DALI

RUBICON C

WHITEPAPER



DALI

IN ADMIRATION OF MUSIC

REMEMBER YESTERDAY. ENJOY TODAY. EMBRACE TOMORROW.

Investing in the newest tech is, for some enthusiasts, the essence of Hi-Fi. Others want to invest once and keep their audio system for decades. Either way, this goes along with the joy of listening to their favourite songs and the urge to explore new music. There are multiple sources to gain these great sound experiences from . Some people prefer vinyl, others CD; some experiences are only accessible via streaming, and some people prefer a specific live concert shown on their TV's.

Here is the challenge. Despite the appetite for varied musical experiences, people often end up staying embedded in the same eco-system without prospect of upgrading their existing audio system in an appropriate way.



Usually, the difficulty is obtaining the advantages of wireless digital technology, while keeping high quality analogue sources easy to access.

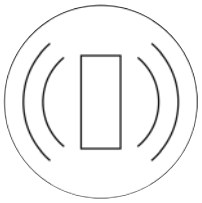
In addition to the requirement of future-proofing, specific terms have gained a certain priority in the world of Hi-Fi. Terms such as 'zero-loss, 'convenience', 'connect to everything' and 'wireless setup' are increasingly becoming essential requirements within this market. Implementation of these elements often leads to lack of quality and performance, which leaves the music lover with the choice of setups that are more advanced or at worst, abandoning the search for new captivating musical experiences.

At DALI we recognize the dilemma of customers having to choose between high quality performance and convenience in ease of use, bringing both the analogue and digital experiences to life. We set out to develop a solution which brings together the best of both worlds, with the potential of being upgradable.

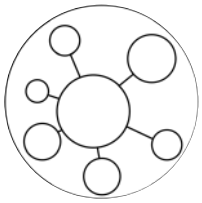
RUBICON C is DALI's approach to deliver the beautiful harmony between the technical advantages and convenience of the digital world, whilst still maintaining the overall goal of maximum 'human-friendly' true musical reproduction from the analogue world – an ideal we must never give up on!

Priorities made in admiration of technology have ruined many good intentions and sound moments within the audio world!

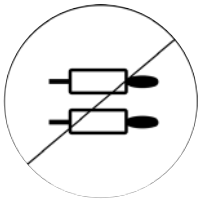
Rubicon C is the exact anti-thesis to that!



Zero-loss



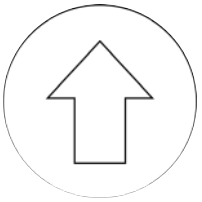
Connect to everything



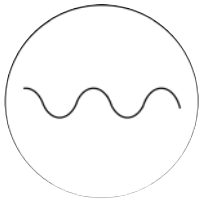
No speaker cables



Convenient in use



Upgradeable



Authentic DALI sound

DALI RUBICON C

ACTIVE SPEAKERS

Bringing the DALI RUBICON into the world of active speakers was both a logical step and a daunting task.

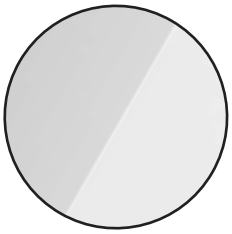
The RUBICON range has over the years since its launch gained abundant praise for its superior audio performance.

Drawing on the knowledge gained from designing and constructing the amplifier for the CALLISTO system, in addition to the intimate understanding of the RUBICON drivers, gave us the foundation needed to bring the RUBICON to new heights of performance and usability.

DALI RUBICON C comprises the exemplary combination of the drivers and cabinet construction from RUBICON, the amplifier technology from CALLISTO, and the wireless audio transmission from the DALI SOUND HUB.



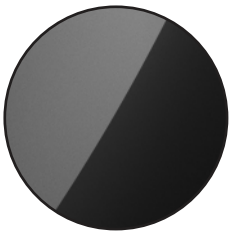
SPIKE SET PREMIUM is included in RUBICON 6 C and RUBICON 8 C package



White high gloss finish



Walnut finish



Black high gloss finish

RUBICON 2 C
A stand mounted speaker with a 6½ inch low-loss woofer and a 29mm ultra light soft dome tweeter. With its impressive soundstage and large bass reproduction, it's perfect for stereo or surround setups.

RUBICON 6 C
A floor standing speaker that features an additional 6½ inch woofer, which makes it more powerful, with an enhanced and controlled performance. The RUBICON 6 C is able to deliver even more physical bass to fill a larger room.

RUBICON 8 C
A large floorstander with 3 x 6½ inch woofers, the RUBICON 8C delivers a powerful and effortless performance in any room. A real powerhouse!

ZERO-LOSS
With a focus on zero-loss, no latency and easy setup, the wireless connection requires only mains power to be fully functional, which means easy installation and no requirement for audio cables. The wireless connection between RUBICON C and the hub will even work without a Wi-Fi network, thanks to a direct connection between the units.

The co-operation between the RUBICON C and the DALI SOUND HUB makes it possible to connect several devices – analogue and digital. And the sound hub will always pick up where it left off, or choose a new active source, if the signal is lost.

DALI SOUND HUB – wireless audio

The DALI SOUND HUB is the starting point when setting up RUBICON C speakers. It is the distribution source of the wireless audio signal and where the pairing process begins.

The DALI SOUND HUB houses all the potential connections; has built-in controls for Power On/Off, Volume control, Source select, Mute and Speaker pairing, and also visual indications for Volume, Source and Speaker placement.

The sound hub remote control is connected via Bluetooth, so ensuring optimal performance stability, visual feedback, and ease of operation from distance. Bluetooth also enables the user to place the sound hub anywhere within max 10 meters, preferably in the same room as the speakers.

DALI SOUND HUB INPUTS

- Wireless connection 24 bit / 96 kHz
- Bluetooth (AAC, Apt-X and Apt-X HD)
- 3.5 mm Stereo (mini-jack)
- Coax (S/PDIF)
- 2 x Optical - AUDIO /TV (TosLink)
- RCA (Analogue stereo)



The display of the hub showing speakers connected

Hidden away on the back of the sound hub: The link button, every input and output, and the expansion ports are readily accessible.





The DALI SOUND HUB is MQA certified MQA Ltd. when fitted with the optional BluOS NPM2-i module or the discontinued NPM1 module.

EXPANSION PORTS
– Future-proofing your RUBICON C speakers

The two modular expansion ports on the back panel form one of the most innovative features of the DALI SOUND HUB, and opens a world of possibilities. Via the DALI-designed open standard connector, any type of audio module can be fully integrated with the sound hub system.
The sound hub supports I2S audio transfer on up to eight channels, and command transfer to control volume and other essential information. This enables the seamless addition of extra functions to the sound hub, not only allowing for streaming, multi-room or even multi-channel expansions, but also future-proofing the sound hub and any connected speakers by separating the quickly evolving music delivery technologies from the more robust and time-durable speaker technology.



In- and outputs on the back of the hub.

DALI SOUND HUB OUTPUTS

Sub-out - LFE type subwoofer output (< 100 HZ)

Pre-out - Line level RCA output (pre-amplifier)

USB Power (5V 1 A output)
to power a device - no playback audio

Plug-in module 1

Plug-in module 2

WIRELESS AUDIO TRANSFER

The wireless connection between the sound hub and the speakers is an extremely stable digital connection, made on either the 2.4 GHz or the 5.8 GHz band depending on location and quality of the connection.

The proprietary 30 bit protocol transfers an uncompressed I2S audio signal in 24 bit 96 kHz and utilises the remaining bits to control volume, speaker ID and other functional data.

Because it works on a less busy band, and because the protocol is specially designed for transporting audio signals, the connection is highly stable, and introduces next to no packet loss. The protocol uses forward error correction to remove the result of packet loss should it occur.

The high bandwidth/low latency protocol functions as a point to multipoint connection. This allows for multiple speakers to connect to the same stereo signal. With latency below 25 ms, sync between video and audio from a movie or TV source is obtained well within conventionally acceptable limits.

CABINET

Made from Medium Density Fibre board (MDF), the RUBICON C series cabinets form a rigid foundation for the drivers, which are screw-mounted directly into the 25 mm thick front baffle.

The woofers are secured to the cabinet using five screws, each positioned on the arms of the die-cast aluminium chassis, ensuring the most secure mounting possible.

The hybrid tweeter module is molded in thick, solid aluminium and held securely in place with four screws to eliminate vibrations and resonance.



Link connect ensures connection to the hub

The main power connector, link button, setup display, the line-in connector and USB port for firmware upgrades are located on the back of the speakers.

Hybrid tweeter on RUBICON 6 C



The cabinets of both models separate the mid-range and bass drivers into their own chambers.

This enables individual optimisation of every driver to its specified frequency range, and thereby maximise the woofer output.

Furthermore, every woofer has its own bass reflex port placed directly to the rear to minimise turbulence, and to optimise the timing between the woofer and the bass port.

Visual upgrade - LED bar shows the volume level



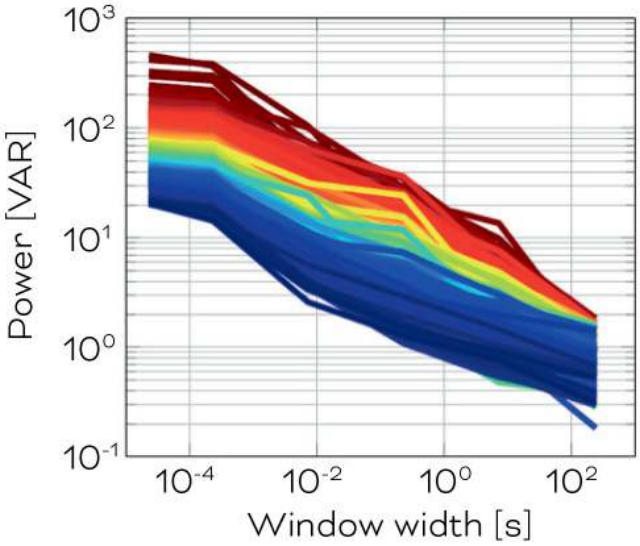
THE AMPLIFIER

Designing a 'best in class' active speaker system is the combination of many elements. One truly important element is the amplifier, or more correctly, the amplifier module.

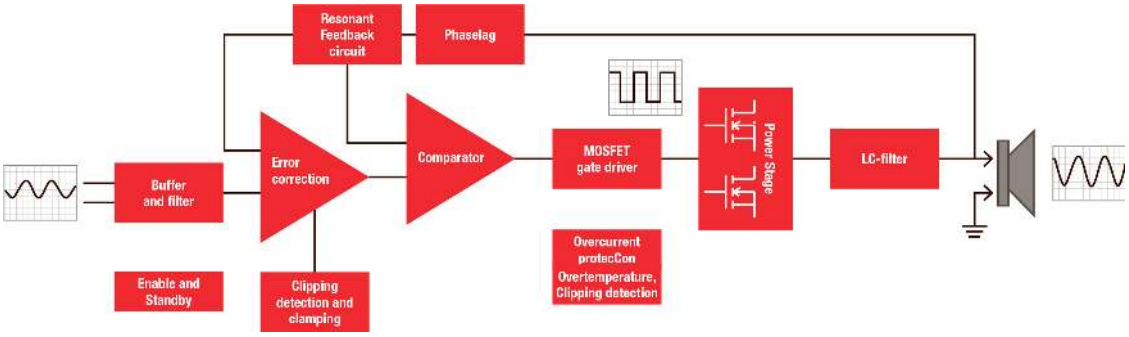
Using a digital crossover in place of the RUBICON's analogue one, the two amplifiers in each speaker drive the woofers and tweeters directly. This enables our acoustic engineers to optimise the interaction between amplifier and driver perfectly, bringing out even more detail from the source material than possible before.

The 6½" wood fibre SMC-based woofer delivers the mid-range and bass frequencies fed by one of the two 250-Watt amplifiers. The combination of the low loss design, the wood fibre membrane and the SMC pole piece enables this woofer to work with minimal distortion of the amplifier signal. This, together with the extremely musical Class-D amplifier, delivers audio with excellent dynamic detail.

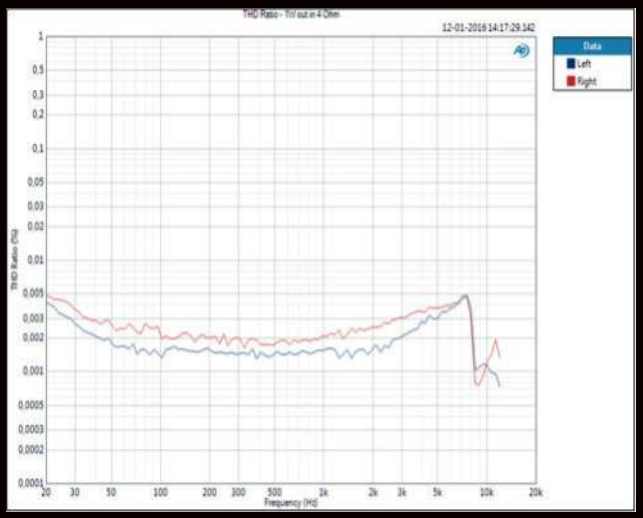
Our Class D amplifier is based on patented, state-of-the-art technology with a global feedback, self-oscillating design, chosen for its very musical properties. Being able to deliver an output of 250 Watts, there is plenty of power to ensure more than enough sound pressure for dynamic musical passages as well as impressive effects for movie soundtracks.



There is a 10x peak to average power ratio for normal music, and with 250 Watts for up to 5 seconds the RUBICON C amplifier has more power than most amplifiers.



Simple diagram of the amplifier structure showing the self oscillating global feedback loop



The Total Harmonic Distortion (THD) of the amplifier is below 0.005% across the audio bandwidth 20-20 kHz measured at 1W output power into 4Ω. At 30W output power the amplifier meets THD levels between 0.015% and 0.03% successfully independent of frequency.

Self-oscillating loop

The self-oscillating loop PWM (Pulse Width Modulation) amplifier enjoys improved performance over conventional fixed-frequency triangle-based PWM amplifiers because the bandwidth of the feedback loop is higher than that of a conventional feedback loop required to obey conservative stability criteria.

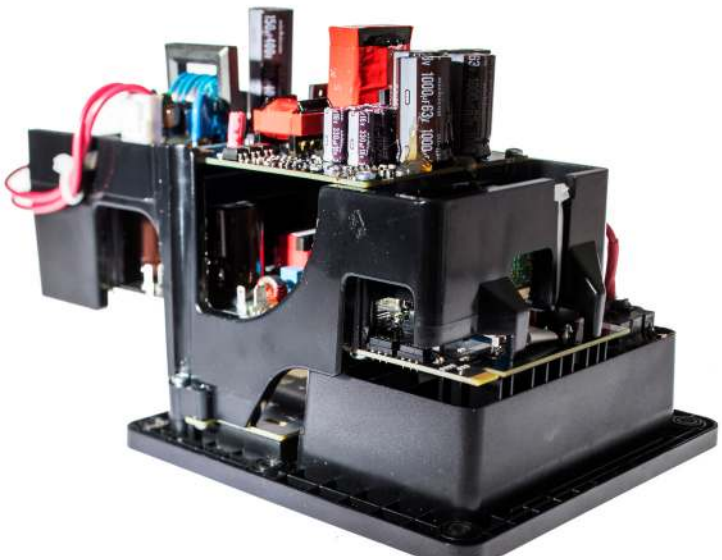
The post-filter feedback also reduces distortion and provides best-in-class load invariance. To keep control of the self-oscillating switching frequency and to ensure fast recovery after a clipping situation, the limiter circuit acts whenever the voltage difference between the input and output of the error amplifier exceeds a hardware defined threshold. This threshold is tuned so that THD levels do not exceed approximately 1% at the speaker output.

Signal processing
The core of the signal processing is comprised of a 50MIPS Digital Signal Processor, and an audiophile 24bit Digital to Analogue Converter. The DSP boasts an audio processor capable of up to 1024 instructions per cycle.

On the output side, the DSP is connected through I2S to a Burr Brown DAC that makes use of advanced segment architecture to achieve excellent 123dB dynamic range performance.

Differential current outputs are provided to suppress common mode noise and, by nature of the analogue interface, clock jitter is eliminated on the audio interface to the class D power amplifier.

The current to voltage conversion is done at the power amplifier input, securing the shortest possible signal path without the need of sound quality degrading AC-coupling capacitors.



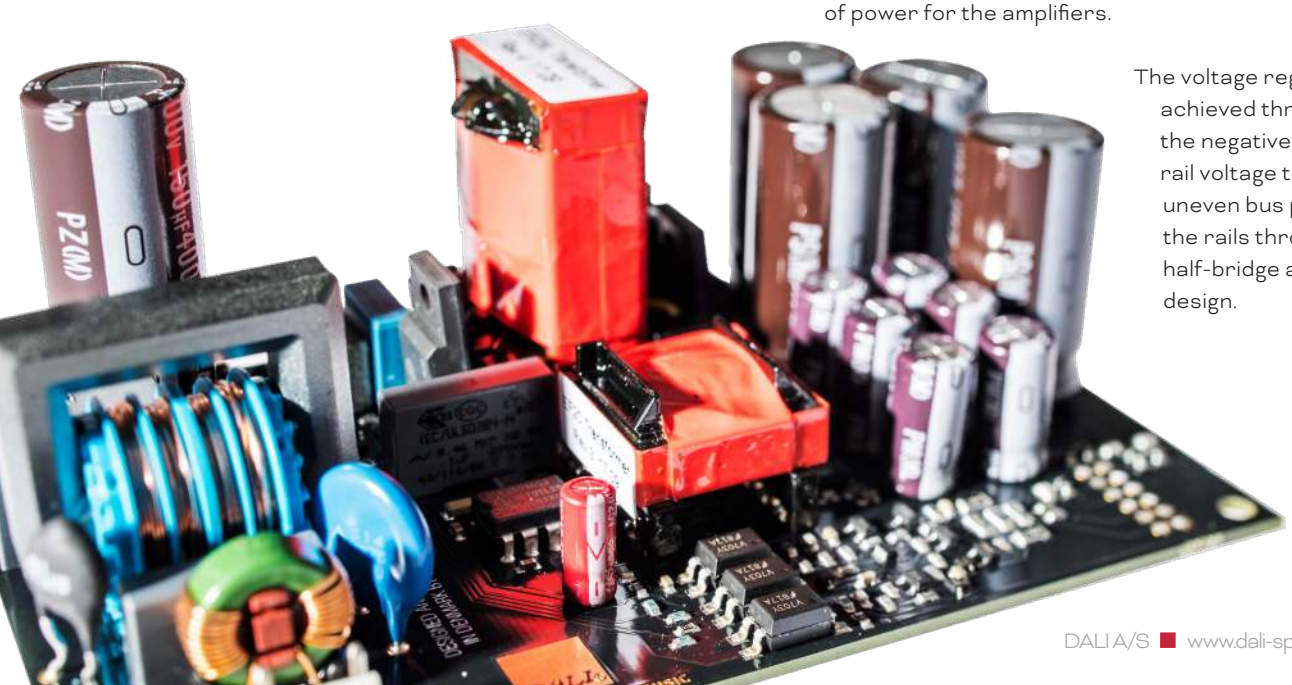
Every part of the amplifier module is designed and developed by DALI.

The master volume control takes effect in the signal chain just before the analogue amplification stage, to ensure optimal Signal-to-Noise-Ratio, and true 24 bit HD resolution at all volume levels. This means that no matter which of the many possible volume controls is used for adjusting the master volume, the actual volume change occurs at the very end of the signal chain.

The two amplifiers in every speaker are connected directly to the drivers, with all of the crossover filtering done in DSP. Having complete control over every step of the audio handling has the clear benefit of being able to maximise the utilisation of every component in the audio chain. Optimising the crossover parameters with the knowledge of precisely how the driver is going to react, means that we can push the performance of the individual driver right to the limit without ever going beyond. Combined with the well-known DALI driver performance, this creates a large part of the 'best in class' sound of the RUBICON C speakers.

The Power Supply Unit
The power supply for the system is a universal mains input switch mode PSU, capable of delivering 250 Watts of power for the amplifiers.

The compact but very powerful PSU is able to deliver up to 250 Watts peak power.



The voltage regulation is achieved through both the negative and positive rail voltage to suppress uneven bus pumping on the rails through the half-bridge amplifier design.

WOOFER

Having designed a magnet motor system that introduces almost no distortion, we wanted to add components that had these same qualities. We designed a woofer (bass/midrange driver) which is able to reach up well into the upper mid-range making the "handover" from the woofer to the tweeter sound entirely seamless.

Using a 6½" wood fibre cone manufactured by the same company that makes the EPICON cones, gives the woofer a light, rigid and randomly uneven membrane.

This makes the cone easy to move, ensures even piston-like movements and reduces the possibility of surface resonance greatly. These things combined result in ample detail and very little colouration in the reproduced signal, even at low volume.

All of the components are mounted in an aluminium chassis designed for maximum airflow around the cone and magnet system.

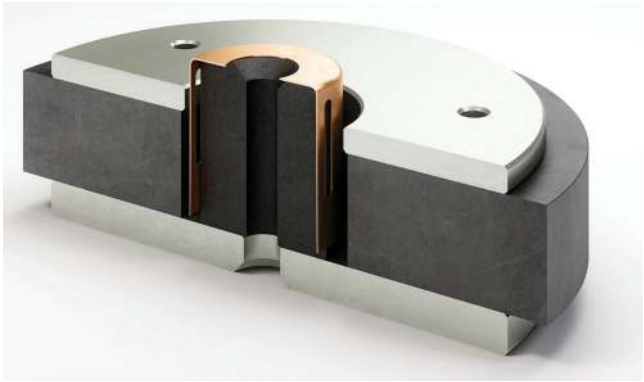
The use of aluminium for the chassis also negates any effect of the magnet system, since aluminium is not magnetically conductive and therefore does not interfere with the magnetic field.



Exploded view of all the parts included in the woofer of RUBICON C

The cone terminates in a soft low-loss rubber surround that has been designed from the ground up, and is bespoke for the RUBICON driver. The surround ensures that the cone moves easily and without loss of energy.

The SMC-based pole piece and its slitted copper cap forms the basis of the low-distortion magnet system



Magnet system
Reproducing undistorted, uncoloured sound, rich on detail, has always been the goal at DALI.

With the recently introduced SMC (Soft Magnetic Compound) 'Linear Drive System' we knew that we had the tools to raise the bar on sound quality in the mid-range loudspeaker section.

Finding a way to implement the knowledge was when things became more complicated. Wanting to maximise the effect of the SMC whilst keeping the magnet motor simple, led to countless experiments in our R&D department.

The result was a pole piece constructed entirely from SMC, surrounded with a copper cap, and enclosed within a large ferrite magnet. This way the effect of the SMC was maximised and the design of the magnet motor system was kept fairly simple.

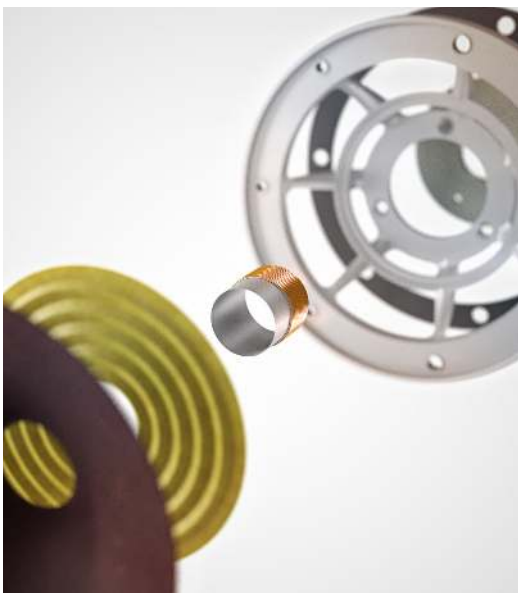
Low Loss Magnetism
The use of SMC (Soft Magnetic Compound) has many advantages, but the overarching result is a significant reduction of distortion from losses in the magnet motor.

SMC's unique ability to deliver a high magnetic conductivity and a very low electrical conductivity, gives us all the desired qualities of a really good speaker magnet, without the traditional disadvantages.

When using iron-based magnets in speakers, the magnetisation and demagnetisation introduced by the shifting current directions does not happen at the same pace.

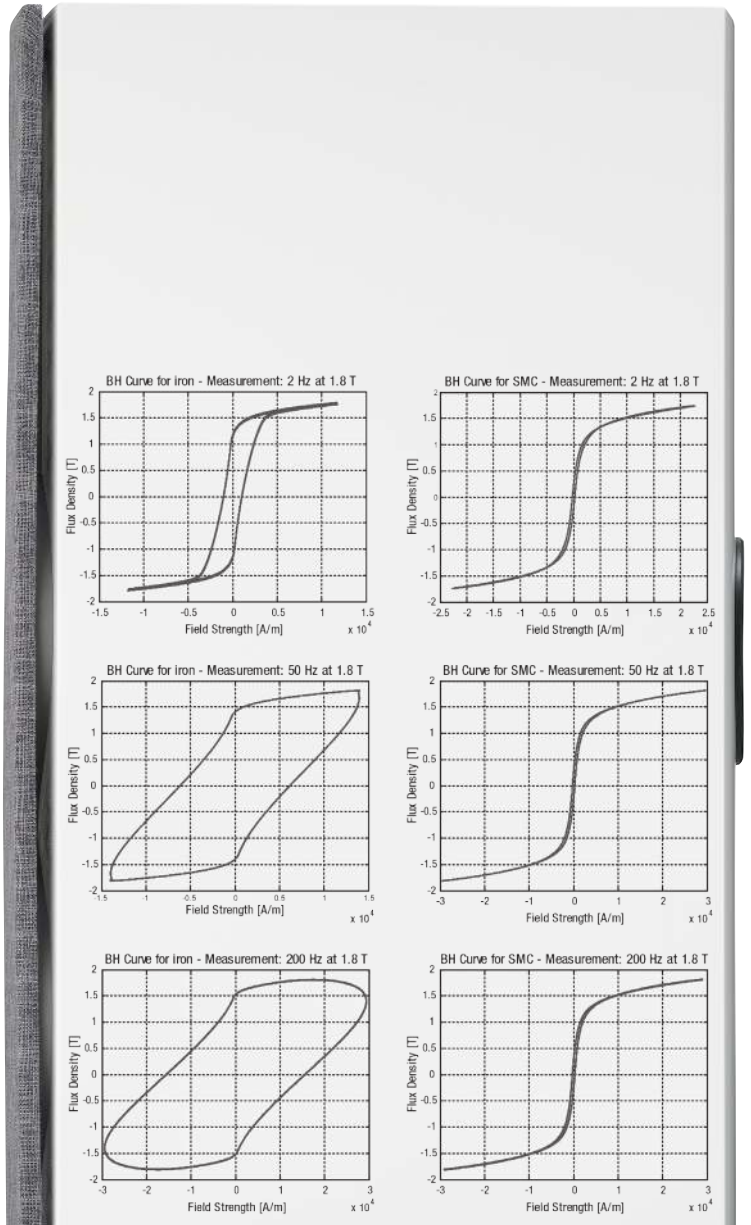
The demagnetisation process is slower than the magnetisation. This phenomenon is called hysteresis, and is a known problem in almost all speaker magnet motor systems.

The problem with hysteresis is that it introduces an unintended resistance to the voice coil, resulting in unwanted distortion. The reason hysteresis occurs is that iron is not only magnetically conductive, but also very electrically conductive.



Exploded view of RUBICON woofer.

SMC on the other hand is very highly magnetically conductive, but has a very low electrical conductivity (approx. 1/10,000's of iron). The result of using SMC is almost no hysteresis, and therefore no distortion.



Graphs are showing the hysteresis on iron based magnets in relation to SMC. There is almost no hysteresis, and therefore no distortion using SMC.

Current linearity
In a traditional iron magnet system, the current in the voice coil will modulate the flux in the magnet gap. This flux modulation is a course of distortion, and creates a working environment for the voice coil that is far from ideal. This modulation of the magnetic flux is caused by the iron being electrically conductive.

By introducing SMC into the area close to the magnet gap, this modulation is significantly less influenced by the current in the voice coil. As a result, we manage greatly to reduce the distortion from current-generated flux variations.



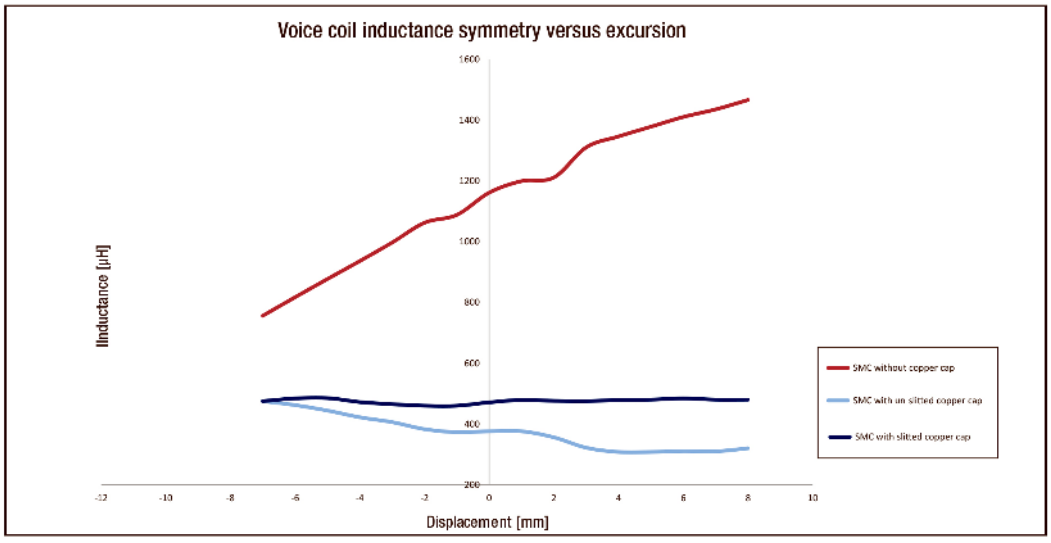
Cross section of the voice coil

Inductance Linearization

Making our speakers amplifier-friendly is an important part of the design process. We want to make sure that it is the amplifier and not the speaker that forms the audio signal. To get the best from the amplifier, the speaker has to deliver a stable working environment.

By keeping the impedance as flat as possible across the entire frequency range, the amplifier is able to deliver the same amount of power at all frequencies. In many magnet motor designs, the voice coil inductance depends on the position of the voice coil which means impedance varies with both frequency and level.

By surrounding the SMC pole piece with a copper cap, and controlling the effect via small slits in the copper, we focus the effect of the SMC around the voice coil, and linearise the inductance generated in the voice coil to a degree that it is seen as almost flat.



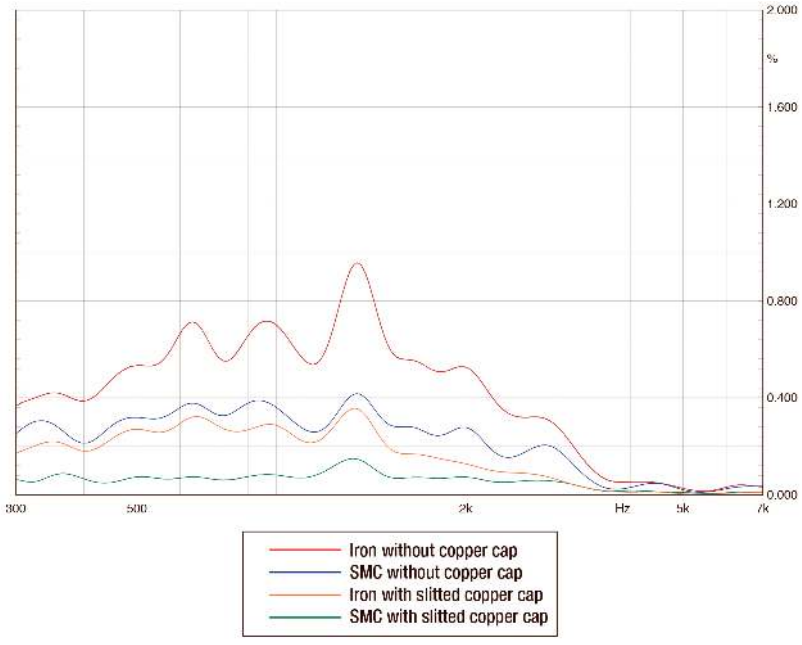
Graph showing the linearised inductance in the voice coil caused by slits in the copper cap

All of these individual component parts are assembled in-house to produce the RUBICON C driver.

They work together to reproduce clean, detailed sound, with no colouration or unwanted distortion. Every driver is configured to match the model they are destined for.

This is done by optimising the bass drivers for long excursion, and the midrange driver for a large, useful frequency range, so roll-off is handled in the crossover and not in the driver.

This same type of optimisation is achieved for the entire range of woofers used in the other models.



Generic example of 3rd. order distortion. This graph show the effect on a RUBICON 8 woofer, which, with only minor details, is much alike the woofer on RUBICON 6 C .

TWEETER

The tweeter modules are driven directly from the 250-Watt amplifier leaving the crossover function to the DSP.

On the RUBICON 2 C, the high frequencies are handled by a soft dome tweeter and on RUBICON 6 C, a hybrid tweeter module.



Soft dome tweeter

The ultra-lightweight soft dome tweeter module is designed to reach higher into the very high frequencies than is normal for a soft dome used in a DALI hybrid tweeter.

The hybrid tweeter module is one of DALI's trademarks. It combines a dome tweeter with a ribbon tweeter for an amazing reproduction of high frequencies, with wide dispersion at ultra-high frequencies keeping things crisp and airy.

The dome tweeter is able to reach down well into the midrange frequencies, making the handover from the woofer to the tweeter sound more natural and totally seamless. Along with the wide-banded bass/midrange, this ensures the all-important midrange area is balanced, coherent and detailed.



Top: Ribbon tweeter **Bottom**: Soft dome tweeter

To achieve this broader bandwidth we designed a voice coil that is very light and agile. We replaced the traditional copper wire on the voice coil with copper clad aluminium. This lighter voice coil is placed inside a powerful ferrite magnet that keeps tight control of its movements.

The ribbon part of the hybrid module is a magneto static type tweeter. Four bands of conductive material make up the active diaphragm that is controlled by a strong magnetic field formed around it. The ribbon tweeter is the master of wide dispersion and combining it with the soft dome, we get a tweeter module that starts working at frequencies as low as 2.5 KHz, and continues to perform well above 30 KHz. This extreme bandwidth combined with ultra-wide dispersion is an important part of the DALI sonic definition.

Exploded view of a RUBICON hybrid tweeter



OUTRO

The RUBICON C series represents a new era of revolution in loudspeaker development, yet still delivers on DALI's entire core values in a wireless context. With its own character, this elegant audio system delivers modern Hi-Fi with the same high level of quality, and in some ways better than the original RUBICON series.

In high-tech dialogue with the DALI SOUND HUB, the RUBICON C delivers solid and trustworthy high performance audio.

The comprehensive and user-friendly setup, designed with a focus on zero- loss, connectivity and convenience, is effortlessly achieved.

TECHNICAL SPECIFICATIONS

	RUBICON 2 C	RUBICON 6 C	RUBICON 8 C
Frequency Range (+/-3 dB) [Hz]	46 - 26,000	37 - 30,000	36 - 30,000
Maximum SPL [dB]	108	110	112
Crossover Frequency [Hz]	2,600	800 - 2,600 - 14,000	500-800-2,600-14,000
Crossover Principle	Hybrid Full Active 24 bit DSP and Passive all analogue	Hybrid Full Active 24 bit DSP and Passive all analogue	Hybrid Full Active 24 bit DSP and Passive all analogue
High Frequency Driver	1 x 29 mm soft dome	1 x 29 mm soft dome 1 x 17 x 45 mm ribbon	1 x 29 mm soft dome 1 x 17 x 45 mm ribbon
Low Frequency / mid-range Driver(s)	1 x 6½"	2 x 6½"	3 x 6½"
Enclosure Type	Bass Reflex	Bass Reflex	Bass reflex (Front ported)
Bass Reflex Tuning Frequency [Hz]	51.0	36.5	36.5Hz
Amplifier Output [watt]	250	250	250
Connection input	ADC-In (RCA)	ADC-In (RCA)	ADC-In (RCA)
Input Impedance [Ω]	5k	5k	5k
Input Sensitivity [mV]	1,400	1,250	1,250
Wireless input	Full 24 Bit / 96 kHz (No bit-loss attenuated)	Full 24 Bit / 96 kHz (No bit-loss attenuated)	Full 24 Bit / 96 kHz (No bit-loss attenuated)
Wireless Audio RF Band	5725-5875 MHz	5725-5875 MHz	5725-5875 MHz
Amplifier Type	Discrete Class D (Closed Loop, Self Oscillating)	Discrete Class D (Closed Loop, Self Oscillating)	Discrete Class D (Closed Loop, Self Oscillating)
Onboard DAC	Burr Brown PCM1796 (Balanced output)	Burr Brown PCM1796 (Balanced output)	Burr Brown PCM1796 (Balanced output)
Maximum digital resolution [bits/KHz]	24 / 96	24 / 96	24 / 96
Recommended Placement	Stand / Shelf	Floor	Floor
Recommended Distance from Wall [cm]	20 - 120	20 - 180	20 - 180
Input mains	Universal mains 100 - 240V	Universal mains 100 - 240V	Universal mains 100 - 240V
Maximum Power Consumption [W]	325	325	325
Standby Power Consumption [W]	1.2	1.2	1.2
Dimensions (HxWxD) [mm]	353 x 195 x 335	990 x 200 x 380	1100 x 220 x 445
Weight [kg/lb]	8.4 / 18.5	20.8 / 45.8	27.8 / 61.2
Accessories Included	Manual, Rubber Feet, Front Grille	Manual, Rubber Feet, Front Grille, SPIKE SET PREMIUM	Manual, Rubber Feet, Front Grille, Spike Set Premium

All technical specifications are subject to change without notice.

TECHNICAL SPECIFICATIONS

	DALI SOUND HUB
Connection Input	2 x Optical (TosLink), Coax (S/PDIF), RCA (Analogue stereo), 3.5 mm Stereo (mini-jack), 2 x Plug-in module
Input Impedance RCA [Ω]	10k
Input Sensitivity RCA [V]	2.3
Input Impedance 3.5mm mini-jack [Ω]	10k
Input Sensitivity 3.5mm mini-jack [V]	1.2
Input Impedance S/PDIF [Ω]	75
Connection Output	Stereo Line level (RCA), Sub-out (RCA), USB Charge (5V/1A)
Output Voltage Max. Line Level [V]	1.9
Output Voltage Max. Sub-Out [V]	0.9
Maximum digital resolution [bits/KHz]	24 / 96
Wireless Input	Bluetooth 4.2 (AAC, Apt-X, Apt-X HD)
Wireless Audio RF Band	5725-5875 MHz
Wireless Output	Full 24 Bit / 96 kHz (No bit-loss attenuated)
Input mains	Universial AC Mains Adapter (1.75 m wire length)
Maximum Power Consumption [W]	4.5
Standby Power Consumption [W]	2.5
Dimensions (HxWxD) [mm]	76 x 300 x 213
Dimensions (HxWxD) [Inches]	3.0 x 11.8 x 8.4
Weight [kg/lb]	1.6 / 3.2
Accessories Included	Quick Setup Guide

All technical specifications are subject to change without notice.