

Bel Canto REF600M Power Amplifier A Class D Reference

Equipment report

by [Steven Stone](#) | Feb 01st, 2017

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It may be hard to imagine, but when Bel Canto first opened its doors in 1994 the company made only tube-based electronics. The Bel Canto Orfeo SE2 power amplifier was a two-stage amplifier that used a triode input stage and one 845 triode output stage with local degenerative feedback and no global feedback. But in 1998, John Stronczer, Bel Canto's chief designer, began to investigate switching amplifiers. "We began exploring linear switching Class D amplification in early 1998 with the goal of developing a more efficient, highly accurate, yet musical amplifier," explains Stronczer. "We transitioned from our SET tube amplifiers to a technology that promised to offer superior performance over the long term. Our initial choice was from a company called Tripath."

In 2000, Bel Canto introduced its first switching amplifier, as part of the Evo line that included both stereo and multichannel models. Within these designs Bel Canto implemented proprietary modifications to the original Tripath module and provided its own 50/60Hz power-supply architecture for main and auxiliary power supplies. The Evo line was in production for six years before the Tripath module was replaced by B&O's ICEPower digital technology.

ICEPower offered lower-noise performance with even greater dynamic transparency due to its integrated switch-mode power-supply architecture. Stronczer designed and implemented external power filters and low-noise rectifiers as well as proprietary input stages in a compact, rigid chassis to improve the basic performance of the core ICEPower device. This technology was used in Bel Canto's REF300M, REF1000M, and REF500M power amplifiers, which were in production for almost ten years.

Recently Bruno Putzeys developed new Class D NCore technology for Hypex. NCore uses an advanced, fully discrete, self-oscillating Class D architecture combined with a 5th-order control loop to achieve extremely low levels of noise and distortion throughout the audio bandwidth. A version of this NCore technology was chosen for application in Bel Canto's current flagship Black power amplifiers, which were introduced in 2015—essentially a custom version of the NC1200 amplifier with the gain stage removed, replaced by a Bel Canto discrete gain stage.



Bel Canto REF600M

The Bel Canto REF600M is the first amplifier in the REF series to use the NCore technology. According to John Stronczer, “There was a 10dB drop in noise going from Tripath to ICEPower. I’ve measured at least a 10dB drop in distortion, especially at high frequencies, going from ICEPower to NCore. Each 10dB represents a significant improvement in the technology. Noise also dropped by 3–6dB, (equal to 1.4x to 2x), reducing sonic artifacts and increasing musical detail and resolution.”

With its latest design Bel Canto claims to have achieved “the right balance between neutral transparency and musicality.” Stronczer says that the REF600M “demonstrates the full sonic promise that began to emerge over 15 years ago with the implementation of our first Class D amplifier.”

Description

The REF600M power amplifier, which can produce up to 300 watts into eight ohms, and 600 watts into 4 ohms, weighs only 15.4 pounds. Its half-size chassis is very similar to Bel Canto's earlier eSeries amplifiers, but with a rounder and less squared-off faceplate. The back of the REF600M includes both single-ended and balanced connections along with a push-button selector, a pair of WBT “NextGen” five-way speaker connectors, a standard AC connection, and a 5-to-12 volt trigger connector. The REF600M comes from the factory set for 27dB of gain, but this can be changed to 33dB via an internal dip-switch.

The REF600M is based on Hypex's NC500 OEM module and SMPS 1200 power supply. Bel Canto uses proprietary low-noise amplifiers with precision film resistors and capacitors to filter out high-frequency noise and prevent its aliasing within the audio band. The REF600M is also DC-coupled to avoid any dynamic degradation brought by coupling capacitors. According to Stronczer, “There is a lot of architectural similarity with the original Orfeo design and the REF600M. Both employ simple high-performance stages with local feedback and no global amplifier feedback. Also both have a first stage that provides most of the amplifier gain with a high input impedance and low output impedance to drive the output power stage.”

Setup

The vast majority of my listening time with the REF600M was spent with them tethered to a pair of Spatial M3 Turbo SE loudspeakers (\$2650). These open-baffle horn designs have a sensitivity of 94dB so they require very low-noise amplification. With the REF600M powered up I could hear only the faintest hiss if I put my ears within a few inches of the Spatial's coaxial driver. I ran the M3/REF600M combination full-range with no crossovers limiting their bass extension. I combined the Spatial M3s with a pair of JL Audio Fathom f112 subwoofers set for a 45Hz crossover with a 24dB roll-off.

I also used the REF600Ms with a pair of AV123 X-Statik open-baffle loudspeakers modified by Skiing Ninja with an external crossover and No-Rez interior damping material. Again I ran the X-Statiks full-range and coupled one Velodyne DD 10+ subwoofer set to 50Hz crossover with a 12dB-per-octave roll-off.

Sound

The problem with saying that a solid-state or a switching amplifier is "tube-like" is that readers will inevitably think that you are referring to its warmer harmonic balance or softer top octaves. But the REF600M is not tube-like in that way. No, its tube-like characteristics are in its soundstaging and dimensional capabilities. To put it bluntly I've never experienced a switching amplifier that is as spatially accurate or three-dimensional as the REF600M.

Michael Morgan, who is a world-class on-location recording engineer, came to visit me during the review period. He brought with him some of his fine recordings. He immediately noticed the REF600M's imaging capabilities. Through the REF600Ms all of his recordings were mapped out in the soundstage so clearly that you could easily and instantly locate every instrument or vocalist. Also the layering and depth retention was as three-dimensional as I've heard from any recording on any system. My own recordings also sounded more three-dimensional than with any switching (and most linear solid-state) power amplifiers I've had in my system. Only the Pass Labs X150.3 had the same level of dimensional accuracy.

One of the principal sonic failings laid at the feet of most switching amplifiers is their harmonic threadbareness. In timbral neutrality I'd place the REF600M on the darker, richer side of the razor's edge, primarily due to its more nuanced lower midrange. Compared to the Bel Canto 300M amplifiers that I often use for the rear channels in my 5.1 system the REF600M had a less mechanical and more relaxed harmonic presentation. Not only was I immediately struck by the REF600M's richer tonal palette, but also by its superior dimensionality and by spatial characteristics that were noticeably superior to the 300M.

The REF600M's relaxed harmonic character was also a result of its less forward upper midrange. Compared to one of my reference power amplifiers, the April Music Eximus S1, the REF600M was less hi-fi-like and more natural. The midrange's leading edges didn't jump out, but instead remained within the confines of the music. Usually when an amplifier is more "relaxed" image specificity suffers as a result, but the REF600M still outpointed the Eximus S1 when it came to dimensional accuracy and depth retention. Simply stated, music sounded more like the real thing through the REF600M than it had via any switching amplifier I've heard before.

Does the REF600M do everything better than its competition? Not quite. Its mid- and low-bass response was not as vibrant and impactful as several of my reference power amplifiers. While not soft or overly fluffy in a tubey way, the REF600M did not produce the same amount of dynamic punch or bass slam as either the April Music Eximus S1 (used in bridged mode as dual mono amplifiers) or my freshly refurbished Pass Labs X150.3. (The reason for this refurbishment was due to increased noise from aging capacitors and resistors after almost 15 years of continuous use.) After its return from the factory the Pass was almost as quiet in terms of noise (without a signal) as the REF600M, with only a slightly higher hiss level and zero hum.

Conclusion

In the past I've reviewed lots of power amplifiers. Once I even had a dream that I was twenty feet tall with a Krell 160 monoblock under each arm striding across the urban landscape yelling, "I am Amp Man!" (imagine Godzilla, only prettier). Luckily I had that dream only once. But with the advent of compact and lightweight switching amplifiers such as the REF600M no audiophile need experience the "pleasures" of lugging around a 60-plus-pound amplifier because it was the only device that could deliver the power and finesse needed to drive a top-echelon system.

How good is the REF600M? To my ears it's good enough to qualify as the best all-around power amplifier I've heard to date, regardless of technology or circuit topology. Its combination of extremely low noise (that makes it suitable to drive even highly sensitive loudspeakers), precision three-dimensional imaging, relaxed and natural harmonic balance, and power capability makes for a potent package. Couple all its sonic achievements with its relatively modest price, and you have a power amplifier that could well be a benchmark reference for many audiophiles for years to come.

Specs & Pricing

Type: Switching

Output power: 600W into 4 ohms, 300W into 8 ohms

Inputs: Single-ended RCA or balanced XLR

Input impedance: 100k ohms/200k ohms

Output impedance: <8 milliohms at 100Hz

Dimensions: 216mm x 88mm x 305mm

Weight: 15.4 lbs.

Price: \$2495 each

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Associated Equipment

Source devices: A 2010 Mac Mini with 8GB of memory and OS 10.11.1, running iTunes 12.3.3 and Amarra Symphony 3.3, Pure Music 3.0.1, Audirvana+ 2.5, Roon 1.2, and Tidal 1.3; QNAP TS-251, Cary Audio DMC-600SE

Analog sources: VPI TNT III w/Graham 1.1 tonearm and ClearAudio Victory II cart, VPI HW-19 with Souther SLA-3 tonearm and Denon 103/van den Hul cartridge

Phono preamps: Vendetta Research SCP-2B and Rossi LIO

DACs: PS Audio Direct Stream Jr., Cary Audio DMC-600SE Music Hub

Amplifiers: Pass Labs X150.3, April Music S1 monoblocks, NuPrime ST-10

Speakers: AV123 X-Statik modified by Skiing Ninja, Spatial M3 Turbo SE, two JL Audio Fathom f112 subwoofers, one Velodyne DD 10+ subwoofer

Cables and accessories: WireWorld Silver Starlight USB cable, WireWorld Eclipse 7 balanced interconnect, AudioQuest Carbon USB cable; AudioQuest Colorado single-ended RCA interconnect, Kimber KCAG single-ended and balanced interconnect, Audience Speaker AU24e speaker cable, PS Audio Quintet, Dectet, Octet, and Premier power conditioners