



# HH Humble Homemade Hifi

L' Orfeo Series Concert Series Tips and Tricks Components Services About us  
News Music History Contact Disclaimer Home



## Concertino



The Concertino is not just another small monitor loudspeaker, but a meticulously designed precision audio component. For example the crossover parts are sourced from various suppliers and have been chosen for optimum coherence and synergy with the Scanspeak drivers - not just sourced from one supplier to maximize profits. Also the drivers and the crossovers are available as matched pairs, a prerequisite for perfect stereo imaging.

The crossover-point between the 15cm glass-fibre cone midwoofer and the 26mm soft-dome tweeter is 2400Hz. The cabinet has an internal volume of 9 litres and is vented on the rear via a large, low-noise, trumpet shaped reflex-port that is tuned to about 58Hz. Inside the enclosure there is also a *Quadratic Residue Diffusor* that is aimed on reducing the intensity of the standing waves inside the cabinet. Especially in the critical midrange where the amount of damping-material needed inside the cabinet can be minimized. The end result being a more dynamic and open sounding image.

The Concertino is available as a high-grade DIY loudspeaker kit. The kit is sold with all components except the cabinets and comes with the [Scanspeak 15W/8434G00](#) midwoofer, the [Scanspeak D2604/8330](#) tweeter, Supra 5N internal-wiring, gold-plated bindingposts, Intertechnik Damping-10 damping material, Intertechnik Jet Set-50 reflex-port, black mounting screws and a pre-assembled crossover that uses very high-grade Mundorf and Jantzen Audio components. In addition, a precisely CNC-milled baffle is available from our [webshop](#). Furthermore WBT-0703-Cu Nextgen binding-posts are available as an option at a small surcharge. On our [download](#) page you will find free CAD-drawings of the loudspeaker cabinet and the loudspeaker's baffle.



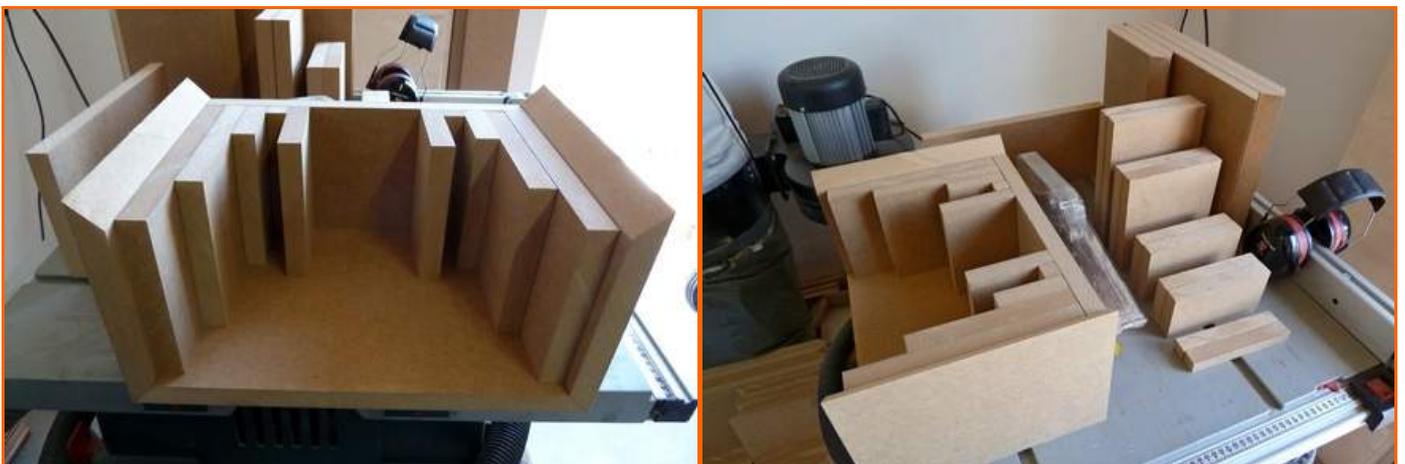
### Specifications

Sensitivity	84,5 dB / 2,83 volts
Impedance	8 ohms nominal (minimum 6,5 ohm @ 220 Hz)
Frequency response	55 - 40.000 Hz (-3dB)
Dimensions (W x H x D)	200 x 375 x 336 mm
Weight (finished product)	15 kg each



## The Concertino in detail

The Concertino is designed to be an accurate and extremely neutral monitor loudspeaker with a modest price-tag. It is as well at home in a high quality two channel stereo system as it is in a multi-channel home theatre set-up where it can also be implemented for the centre and rear channels. The angled baffle time-aligns the two drivers for optimum phase integration resulting in a very stable and spacious image. From the outside, the cabinet looks rather standard issue, but inside it is a totally different story. Instead of a standard six panel box, this loudspeaker uses a unique *Quadratic Residue Diffusor* type of woofer loading. This internal diffusor has several major advantages: first of all it creates an irregular shape that breaks the back wave produced by the woofer. This minimizes the amount of delayed energy that (in more conventional designs) is reflected back off the rear wall and travels through the thin cone of the midwoofer, "smearing" the original clean signal that is fed to the woofer. The second advantage is that the cabinet width and depth vary internally so the strong standing waves that you usually get between two parallel surfaces are broken down into several smaller and therefore less harmful ones. Third item is that the constrained panel layers help reduce panel-borne resonances, flexing and vibrating energy that travel through a panel of constant thickness. Advantage number four: all these extra panels help to make the whole construction "dead" and heavy, again reducing unwanted excess energy radiating from the cabinet. This little loudspeakers weigh 15 kg's each! All these advantages together result in a very quiet cabinet that also needs only a minimum of damping material inside and therefore adds to a "live" and dynamic approach to music.





The photo's above show how all the panels are positioned inside the cabinet. It may look a little complicated at first, but all the necessary panels are just cut into straight forward rectangular panels, also many panels have the same dimensions. I cut the 10 degree angle for the baffle after all parts (except the baffle itself) were glued together. I cut the outer cabinet panels full length and made mitred joints, check the high-resolution [CAD-drawings](#) for the exact measurements. The damping material inside these loudspeakers consists of 10mm thick Intertechnik Damping-10 (made from recycled cotton) only. Half a sheet of Damping-10 per speaker is cut to size and covers the flat internal surface area around the drivers. It also covers the beginning of the outer two diffusor panels. The area around the reflex-port is kept free from any type of dampingmaterial.

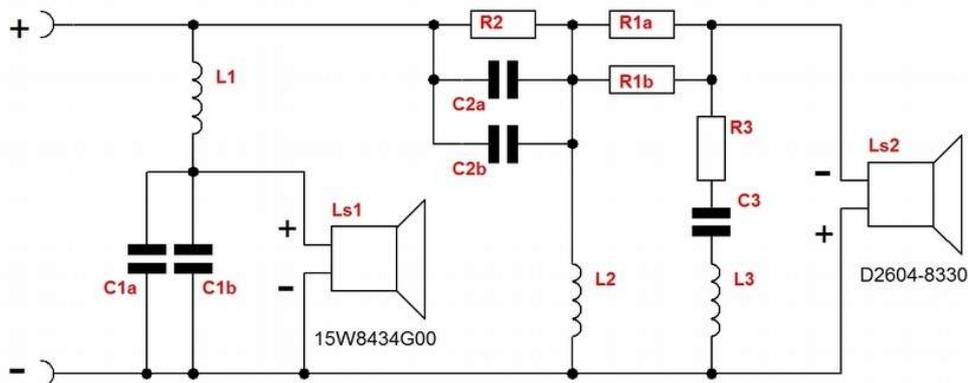


On the centre of the rear of the cabinet there is an Intertechnik Jet Set-50 reflex-port with very large internal and external flares. The port length is such that the supplied inner tube should be cut exactly in half. Each half is then terminated with an internal flare and the larger external flare and then taped together. The ports and the drivers have an air-tight seal to the cabinet by means of self adhesive compression tape (supplied with the kit) that is applied to the rear of the drivers baskets and the rear of the outer port flare. The binding-post terminal-plates come with their own foam backing. For screwing in all the black screws (also supplied with the kit) I use an electric screw-driver for the most part. The final tightning I always do by hand, that way you get a feel of how tight the screws are and you can't over tighten them and cause any damage to the plastic reflex-ports for example. Always work cross-ways, so first one screw nearly all the way in, then the screw opposite and so on.



The drivers, crossovers and terminals should be connected together by the supplied Jantzen Audio 5N stranded wire (made by Supra Cable of Sweden). The tweeter is connected in reverse phase relative to the woofer. The crossovers are mounted on the centre of the inside of one of the side panels, keeping them far enough away from the drivers magnets and keeping them out of the way of the reflex-port. The minor change in netto volume won't have any impact on the overall end result. If you find it a little too fiddly working through the woofer cut-outs, you can always mount the crossovers externally.

The crossover schematic might look at little complex at a first glance due to the many parallel components, but basically it is a second-order parallel network. The low-pass function for the two midwoofers is formed by L1 + C1 and the high-pass function for the tweeter is done by C2 + L2. Furthermore the tweeter level is lowered to match that of the woofers by means of resistor R1 and the tweeter also has a notch filter parallel to its terminals that tames a little bump in the output level around 4-6kHz. As you might know, I like to "cook" when designing a crossover. All the crossover components have therefore been chosen not only for their high sonic and build quality but have also been selected for maximum synergy with each other and with the drivers used. Inductor L1 and capacitor C2 have the most impact on the overall sonic performance. For L1 I chose a Mundorf Copper Foil with Laminated Feron I-Core that combines both the low level output distortion and the low internal resistance of Feron core coils with the high resolution and the great dynamic properties of OFC copper foil. Furthermore, they are distinguished by an excellent value for money ratio as well as by their compact dimensions. For all the main capacitor values I chose Jantzen Audio Superior Z-Caps for their spacious and neutral presentation and their uncompressed, dynamic nature that matches very well with the Mundorf CFS coils. The remaining components give the final touch by bringing out a fraction more micro-detail and even more natural overtones.



Humble Homemade Hifi - Concertino © 2013

#### Inductors

- L1 = Mundorf MCoil CFS14 Copper Foil with Laminated Feron I-Core
- L2 = Mundorf MCoil CFC16 Copper Foil
- L3 = Jantzen Audio baked varnish air-core / 0,70mm wire

#### Resistors

- R1a = Mundorf M-Resist Supreme / 20 watts
- R1b = carbonfilm resistor / 0,25 watts
- R2 = carbonfilm resistor / 0,25 watts
- R3 = Jantzen Audio SuperRes Non-Inductive / 10 watts

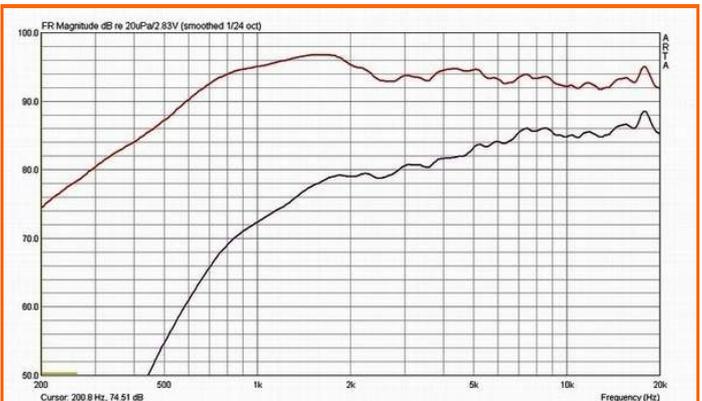
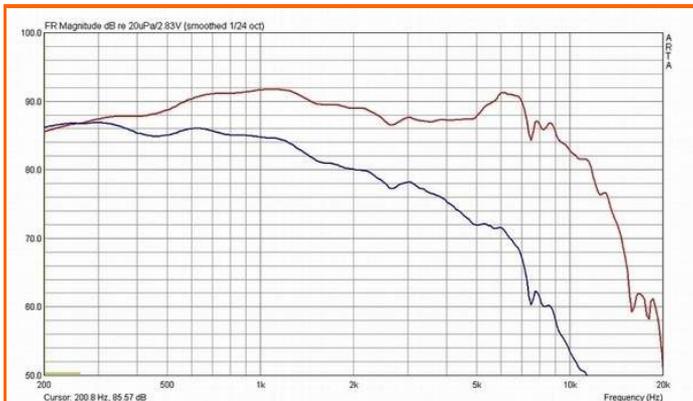
#### Capacitors

- C1a = Jantzen Audio Superior Z-Cap / 800VDC
- C1b = Vishay MKP1839 / 400VDC
- C2a = Jantzen Audio Superior Z-Cap / 800VDC
- C2b = Vishay MKP1839 / 400VDC
- C3 = Mundorf MCap / 250VDC



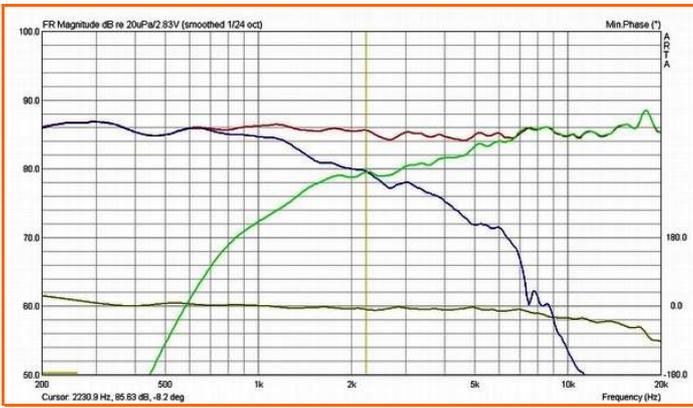
### Concertino - listening and measurements

These loudspeakers should best be placed on sturdy stands with ear-height between the tweeter and the woofer. This also how the measurements were taken. Playing with the amount of toe-in lets you find the right balance between top-end clarity and image size. The distance between the rear of the cabinets and a wall should be at least 20cm's. By varying this distance you can adjust bass-weight to your personal situation. After you have finished building these loudspeakers give them a few weeks of normal use to settle in, at least about 100 hours. When first connected they will sound a bit on the bright and lean side and the image will tend to stick to the loudspeakers. This is quite normal and is the case with any new loudspeaker. After a while the sound will grow, become warmer, more spacious and will extend at both frequency extremes. Once fully burnt-in these loudspeakers will sound extremely neutral and accurate. They have a very honest nature and what you feed them is what you get. Therefore these loudspeakers perform well with a large variety of source equipment and amplification, they just seem to grow as the quality of the equipment grows with them. Because of the Concertino's honest nature it isn't a loudspeaker that make things sound prettier than they are. Play them a poorly recorded 1980's rock record and it will sound like a poorly recorded 1980's rock record. But if you feed them something recorded well, it will sound very good indeed!

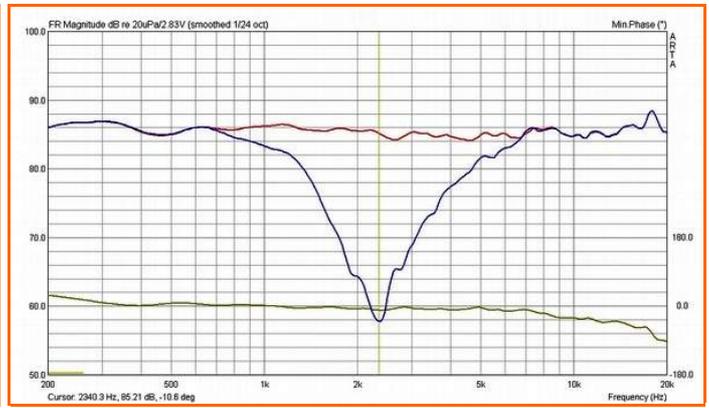


Above left: frequency curves of the midwoofer without crossover (red) and with crossover (blue); frequency range 200Hz - 20kHz; vertical range 50dB - 100dB, subdivision 2dB's.

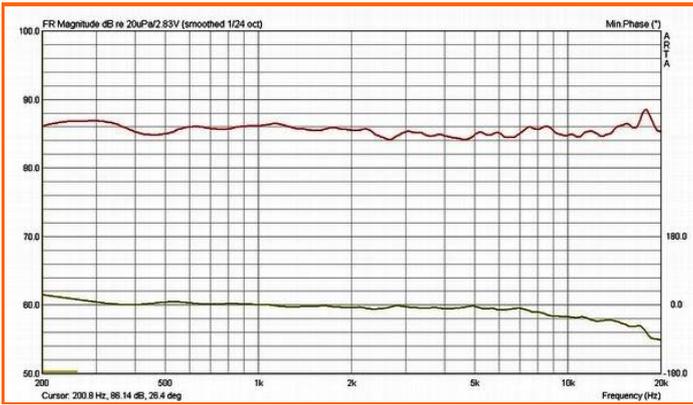
Above right: frequency curves of the tweeter without crossover (red) and with crossover (blue); frequency range 200Hz - 20kHz; vertical range 50dB - 100dB, subdivision 2dB's.



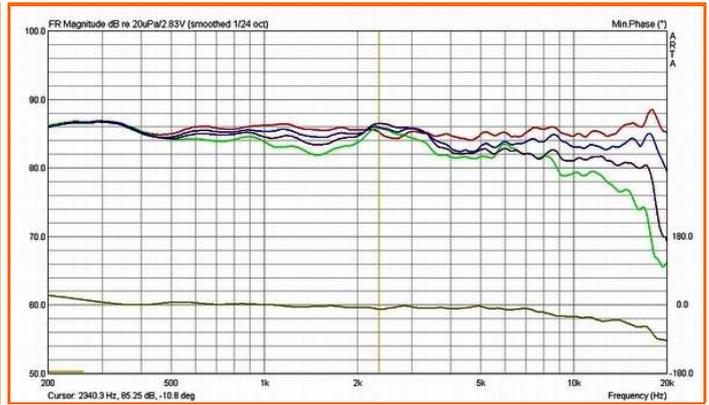
Above left: individual frequency curves of the midwoofer (blue) and tweeter (green) and the summed response of the finished system (red) with corresponding acoustic minimum phase; frequency range 200Hz - 20kHz; vertical range 50dB - 100dB, subdivision 2dB's. The crossover point is centred at about 2250Hz with the drivers crossing at a perfect 6dB's below the summed response.



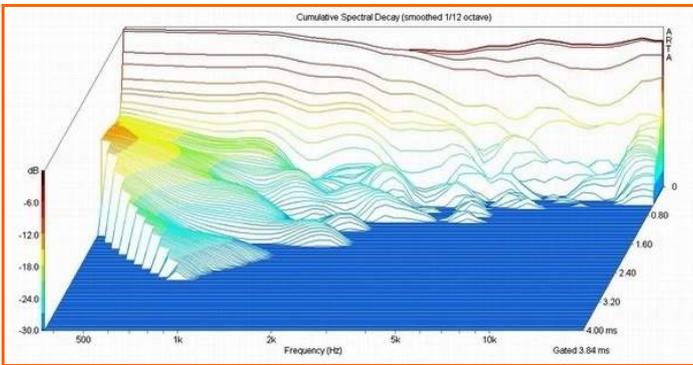
Above right: summed response of the finished system (red) and the summed response when the polarity of one of the drivers is reversed (blue); frequency range 200Hz - 20kHz; vertical range 50dB - 100dB, subdivision 2dB's. The reverse polarity measurement shows a very deep reverse null indicating an excellent phase tracking between the two driver units at the crossover-point!



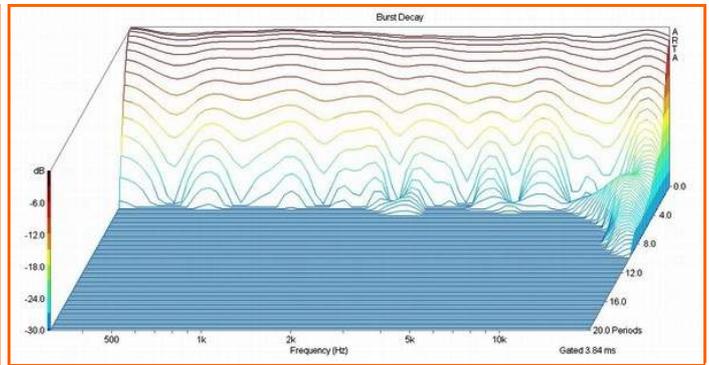
Above left: summed response of the finished system in the horizontal plane; on-axis (red); frequency range 200Hz - 20kHz; vertical range 50dB - 100dB, subdivision 2dB's. The output level is within +/-1dB over the whole range!



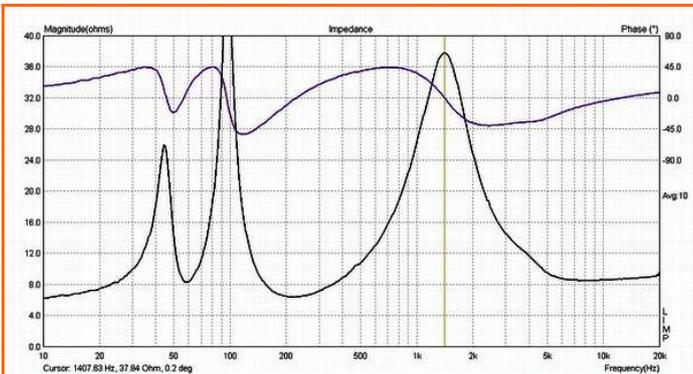
Above right: summed response of the finished system in the horizontal plane; on-axis (red); 15 degrees off-axis (blue); 30 degrees off-axis (purple); 45 degrees off-axis (green); frequency range 200Hz - 20kHz; vertical range 50dB - 100dB, subdivision 2dB's. Diffraction on the baffle edges create an increase of off-axis energy.



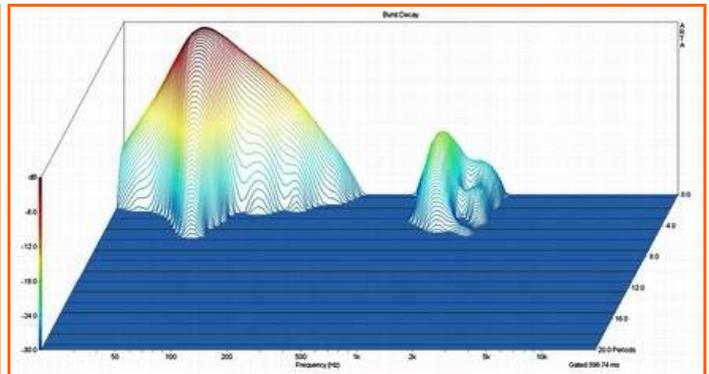
Above left: Cumulative Spectral Decay of the finished system; frequency gated range 200Hz - 20kHz; vertical range -30dB, subdivision 6dB's, time window 4 milliseconds.



Above right: Burst Decay of the finished system; frequency range 200Hz - 20kHz; vertical range -30dB, subdivision 6dB's, time window 20 periods.



Above left: Impedance plot (black) with corresponding electrical phase (purple) of the finished system; frequency range 10Hz - 20kHz; vertical range 40 ohms, subdivision 4 ohms. A healthy 8 ohm nominal load with the port tuning frequency at 58Hz. Impedance minimum 6 ohms at 220Hz.



Above right: Burst Decay of the port measured directly in front of the rear-firing port; frequency range 20Hz - 20kHz; vertical range -30dB, subdivision 6dB's, time window 20 periods. Maximum port output at 55Hz. Port noise around 1kHz that disappears completely when measured from the front (see the above Burst Decay of the finished system).

## Concertino - built by others



Concertino by Boban from Serbia

*"I've always liked monitor speakers, they have something of their own. But this time, I completely changed the perception of this type of speaker, when you are listening to them they do not exist, there's only music. All instruments and voices are natural in colour, timbre and size. They play all kinds of music equally well, which is very, very difficult to achieve. These speakers are outstanding - period!!! I do not know how you did this, hands-down, maestro! Thanks Tony for all your help and for such a superb product."*



Concertino by Roman from Switzerland

*"I am still looking for a way to feed the amp with high quality flac files, and to put the loudspeakers higher ;- ) I will probably do a stand with walnut wood. I am very amazed and happy with this product. Sound was never so clear and crisp in mid and hightone in my home. I clearly hear details I had never heard before. Thanks for the great product."*



Concertino by Philip from Switzerland

*"I am an amateur pianist and have attended many classical concerts and I am very very happy with the result. Listening to Pierre-Laurent Aimard's recording of The Art of Fugue (as featured on the film Pianomania, a technician's perspective on grand piano voicing) you have the feeling of standing a few feet away from the grand piano. I can't say more than that they sound excellent and neutral. Many thanks for all the help (and a wonderful product!)."*



No part of this website may be reproduced in any form without written or e-mail consent from the author. The designs are free to use for private DIY-purposes only, commercial use is strictly prohibited. Copyright Humble Homemade HiFi © 2000 - 2015  
Humble Homemade HiFi is a subsidiary of tg-acoustics - Chamber of Commerce 37138402 - The Netherlands

Last updated 18.2.2015