VOLUME 25, ISSUE 2 DECEMBER 2011

VOICE COIL

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Test Bench

New Ribbon from FPS and Two 4" Drivers from SB Acoustics

By Vance Dickason

The samples received for this month's installment of Test Bench included a large format multi-cell ribbon from FPS, the FPS1030M3F1R, plus two 4" ferrite motor drivers from SB Acoustics, the SB12NRX25-4 woofer and the SB12MNRX25-4 midrange.

FPS, which stands for Flat Panel Speakers, is a Japanese company founded in 1999 to produce ribbon-based technology. The company manufactures a variety of ribbon transducers from tweeters to large format units intended for use as PA speakers in public venues to pro sound line source stage speakers. Most of their technology is based on a patented (Patent # U.S. 6,963,654 Diaphragm, Flat-Type Acoustic Transducer, and Flat-Type Diaphragm) multiple ribbon cell format titled MMCA for Multi Cell Microtransducer Array (see **Photo 1**). **Figure 1** gives the basic layout of their ribbon transducers with the total ribbon area formed by an array of voice coils with alternating magnetic polarity. You can see how this is specifically applied in the photos of the review subject, the FPS1030M3F1R. **Figure 2** illustrates the diaphragm voice coil layout, and **Figure 3** depicts the frame and neo magnet layout.

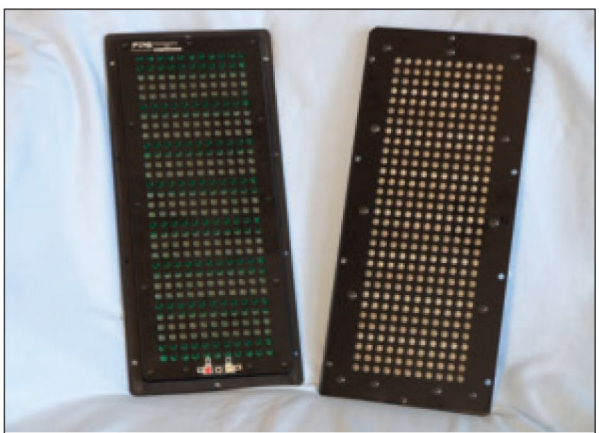

Photo 1: The FPS1030M3F1R, a large format multi-cell ribbon, from Flat Panel Speakers (FPS)

Note that the frame photo is for only one side, with another set of magnets located on the opposite side of the frame.

In terms of features, the FPS1030 is a large-format ribbon suitable for full-range PA applications or as a mid-range in a multi-way system, or as a wide range in a line source. The ribbon radiating area is about 30.5 × 10.5 cm, or about 320 cm^2. Power handling is rated at 75-W nominal, sensitivity at 82 dB with a frequency range of 90 Hz to 10 kHz, and is a nominal 8 Ω.

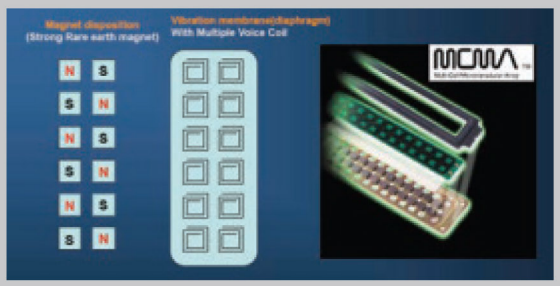

Figure 1: Graphic layout of the FPS MMCA ribbon configuration

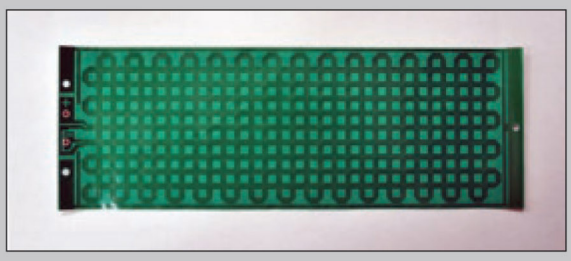

Figure 2: Photograph of the voice coil layout in the FPS1030M3F1R

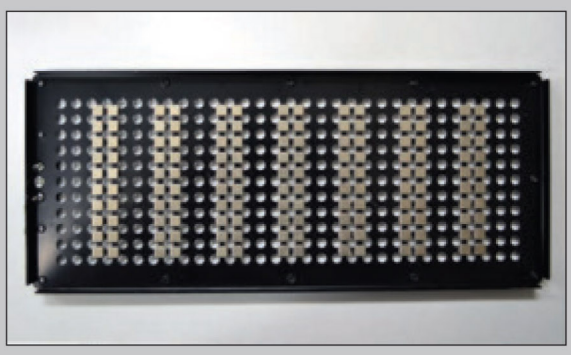

Figure 3: Photograph of the frame and magnet layout of the FPS1030M3F1R

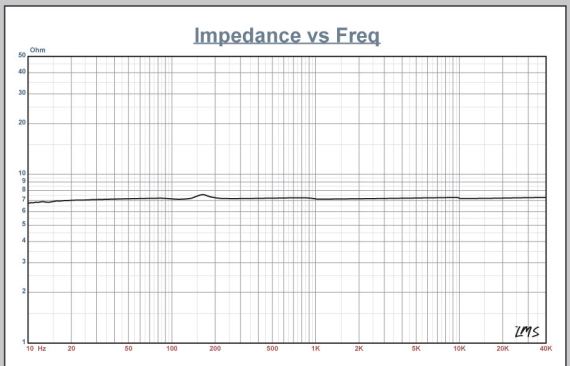

Figure 4: Effect of acoustic leakage on frequency response

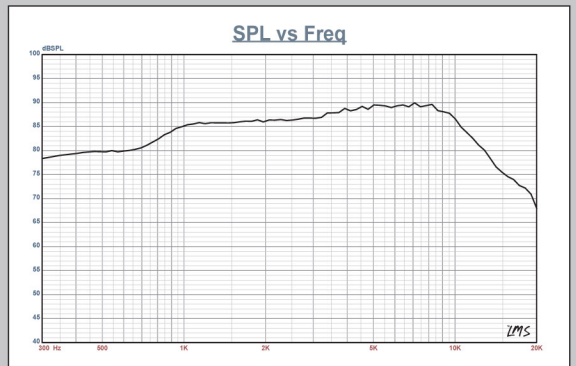

Figure 5: Comparison of different headphone types

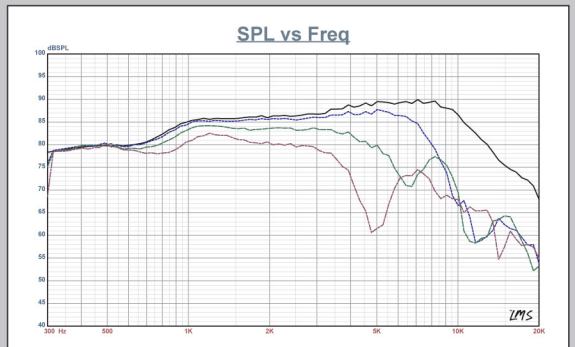

Figure 6: Analyzer setup for measuring headphone response

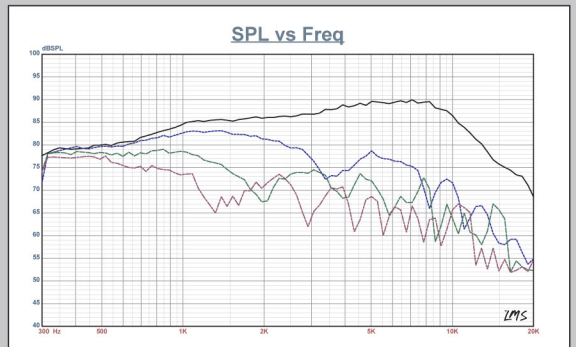

Figure 7: FPS FPS1030M31R vertical on- and off-axis frequency response (0° = solid; 15° = dot; 30° = dash; 45° = dash/dot)

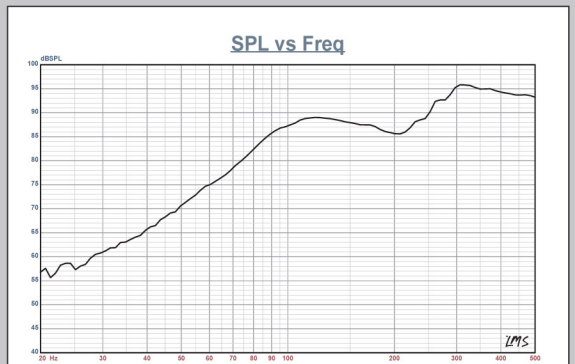

Figure 8: Nearfield frequency response of the FPS FPS1030M3F1R from 20 Hz to 500 Hz

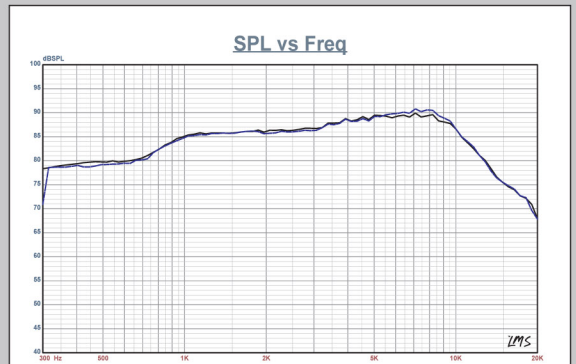

Figure 9: FPS FPS1030M3F1R two-sample SPL comparison

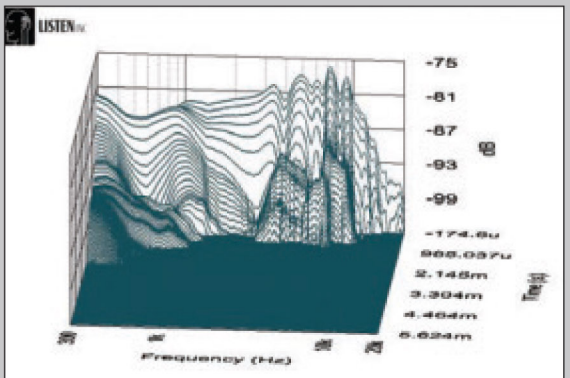

Figure 10: FPS FPS1030M3F1R SoundCheck CSD waterfall plot

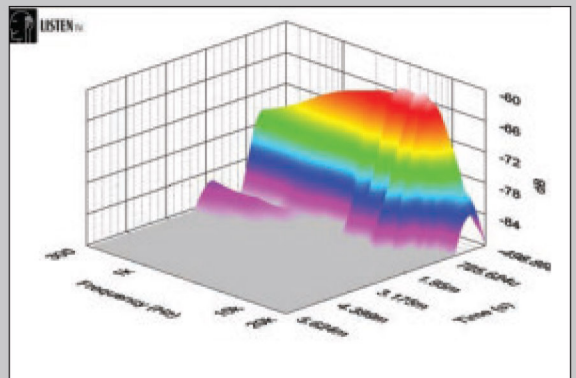

Figure 11: FPS FPS1030M3F1R SoundCheck CSD waterfall plot

Testing commenced using the LinearX LMS analyzer to measure the impedance as seen in **Figure 4**. As with most ribbons, the impedance is very flat 7.2 Ω across most of the operating range with a minor resonance at 163 Hz. Next, I mounted the transducer in a small enclosure filled with damping material about the same size as the ribbon frame, so very little baffle reinforcement. **Figure 5** gives the on-axis response down to 300 Hz using a 100-point stepped sine wave sweep. The response is quite smooth out to about 10 kHz, with a 6-dB shelf between 600 Hz and 1 kHz. With a larger baffle or mounted in half-space like an in-wall speaker, the ribbon would perform to a substantially lower frequency. **Figure 6** displays the on- and off-axis response in the horizontal plane out to 45° off-axis, while **Figure 7** gives the same data in the vertical plane. Given the directivity in the horizontal plane, using the FPS1030 as a midrange in a multi-way system, crossover points of 800 Hz to 5 kHz with a narrow baffle would likely work well, and a lower cross point in half-space or with a larger baffle. **Figure 8** shows the nearfield response with a low-frequency roll-off of about –3 dB at 91 Hz, as specified in the product data. And for the last SPL measurement, **Figure 9** gives the two-sample SPL comparison showing these drivers to be well matched throughout the operating range.

The final test procedure was to setup the Listen, Inc. SoundCheck analyzer along with the Listen, Inc. SCM ¼" microphone (provided courtesy of Listen, Inc.) to measure the impulse response with the FPS ribbon recess mounted on the test baffle. Importing this data into the Listen Inc. SoundMap software produced the cumulative spectral decay plot (usually referred to as a "waterfall" plot) given in **Figure 10**. **Figure 11** is a Short Time Fourier Transform (STFT) displayed as a Surface Plot. For the last SoundCheck test procedure, I set the 1-m SPL to 94 dB (7.13 V) using a noise stimulus, and measured the 2nd and 3rd harmonic distortion at 10 cm, depicted in **Figure 12**, which was very low throughout the operating range of the device.

FPS makes a whole line of MMCA drivers, so check out their entire OEM line of different sized ribbon transducers at www.usfps.com.

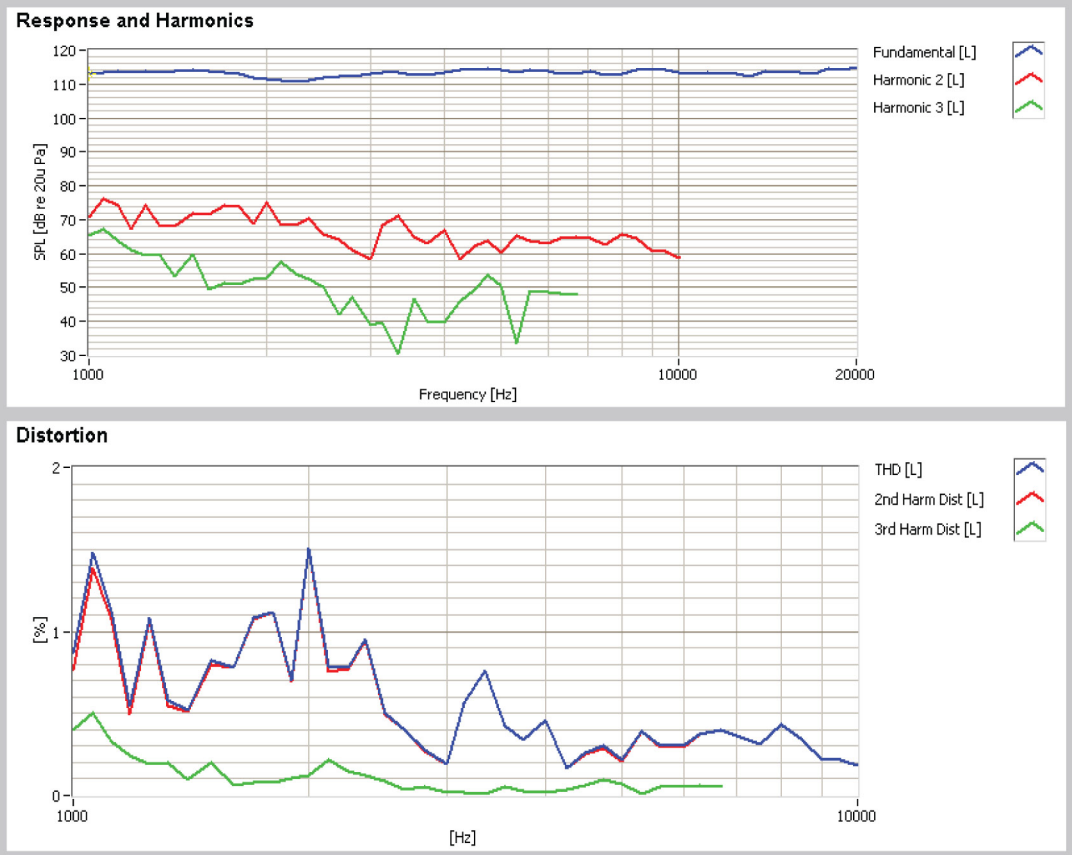

Figure 12: FPS FPS1030M31R SoundCheck distortion plots