A Ribbon-Type Transducer From Bozhen New Audio Lab and Two New Tweeters from Scan-Speak

By Vance Dickason

This month brought some interesting new high-frequency drivers to *Voice Coil*'s Test Bench. From Bozhen New Audio Labs, we received the CQ66, which is the next generation of its CQ76 ribbon tweeter (featured in *Voice Coil*'s April 2013 issue). And, Scan-Speak sent two beryllium dome tweeters, the D3004/604000 and the D3004/604010.

Before beginning this month's analysis, I would like to thank Audiomatica for it's CLIO analyzer, the CLIO Pocket, which has been added to the list of high-performance equipment used in the *Voice Coil* Test Bench column. The CLIO Pocket will supply a new graphic format—horizontal and vertical polar plots. Also, if you read the review of the new CLIO Pocket in *Voice Coil*'s March 2016 issue, I noted that the analyzer would only operate in a fairly narrow temperature range of 68° to 79°. That was my misunderstanding. The temperature range of 68° to 79° only refers to the calibration procedure, not the operating range of the instrument, so you can do outdoor measurements in the snow with CLIO Pocket!

The CQ66

The first transducer I characterized is a new high-end ribbon tweeter from a Shenzhen, China-based company, Bozhen New Audio Lab. Bozhen was founded in 1995 as a high-frequency ribbon manufacturer, but has expanded its product line to include the DDQ line of patented woofers that are a somewhat similar concept to the Tymphany LAT transducers.

The CQ66 ribbon tweeter (see **Photo 1**) is a smaller iteration of the CQ76. As with the CQ76, the CQ66 is another application of Bozhen's unique patent number ZL200820128865.6 for ribbon tweeter design (see **Figure 1**). "CQ," besides being the amateur radio calling anyone protocol, is an acronym of Chinese pinyin "Chuan-dao-pian Qu-dong," which in English means "ribbon loudspeaker based on slice-conducted technology."

Photo 1: The Bozhen New Audio Lab CQ66 ribbon tweeter

The CQ66 utilizes a 65 mm × 15 mm pleated aluminum diaphragm (the CQ76's diaphragm is 80 mm × 20 mm). The pleats are mechanically connected to a section of the voice coil (see **Figure 1**). The CQ66 uses a closed-back design injection-molded rear cavity. Other features for this design include the neodymium motor system, injection-molded faceplate (the CQ76 has a brushed aluminum faceplate), a black mesh screen protecting the diaphragm, and a pair of gold-plated terminals.

I commenced the CQ66's analysis by performing a 300-point impedance curve (see **Figure 2**). Unlike most ribbon devices, this transducer's impedance features multiple resonance peaks, suggesting a complex cavity, plus a sharp reactive rise in the impedance above 10 kHz. The CQ66's direct current resistance (DCR) measured 2.3 Ω with a minimum impedance of 4.85 Ω at 2.6 kHz.

Next, I mounted the CQ66 in an enclosure with a 12" × 6" baffle area and measured the on- and off-axis SPL with sweeps at 0°, 15°, 30°, and 45°. I used gated 100-point 2.83 V/1 m sine wave sweeps from 300 Hz to 40 kHz. Data

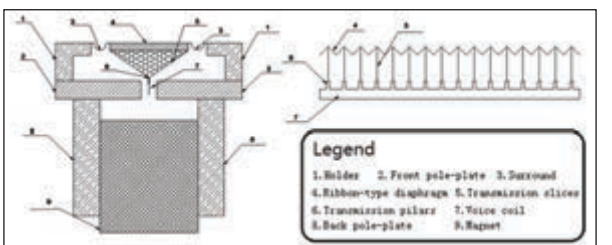

Figure 1: Diagram of the patented Bohzen CQ76/CQ66 ribbon motor

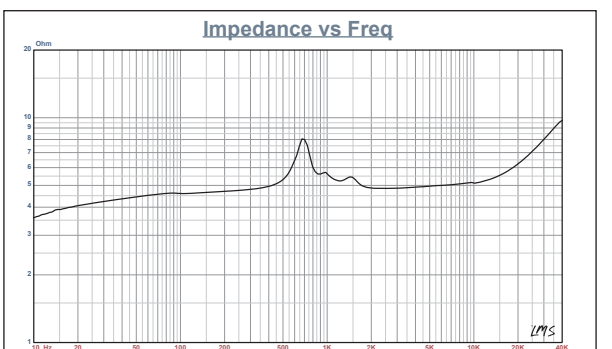

Figure 2: Bohzen CQ66 impedance plot

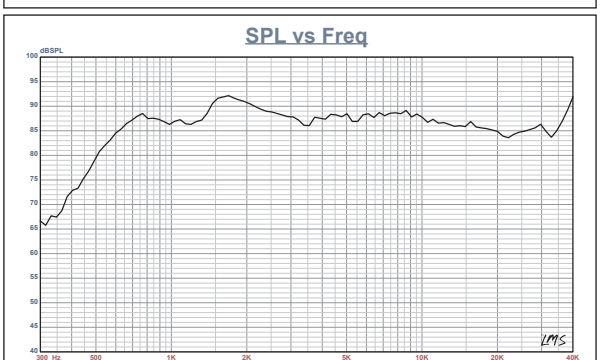

Figure 3: Bohzen CQ66 on-axis frequency response

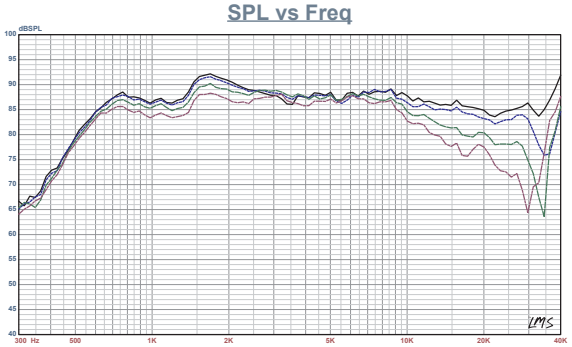

Figure 4: Bohzen CQ66 on- and off-axis horizontal frequency response (0° = solid black; 15° = dot blue; 30° = dash green; 45° = dash/dot purple)

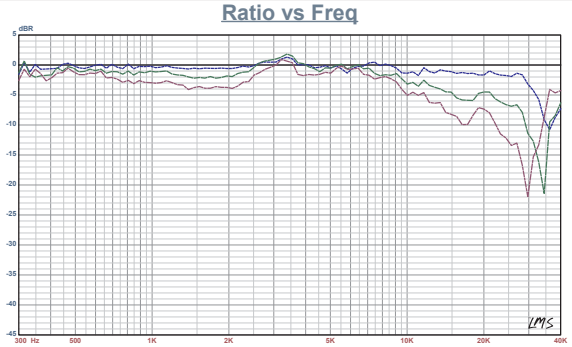

Figure 5: Bohzen CQ66 normalized on- and off-axis horizontal frequency response (0° = solid black; 15° = dot blue; 30° = dash green; 45° = dash/dot purple)

was then taken in both the horizontal and vertical planes. **Figure 3** shows the CQ66's on-axis response. The CQ66's frequency response was a smooth even ±2.13 dB, ranging from 3 kHz to 20 kHz, with effective output out to 40 kHz. There was peaking in the response centered at about 1.75 kHz, but with a 2 kHz crossover, it shouldn't be an issue.

Figure 4 depicts the on- and off-axis frequency response in the horizontal plane, which somewhat resembles the typical directivity of a 1" dome tweeter. **Figure 5** shows the normalized 0° to 45° frequency response. **Figure 6** shows the new CLIO Pocket generated

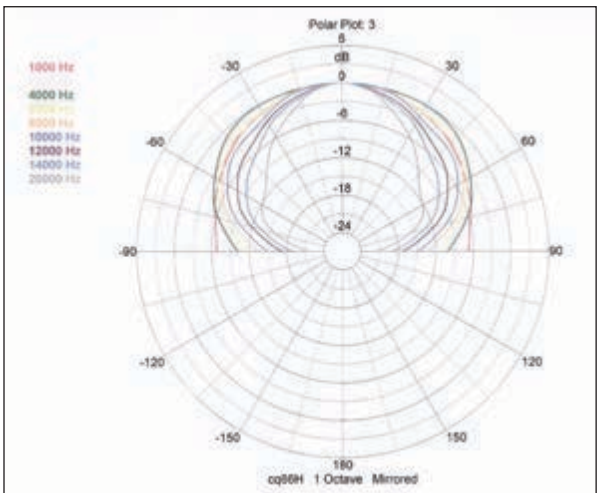

Figure 6: Bohzen CQ66 0° to 90° horizontal plane polar plot (in 10° increments)

horizontal polar plot.

Because the aspect ratio of the CQ66's aperture is like most ribbons, there is substantial directivity in the vertical plane as seen in the on and off axis 0° to 45° curves shown in **Figure 7**, normalized shown in **Figure 8**, and the vertical polar plot shown in **Figure 9**. **Figure 10** shows the two-sample SPL comparison, which indicates that both CQ66 samples were closely matched within the relevant operating range.

Then, I fired up the Listen SoundCheck analyzer (SoundCheck 14.1) with the SCM microphone and the SoundConnect preamp/power supply (provided courtesy of Listen, Inc.). I used the built-in pink noise generator and SLM utilities to set the SPL to 94 dB/1 m (5.84 V). I relocated the 0.25" SCM microphone to 10 cm from the CQ66's faceplate and ran the distortion curves shown in **Figure 11**. The stimulus was limited to 1 kHz as its lowest frequency.

Last, I performed an impulse measurement, and imported the data into the Listen SoundMap software, windowed out the room reflections, and created the

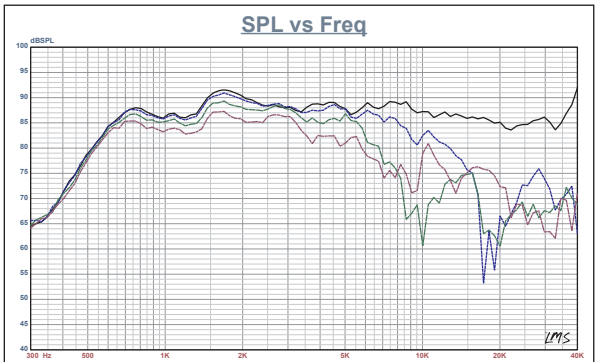

Figure 7: Bohzen CQ66 on- and off-axis vertical frequency response (0° = solid black; 15° = dot blue; 30° = dash green; 45° = dash/dot purple).

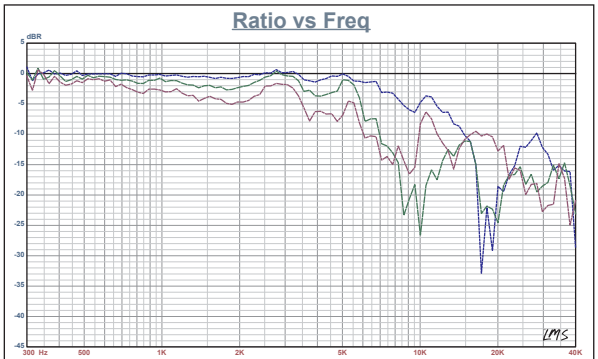

Figure 8: Bohzen CQ66 normalized on- and off-axis vertical frequency response (0° = solid black; 15° = dot blue; 30° = dash green; 45° = dash/dot purple)

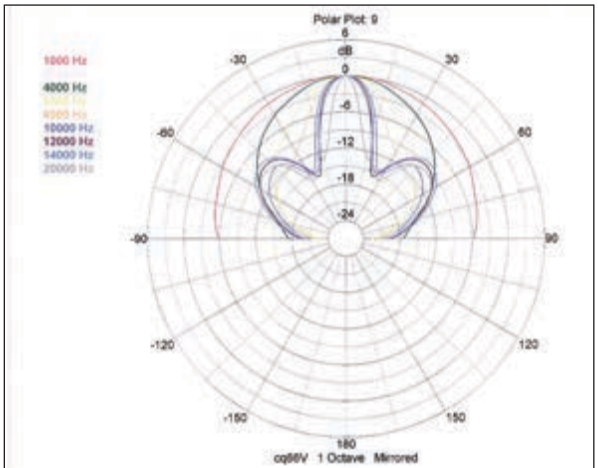

Figure 9: Bohzen CQ66 0° to 90° vertical plane polar plot (in 10° increments)

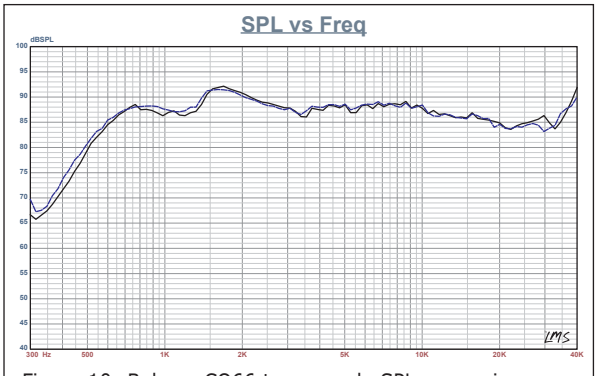

Figure 10: Bohzen CQ66 two-sample SPL comparison

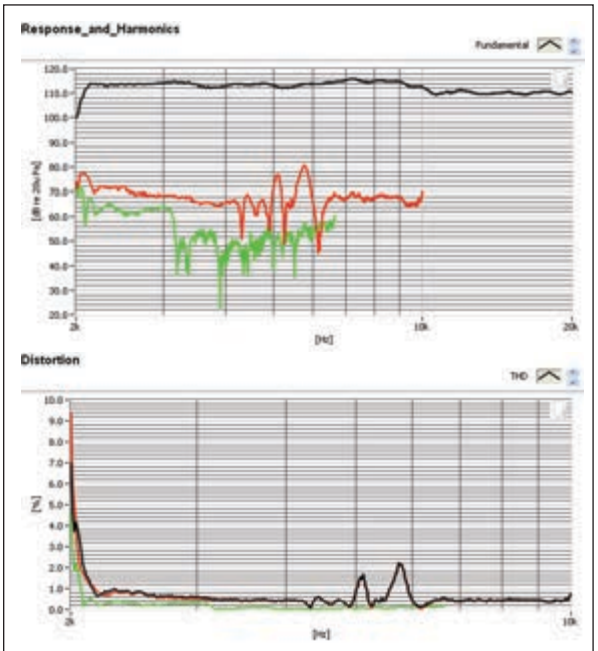

Figure 11: Bohzen CQ66 SoundCheck distortion plot

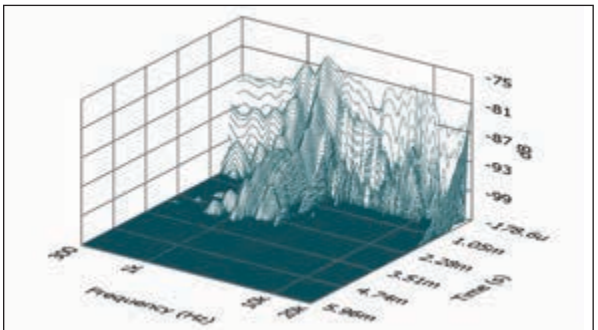

Figure 12: Bohzen CQ66 SoundMap cumulative spectral decay (CSD) graph

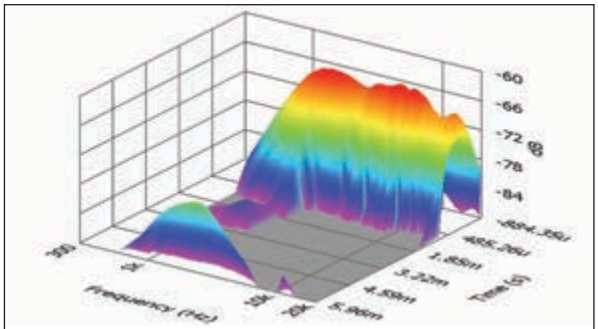

Figure 13: Bohzen CQ66 SoundMap Short Time Fourier Transform (STFT) plot

Cumulative Spectral Decay (CSD) plot shown in **Figure 12** and the Short-Term Fourier Transform (STFT) shown in **Figure 13**. For information, visit www.bzspeakers.com.

The D3004/604010 and the D3004/604000

This month, Scan-Speak sent me two new beryllium diaphragm neodymium motor tweeters, the D3004/604010 (see **Photo 2**) and the D3004/604000 (see **Photo 3**).

These two D3004 beryllium domes basically share the same platform, with the major difference being the D3004/604010 has a lower F_s due to the larger rear cavity. Both tweeters use a Materion 26-mm 99% pure beryllium dome, an underhung two-layer copper wound voice coil with 0.2 mm X_{MAX}, a neodymium ring magnet in conjunction with Scan-Speak's patented symmetrical driver SD-2 motor system (the SD-2 includes copper shorting rings), a non-resonant aluminum rear cavity, a wide coated cloth surround, and a sonically transparent

Photo 2: Scan-Speak's D3004/604010

Photo 3: Scan-Speak's D3004/604000