By Vance Dickason

A High-Frequency Transducer from Tang Band Speaker, Plus a 15" Subwoofer from SB Acoustics

This month, I received a ribbon transducer and a subwoofer for Test Bench analysis. Tang Band (TB) Speaker sent a ribbon transducer, a small diaphragm ribbon that incorporates a matching transformer, and SB Acoustics sent the SB42FHCL75-6, which is the company's new 15" home audio subwoofer.

The RT-2202S

TB Speaker provided the new RT-2202S ribbon transducer (see **Photo 1**). This device is a closed-back ribbon tweeter with a fairly small 30 mm × 10 mm ribbon diaphragm. Features include a thin aluminum foil diaphragm, an injection-molded face plate, a metal chassis, Nd-Fe-B (neodymium) magnet, a matching transformer, and a pair of gold-plated solderable terminals. The RT-2202S is a rated 80 W maximum power handling (8 W nominal). It is worthwhile to note that the assembly is not airtight and requires a small enclosure unless the device is mounted in free air.

I began analysis for the RT-2202S by performing a 300-point impedance curve (see **Figure 1**). As with many ribbon devices, this transducer really doesn't exhibit a defined resonance. However, the impedance decreases rapidly below 500 Hz, and is nearly a dead short at 10 Hz. This is of no consequence with a high-pass filter in place, but if you are testing the driver, you will need to limit the analyzer sweep bandwidth to approximately 1 kHz to prevent problems with your measurement amplifier.

Next, I mounted the RT-2202S in an enclosure with a 12" × 6" baffle area and measured the on- and off-axis sound pressure level (SPL). I set up the LMS analyzer to produce a 100-point 2.83 V/ 1 m gated sine wave sweep from 1 kHz to 40 kHz.

(Normally, I set a 300-Hz-to-40-kHz range, but you need to use a limited bandwidth to protect the measurement amplifier.) I took data in both the horizontal and the vertical planes with sweeps at 0°, 15°, 30°, and 45°. **Figure 2** shows the RT-2202S's on-axis response. The RT-2202S's frequency response is ±4.45 dB from the recommended 4-kHz crossover frequency to 20 kHz, with useful output out to nearly 30 kHz.

Figure 3 depicts the on- and off-axis frequency response in the horizontal plane, which is excellent above 10 kHz. Since the aspect ratio of the RT-2202S's aperture is pretty extreme (as are many ribbon transducers), there is substantial directivity in the vertical plane (see **Figure 4**).

Photo 1: The Tang Band RT-2202S ribbon transducer

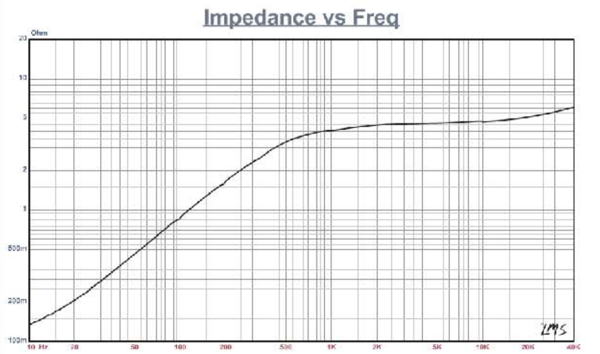

Figure 1: TB Speaker RT-2202S impedance plot

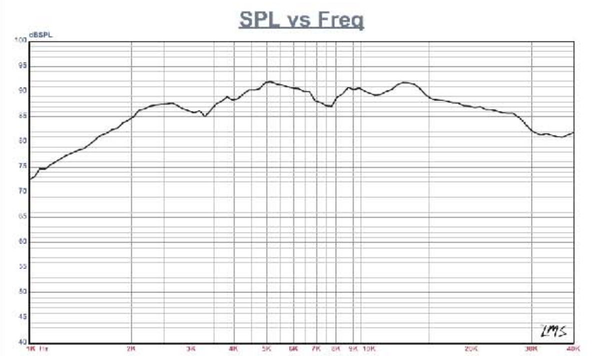

Figure 2: TB Speaker RT-2202S on-axis frequency response

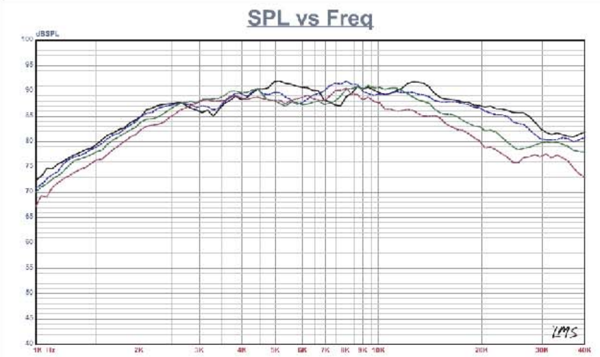

Figure 3: TB Speaker RT-2202S on- and off-axis horizontal frequency response (0° = solid black; 15° = dot blue; 30° = dash green; 45° = dash/dot purple)

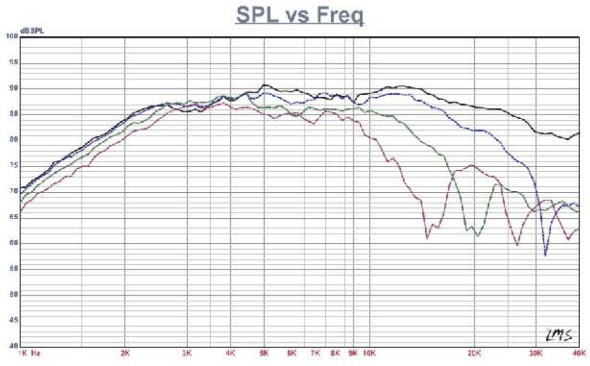

Figure 4: TB Speaker RT-2202S on- and off-axis vertical frequency response (0° = solid black; 15° = dot blue; 30° = dash green; 45° = dash/dot purple)

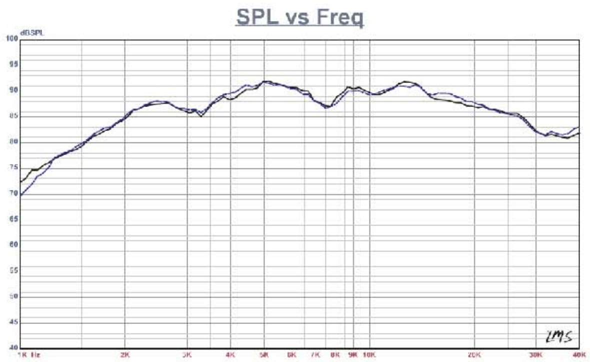

Figure 5: TB Speaker RT-2202S two-sample SPL comparison

Figure 5 shows the two-sample SPL comparison, indicating that the deviation between the two samples was less than 1 dB from 3 kHz to 10 kHz, with some additional deviation above those frequencies.

I set up the Listen SoundCheck analyzer with the SCM microphone and the SoundConnect preamp/power

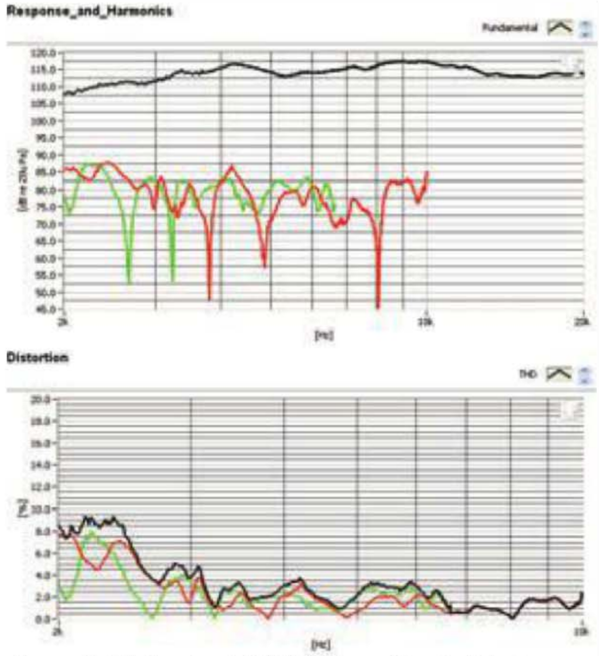

Figure 6: TB Speaker RT-2202S SoundCheck distortion plot

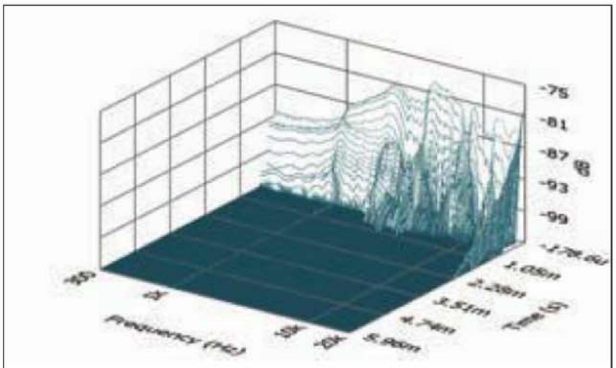

Figure 7: TB Speaker RT-2202S SoundMap CSD graph

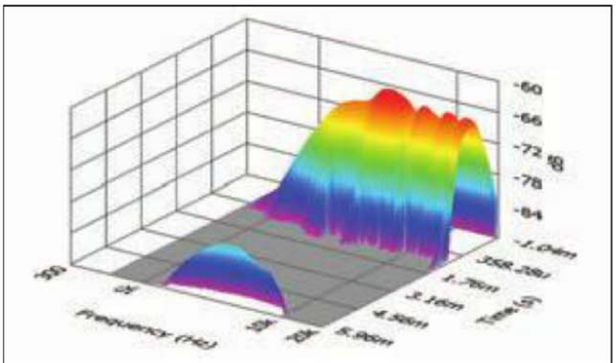

Figure 8: TB Speaker RT-2202S SoundMap STFT plot

supply. I used the built-in pink noise generator and the SLM utilities to set the SPL to 94 dB/1 m (6.39 V). I then relocated the 0.25″ SCM microphone to 10 cm from the RT-2202S's faceplate and ran the distortion curves shown in **Figure 6**. Note that the stimulus was limited to 2 kHz as its lowest frequency, but distortion is most typical above 4 kHz for this driver.

For the RT-2202S's final measurement, I performed an impulse measurement and imported it into the Listen SoundMap software, windowed out the room reflections, and created the cummulative spectral decay (CSD) plot shown in **Figure 7** and the short-time Fourier transform (STFT) shown in **Figure 8**. For more information, visit www.tb-speaker.com.

The SB42FHCL75-6

The other driver I examined this month is a new 15″ subwoofer from OEM driver manufacturer SB Acoustics (SB is short for Sinar Baja, headquartered in Indonesia). The SB42FHCL75-6 has an impressive feature set that includes an eight-spoke cast-aluminum frame (four double spokes) that have four 18 mm × 50 mm and four 18 mm × 10 mm

Photo 2: SB Acoustics 15″ SB42FHCL75-6

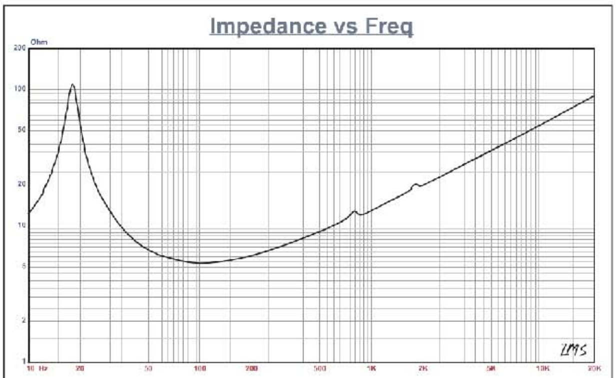

Figure 9: SB Acoustics SB42FHCL75-6 subwoofer 1 V free-air impedance plot

	TSL Model		LTD Model		Factory
	Sample 1	Sample 2	Sample 1	Sample 2	
F_S	17.9 Hz	18.1 Hz	17.6 Hz	17.6Hz	18.4 Hz
R_{EVC}	4.57	4.64	4.57	4.64	4.6
Sd	855.3	855.3	855.3	855.3	850
Q_{MS}	8.58	9.12	8.67	7.56	7.4
Q_{ES}	0.37	0.38	0.36	0.35	0.32
Q_{TS}	0.34	0.36	0.34	0.34	0.31
V_{AS}	497 ltr	486 ltr	495 ltr	513 ltr	462 ltr
SPL 2.83 V	90.9 dB	90.6 dB	90.8 dB	90.9 dB	93 dB
X_{MAX}	11.5 mm	11.5 mm	11.5 mm	11.5 mm	11.5 mm

Table 1: SB Acoustics SB42FHCL75-6 comparison data

vents below the spider mounting shelf for cooling across the top plate (see **Photo 2**). The cone assembly utilizes a stiff 15″ cone that is comprised of a hard paper honeycomb covered and woven glass-fiber sandwich, a 4.25″ diameter hard polypropylene dust cap, a 12 mm × 25 mm nitrile butadiene rubber (NBR) high-excursion surround, a 6.5″ diameter flat cloth spider, and silver tinsel lead wires that extend from about midpoint on the cone to both opposite-mounted terminal sets.

All this is driven by a 75.6 mm diameter (3″) four-layer voice coil wound with round copper wire on a non-conducting fiberglass former. The motor system powering the cone assembly utilizes two stacked 20-mm thick by 180-mm diameter ferrite magnets sandwiched between a polished 8-mm thick front plate and a polished shaped 10-mm tall T-yoke that incorporates a 50-mm diameter pole vent. Two sets of braided voice coil lead wires terminate to a pair of gold-plated terminals.

I began characterizing the new SB42FHCL75-6 15″ subwoofers with the LinearX LMS analyzer and VIBox. I generated the voltage and the admittance (current) measurements in free air at 1, 3, 6, 10, 15, 20, and 30 V. It should also be noted that this multi-voltage parameter test procedure includes heating the voice coil between sweeps for progressively longer periods to simulate operating temperatures at that voltage level (raising the temperature to the third time constant).

I further processed the 14 sine wave sweeps for each woofer sample with the voltage curves divided by the current curves to produce impedance curves. I used a highly accurate LEAP phase calculation routine to generate the phase curves. Then, I copy/pasted the impedance magnitude and phase curves plus the associated voltage