AES 48th Conference on Automotive Audio

The 48th AES Conference on Automotive Audio will be held September 21–23, 2012 in Munich, Germany, at an exclusive venue, the castle Schloss Hohenkammer. Over the last 20 years, automotive audio has changed dramatically from being standard mono sound in one full-range loudspeaker to a true multichannel playback system fully integrated and adjusted to a specific car. Today some of the most advanced sound technology is being developed and applied in automotive audio. The conference will give an overview of the present state-of-the-art technology in a broader perspective, and address many of the new scientific disciplines involved in this still-emerging field. Automotive audio involves combinations of otherwise complementary scientific fields such as power electronics, bus systems (MOST), loudspeaker drive units, digital signal processing (DSP), advanced analog design, EMC, and more.

Paper topics will cover a number of the following areas:

- System architecture and hardware
- Automotive amplifier design
- The soundfield inside cars
- Microphones for speech and noise
- Reduction of unwanted vibrations
- Automotive loudspeaker design
- Rear-seat entertainment
- Audio reproduction in cars
- Equalization techniques
- Upmixing algorithms
- Spatial enhancement
- Discrete multichannel playback
- Acoustic adaptation to the car interior
- Dynamic audio reproduction in cars
- Noise compensation
- Noise cancellation
- Loudness adaptation
- Interior and exterior audio cues for electric vehicles
- Speech enhancement and in-car communication
- Perception & psychoacoustics
- Sound-tuning philosophies and targets
- Assessment of automotive sound systems
- Listening in rooms versus cars

For more information, visit the Audio Engineering Society website at www.aes.org.

Winter Symposium 2013 Call for Papers

The Association of Loudspeaker Manufacturing & Acoustics has issued a "Call for Papers" for ALMA International's 2013 Winter Symposium. The program,
This month, I received drivers at both ends of the transducer spectrum. From B&C, a new high-power handling 18” ferrite motor woofer, the 18TBW100-8, and from FPS, two of its small-format MMCA ribbon-type transducers, the FPS0204R3R2 and the FPS0206N3R1.

**The B&C Pro Sound Woofer**

B&C’s new 18” woofer, the 18TBW100-8 (see Photo 1a and Photo 1b) is another in a series of high, continuous, power-handling rated pro sound woofer/subwoofers (anything that goes much lower than 35 to 40 Hz is pretty much a subwoofer in the pro sound world) that B&C has been producing over the last several years. Like the B&C 18SW115-4 rated at 3.4-kW continuous program material (Voice Coil, May 2010), the 18TBW100 has a very high continuous-power handling rating of 3 kW. However, unlike the neodymium motor 18SW115, the 18TBW100 uses a ferrite motor design, which is probably going to be the trend in pro woofer design until neo’s prices drop to a more competitive level. In terms of weight, the neo 18SW115 weighs in at 22.6 lbs, while the ferrite motor 18TBW100 weighs 33.3 lbs (a difference of 10.7 lbs), which is certainly more weight, but not a deal breaker by any means.

As expected, the feature set for this kind of performance is substantial, starting with a proprietary cast frame. Like many of B&C’s pro sound drivers and pro sound and high-powered car audio woofers, the frame is very much part of the cooling system. This frame has six double spokes, or 12 spokes thermally coupled to the large ceramic ring magnet motor structure. Venting is fairly complex and includes six 38 mm × 8 mm vents around the peripheral of the base of the frame that couples air to the area between the spider-mounting shelf and the front plate. Additional cooling is provided by a flared 45-mm diameter pole vent, plus eight peripheral 8-mm diameter vent holes on the back of the motor cup, which, when taken together, provide substantial air flow throughout the motor structure.

The cone assembly consists of a ribbed 18” cone that is coated on both sides plus a large 6”-diameter convex coated dust cap. Note that this coating is a special TWP waterproof coating. Compliance is provided by a triple-roll coated cloth surround and a double-silicone coated cloth spider assembly. Coupling the cone assembly to the motor is a 4” (100 mm) diameter glass fiber split winding voice coil wound with round copper wire.

Horsepower for this 33-lb. beast is provided by a large 30-mm thick, 21.8-cm diameter ceramic ferrite ring magnet. Other motor features include a T-shaped pole and an aluminum demodulation ring (i.e., shorting ring or faraday shield). Last, the voice coil tinsel wires are connected to a set of chrome, color-coded push terminals.

Testing for the 18TBW100-8 began using the LinearX LMS and VIBox to produce both voltage and admittance (current) curves with the driver clamped to a rigid test fixture in free-air at 1 V, 3 V, 6 V, 10 V, 15 V, 20 V, 30 V, and 40 V. Note that the driver remained linear in free air up to the 40-V sweep and probably would have remained linear up to 50 V or 60 V, but with 96-dB sensitivity, 40 V is usually my limit wearing ear protectors. Also, please note that I use a procedure that attempts to achieve the third time constant on each sweep, the LMS oscillator is turned on for a progressively increasing time period between sweeps. Also, following the established Test Bench test protocol, I no longer use a single added-mass measurement and instead used actual measured cone assembly weight provided by B&C.

Next, 16 550-point stepped sine wave sweeps were post-processed for each sample. The voltage curves were divided by the current curves to derive impedance curves, phase calculated along with the accompanying
voltage curves, and imported to LEAP 5 Enclosure Shop software. Obviously, this is a more time consuming process than the usual low-voltage impedance curve used for deriving Thiele-Small parameters. The reason for this, if you haven’t been following this column for a number of years, is that the LEAP 5 LTD transducer model methodology results in a more accurate prediction of excursion at high-voltage levels, one of the real fortes of the LEAP 5 software.

Because most TS data provided by OEM manufacturers is being produced using either a standard method or the LEAP 4 TSL model, I additionally created a LEAP 4 TSL model using the 1-V free-air curves. The complete data set shows the multiple voltage impedance curves for the LTD model. See Table 1 for the woofer 1-V free-air impedance curve. The 1-V impedance curves for the TSL model were selected in the Transducer Derivation menu in LEAP 5 and the parameters were created for the computer enclosure simulations. Table 1 compares the LEAP 5 LTD and TSL data and factory parameters for both B&C 18TBW100-8 samples.

Parameter measurement results for the 18TBW100 Qts numbers for my measurements were somewhat higher and the Vas was somewhat lower, plus the sensitivity data I derived was 1.6 to 1.8 dB lower than the factory data. However, my sensitivity rating is at 2.83 V, and the factory is 1 W/1 m based on a 5.3 Ω Re. While not absolutely identical, my parameter measurements were obviously close to the factory data. This is almost always the case when I measure B&C products, which not only speaks to the excellent group of transducer engineers at the company, but also to the fact that they make extensive use of their Klippel analyzer during the product development stage. Given this, I proceeded to set up two computer enclosure simulations using the LEAP LTD parameters for Sample 1. This included two vented alignments, a 4.05 ft³ Chebychev/Butterworth type box with 15% fiberglass fill material tuned to 42 Hz, and the factory recommended 7.06 ft³ vented alignment enclosure with 15% fiberglass fill material tuned to 32 Hz. This is was actually an extended bass shelf (EBS) type of alignment.

Figure 2 displays the results for the 18TBW100-8 in the Chebychev/Butterworth and EBS vented boxes at 2.83 V and at a voltage level sufficiently high enough to increase cone excursion to Xmax + 15% (9.2 mm for the 18TBW100). This produced a –3-dB frequency of 47.0 Hz (i.e., –6 dB = 38.0 Hz) for the 4.05 ft³ C/B.
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enclosure and F3 = 38.0 Hz (i.e., F6 = 29.0 Hz) for the 7.06-ft³ factory recommended EBS-vented simulation. Increasing the voltage input to the simulations until the maximum linear cone excursion was reached resulted in 119.5 dB at 40 V for the C/B enclosure simulation and

Figure 5: Klippel analyzer Bl(X) curve for the B&C 18TBW100-8

Figure 6: Klippel analyzer Bl symmetry range curve for the B&C 18TBW100-8

Figure 7: Klippel analyzer mechanical stiffness of suspension Kms(X) curve for the B&C 18TBW100-8

Figure 8: Klippel analyzer Kms symmetry range curve for the B&C 18TBW100-8
118 dB the same 40 V input level for the larger vented box. See Figure 3 and Figure 4 for the 2.83-V group delay curves and the 40-V excursion curves. If you look at the excursion curves, you will see I cut the simulation off at 40 V mostly because the excursion curve reached 9.2 mm at close to 20 Hz.

Klippel analysis for the B&C 18TBW100-8 produced the BI(X), Kms(X) and BI and Kms symmetry range curves shown in Figures 5–8. The BI(X) curve for the 18TBW100 is very broad and extremely symmetrical (see Figure 5). It is what a loudspeaker engineer would call “picture perfect” since both the BI curve and its accompanying offset curve are almost exactly overlaid. Looking at the BI symmetry plot, the offset curve is mostly invisible since it tracks at the 0 offset level out to 10 mm and only slightly below (coil-in rearward offset) beyond that (see Figure 6). Figure 7 and Figure 8 depict the Kms(X) and Kms symmetry range curves for the 18TBW100. The Kms(X) curve is as symmetrical as possible in both directions, with a trivial 0.75-mm offset, which is further confirmed by the Kms symmetry curve, almost a straight line at the zero rest position tracking again at a non-significant 0.75-mm coil-out (forward) offset. Great job, guys!

Displacement-limiting numbers calculated by the Klippel analyzer for the 18TBW100 were XBI @ 82% (BI decreasing to 82% of its maximum value) 10.7 mm, and for XC @ 70% (compliance decreasing to 70% of its maximum value) 10.7 mm. For more information about the CBT36 speaker project or the Dayton Audio ND Series woofers visit: parts-express.com/vcm

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measured the distortion with the microphone placed 10 cm from the dust cap. This produced the distortion curves for this woofer (see Figure 11).

B&C offers a well-designed, robust 18" for pro-sound applications. For more information, contact B&C Speakers N.A., B&C Speakers NA LLC, 220 West Parkway, Pompton Plains, NJ, 07444 USA, (973) 248-0955, e-mail info.usa@bcspeakers.com, or visit the B&C Speakers website at www.bcspeakers.com.

The FPS0204R3R2 and FPS0206N3R1

I got my first look at the FPS MMCA flat-panel technology when I reviewed its FPS 1030 ribbon transducer (Voice Coil, December 2011). As mentioned in the previous review, FPS, which stands for Flat Panel Speakers, is a Japanese company founded in 1999 to produce ribbon-based technology. Currently, the company manufactures a variety of different-sized ribbon transducers.
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