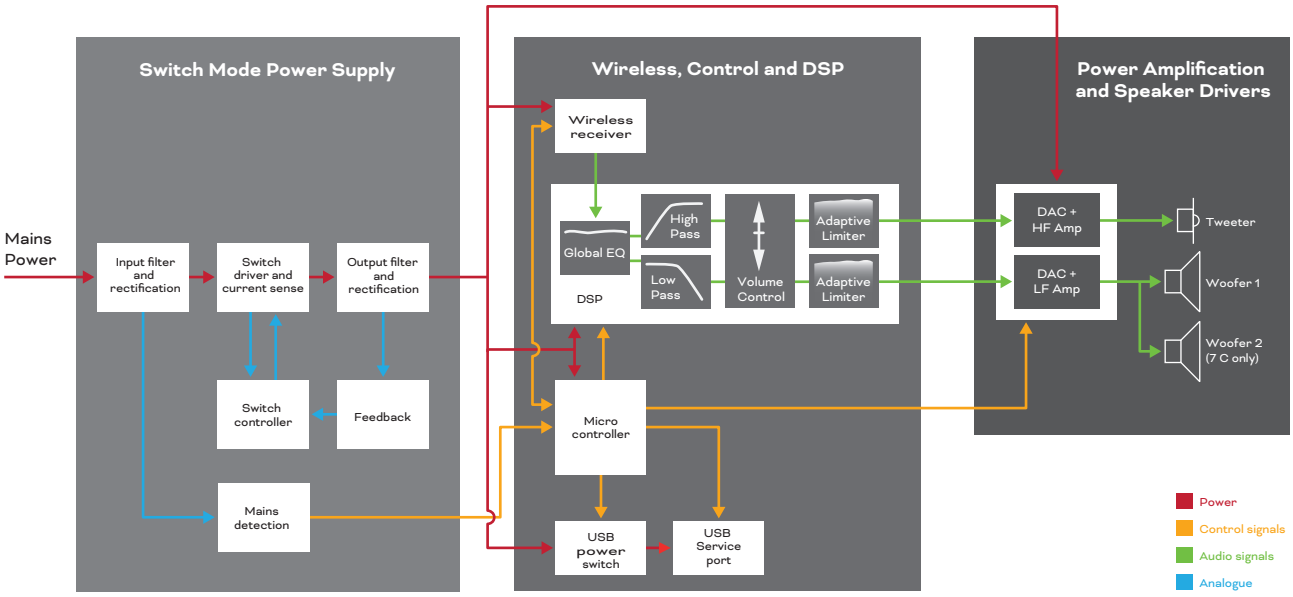
ELECTRONICS AND AMPLIFICATION

The rear panel mounted OBERON C electronic module incorporates a wireless receiver element and user setup interface, a DSP equalisation and crossover filter element, and a highefficiency two-channel power amplifier with a closely integrated power supply.

WIRELESS FUNCTIONS

The OBERON C wireless receiver module acquires the digital wireless stream transmitted from one of the two sound hubs and, depending on the channel role assigned to the speaker when it is set up, either the left or right channel data is discarded (in stereo operation). In multi-channel operation,

OBERON C SYSTEM SCHEMATIC



each speaker receives only the specific audio it is set up to receive, whether used as front, centre, side or rear-channel. The remaining channel data is then passed through unchanged at 24 bit/96 kHz resolution to the DSP based equalisation and crossover filter electronics. Note that any speaker in the OBERON C series can be configured to play any role in your setup. This means that you can use OBERON 1 C speakers as front speakers and an OBERON 7 C speaker as centre-channel if you so desire.

EQUALISATION AND CROSSOVER FILTER FUNCTIONS

The OBERON C equalisation and crossover filter elements play two roles. Firstly, through gentle modification of frequency response, equalisation helps ensure that the speaker produces the appropriate, neutrally balanced overall response in the listening room. Not too bright or too bass-heavy, and with the perfect midrange level. A specific custom DSP equalisation profile was developed for each OBERON C model to create a tonal balance that suits its cabinet size and likely installation environment. Only active DSP technology can enable the degrees of freedom that makes such equalisation feasible. For example, the boundary effect on the frequency response of a wall-mounted speaker such as the OBERON ON-WALL C is all but impossible to correct with passive equalisation, but such correction is easily within the scope of active equalisation. As a result of active boundary correction, the OBERON ON-WALL C displays none of the subjective tonality often associated with on-wall locations. It has more of the open, unconstrained character of a free-standing speaker.

Secondly, the OBERON C equalisation stage analyses the incoming signal and, depending on its low-frequency content and the speaker volume level, applies subtle dynamic profiling to ensure that the bass/mid drivers are not required to work outside their comfortable, low distortion limits. It's partly thanks to dynamic profiling that OBERON C speakers remain subjectively so consistent at all volume levels.

Following equalisation, the crossover filter module divides the signal appropriately for the bass/mid and high-frequency drivers through a pair of digital filters: a low-pass filter feeding the bass/mid driver and a high-pass filter feeding the high-frequency driver. The filter slopes have a profile that combines a relatively slow roll-off with benign phase change through their pass-band regions.

The opportunity to apply both equalisation and crossover filtering entirely in the digital domain is one of the enormous advantages that digital active speakers have over their traditional analogue passive cousins. As we described earlier, however, such theoretical advantages can only result in improved subjecting performance if, as is undoubtedly the case with OBERON C, the fundamental speaker electro-acoustics are up to the task.

POWER AMPLIFICATION

The OBERON C power amplification comprises two 50 Watt peak, closed-loop Class-D power amplifiers chosen specifically for their sound quality and dynamic ability. One amplifier powers the high-frequency driver while the other powers the bass/mid driver (or twin drivers in the case of the OBERON 7 C and VOKAL C). The 100dB signal-to-noise ratio of the power amplifiers ensures that even the smallest detail in a quiet musical passage is reproduced with clarity and accuracy. Powering the amplifier is a custom-designed, 65W(RMS), very low noise switchedmode supply that is able dynamically to share resources between the two amplifier channels in response to demand. The OBERON C is, as a result, unusually frugal in terms of power consumption, yet gives nothing away in terms of dynamic punch when the music demands it.

4. OBERON C
- The Active Choice

The OBERON C series demonstrates that the theoretical advantages of active speakers can be truly realised, and plainly heard, and proves that genuine Hi-Fi speakers can be easily integrated with contemporary lifestyles needs and media systems. And the DALI sound hubs demonstrate that versatility of use in the modern world of both streamed and conventional audio need not mean any compromise of functionality or sound quality.

The OBERON C, the SOUNDHUB, and SOUND HUB COMPACT represent a new era of revolution in the DALI story. The traditional DALI values of easy accessibility, simple operation and class-beating sound quality have found their way into a genuinely high-performance digital, active wireless Hi-Fi system.

Technical specifications

	OBERON 1 C	OBERON 7 C
Frequency range (±3 dB)	39 – 26,000 Hz	31 – 26,000 Hz
Maximum SPL	106 dB	108 dB
Crossover frequency	2350 Hz	2450 Hz
Crossover principle	Full active 24 Bit DSP	Full active 24 Bit DSP
High Frequency driver	1 × 29 mm soft dome tweeter	1 × 29 mm soft dome tweeter
Low frequency driver	1 × 5.25"	2 × 7"
Enclosure type	Bass reflex (Rear ported)	Bass reflex (Rear ported)
Reflex tuning frequency	52 Hz	40 Hz
Amplifier output power	2 × 50 W	2 × 50 W
Amplifier type	Class-D	Class-D
Wireless input	Full 24 Bit / 96 kHz (not compressed)	Full 24 Bit / 96 kHz (not compressed)
Wireless Audio RF Band*	5150-5250 MHz and 5725-5875 MHz*	5150-5250 MHz and 5725-5875 MHz*
Input Mains	Universal mains 100-240 VAC	Universal mains 100-240 VAC
Maximum power consumption	62 W	62 W
Standby power consumption	1 W	1 W
Networked standby power consumption**	1.25 W**	1.25 W**
Time to enter networked standby	< 20 minutes	< 20 minutes
Recommended placement	Stand/ Shelf	Floor
Recommended distance to walls	1 – 50 cm	15 – 100 cm
Dimensions (H × W × D)	274 × 162 × 234 mm	1015 × 200 × 340 mm
Weight	4.2 kg / 9 lb	14.8 kg / 32 lb
Included accessories	Quick start guide, mains cable, front grille, rubber feet, silicone bumpers	Quick start guide, mains cable, front grille, rubber feet, spikes

	OBERON ON-WALL C	OBERON VOKAL C
Frequency range (±3 dB) (Hz)	51 – 26,000 Hz	47 – 26,000 Hz
Maximum SPL	107 dB	107 dB
Crossover frequency	2700 Hz	2450 Hz
Crossover principle	Full active 24 Bit DSP	Full active 24 Bit DSP
High Frequency driver	1 × 29 mm soft dome tweeter	1 × 29 mm soft dome tweeter
Low frequency driver	1 × 5.25"	1 × 5.25"
Enclosure type	Bass reflex (Rear ported)	Bass reflex (Front ported)
Reflex tuning frequency	52 Hz	46 Hz
Amplifier output power)	2 × 50 W	2 × 50 W
Amplifier type	Class-D	Class-D
Wireless input	Full 24 Bit / 96 kHz (not compressed)	Full 24 Bit / 96 kHz (not compressed)
Wireless Audio RF Band	5150-5250 MHz and 5725-5875 MHz*	5150-5250 MHz and 5725-5875 MHz*
Input Mains	Universal mains 100-240 VAC	Universal mains 100-240 VAC
Maximum power consumption	62 W	62 W
Standby power consumption	1 W	1 W
Networked standby power consumption**	1.25 W**	1.25 W**
Time to enter networked standby	< 20 minutes	< 20 minutes
Recommended placement	Wall	Shelf
Recommended distance to walls	On-wall	1 – 50 cm
Dimensions (H × W × D)	385 × 245 × 120 mm	162 x 441 x 295 mm
Weight	4.9 kg / 10 lb	7.5 kg / 16.4 lb
Included accessories	Quick start guide, mains cable, front grille, rubber feet, silicone bumpers, cable clips	Quick start guide, mains cable, front grille, rubber feet, silicone bumpers, cable clips

* Excluding Japan
** Please note that the speaker will remain in networked standby if the SOUND HUB / SOUND HUB COMPACT is powered off.