Dayton Audio HTA20BT Hybrid Stereo Tube Amplifier

Hybrid Power for All

What do a 10th century Danish king and two English engineers (one working at the dawn of the 20th century and the other prominent mid-century) all have to do with a hybrid stereo tube amplifier? Enter Dayton Audio's HTA20BT.

Photo 1: Top view of the Dayton Audio HTA20BT hybrid stereo tube amplifier

By
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(United States)

Modern-day Bluetooth (BT) technology is named for 10th century Danish King Harald Blatland, famous for unifying Scandinavia (as well as sub-par dental health, with teeth that were notable for a black or blueish hue). Thermionic valve technology (aka vacuum tubes) was patented in 1904 by the English engineer John Fleming. Ubiquitous today, Class-D amplification was first made commercially available in the 1960s by Clive Sinclair of London-based Sinclair Radionics.

All three of these technologies (Bluetooth wireless, vacuum tubes, and digital amplification) are combined in Dayton Audio's HTA20BT, a new hybrid tube amplifier with built-in Bluetooth streaming (see **Photo 1**). This device provides an outstanding (and improbable) feature set that is unlike the offerings from older and more traditional consumer electronics brands.

This integrated amplifier incorporates Bluetooth streaming and is built around a pentode vacuum tube preamplifier with a Class D power amplifier section. Blue LED backlighting complements the soft amber glow of the vacuum tubes, so even the illumination sources are a hybrid. And if the feature set and more than 100 years of technological combinatorial artistry aren't quite enough for you, the Dayton Audio HTA20BT can also do double-duty as a vacuum tube headphone amplifier!

Mechanics and I/O

Physically, this amplifier is quite interesting. The housing is finished in a brushed and black anodized aluminum chassis. A large power transformer sits under an ABS cover. In addition, a pair of 6F1 pentode vacuum tubes (protected by acrylic finger guards) and a 2.4 GHz antenna mast quickly inform the casual observer that this is not your typical audio experience. Passive cooling is provided by ventilation slots on the bottom of the steel base.

Mains power is 120 V, 60 Hz via a non-detachable cord set and the rocker power switch is located on the back panel. The top panel features two well-proportioned knobs—one for gain control and the other for input selection. The knobs are plastic, but they have a nice molded texture and feel. A USB 2.0 port provides an onboard media player and direct

local access to MP3, APE, WMA, WAV, and FLAC digital files via a personal USB thumb drive. There are also four small buttons for local digital file or Bluetooth Audio/Video Remote Control Profile (AVRCP) control. The buttons have a good tactile feel, though they are undersized for some hands.

Continuing the 360° "tour de amp," the inputs and outputs are impressive. There are two analog inputs via RCA connectors, as well as an external 2.4 GHz antenna for optimum Bluetooth 4.2 reception.

Bluetooth 4.2 standards specify a 10 m range indoors (and up to 50 m in a free-field environment). The inclusion of the external omni-directional antenna, instead of a compact chip antenna, provides outstanding wireless performance. Bluetooth testing in my home exceeded the 10-m range, going through plaster walls, piping, and more with zero dropouts throughout my testing of this product.

Outputs consist of two pairs of compact binding posts that accept up to 14 AWG wire. There is a subwoofer monophonic RCA connector allowing an elegant option to deploy this in a 2.1 system. Additionally, a 3.5 mm headphone output is also provided, permitting the use of vacuum tubes with your favorite set of headphones.

Media Player Functionality

The inclusion of an onboard USB media player provides an interesting option. By simply adding a USB 2.0 thumb drive, the HTA20BT can be used as a stand-alone audio source and integrated amplifier. This is ideal in areas where Bluetooth isn't consistently available or no analog sources are handy (e.g., in an attic bedroom, office, or small storefront).

The media player options are robust and it is capable of not only playing ubiquitous WAV and MP3 file formats, but also FLAC and OGG, which many budget codec chips don't typically support. While the format support is impressive, especially for those interested in efficient storage of higher quality digital files, the file and the folder management is lacking.

Once you install your USB drive into the HTA20BT, prepare to be "shuffled" back to 2008. This media player is very limited in navigating folder structures. Playback options are brutally simple: play the first track, and then play all other tracks in track order, before moving to the next folder(s). If you use the Pause button, you can restart that track with an additional push. Conversely, if you press Stop, and then Play, then you will be sent back to Track 1 in Folder 1. There is no option to randomize the tracks either, so your playlist is somewhat fossilized (or at least until you go in and manually adjust the tracks using your computer). One further negative, albeit a small one, is that there is no option to use a mobile device as a mass storage device, which would have allowed browsing of files. Since the HTA20BT already has two analog inputs and Bluetooth, this is not a sorely lacked feature.

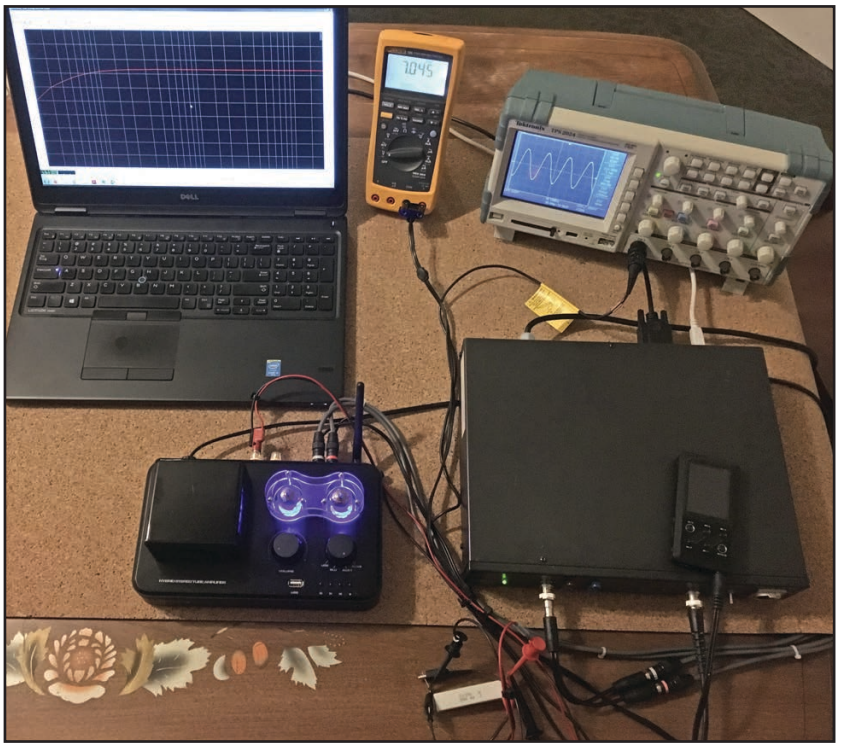

Photo 2: This is my DUT bench setup.

The biggest issue with the media player is the inclusion of the Stop button. It is of very limited use for the media player mode, and has no equivalent mapping when the input is set to Bluetooth. It is disappointing to have a button that doesn't do anything when the Bluetooth mode is selected. This is a small criticism, but one worth mentioning in a device that generally over-achieves in its feature set.

Audio Measurements

I used the following gear to bench test the HTA20BT: the DAAS4 USB (Digital Audio Analysis Software Windows 7 version), Tektronix DSO 2024, Fluke Model 77, and the FiiO X3 DAP (see **Photo 2**).

The preamp section uses a pair of Chinese 6F1

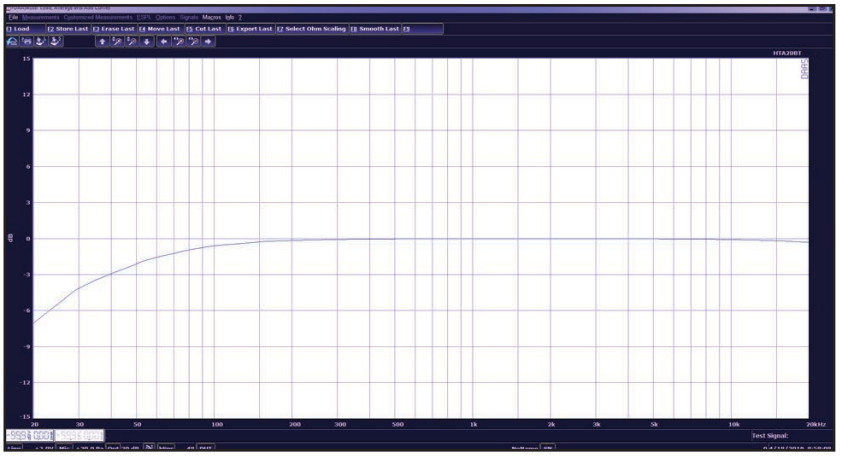

Figure 1: This is the frequency response of the amplifier transfer function.

pentode vacuum tubes, while the Class-D amplifier is built around the STMicroelectronics' amplifier dual BTL chip TDA7491HV.

Dayton Audio lists a frequency response of 20 Hz to 20 kHz, ±2 dB. The datasheet from STMicroelectronics lists a frequency response of 20 Hz to 20 kHz, with a maximum deviation of ±3 dB.

Figure 1 shows a measured frequency plot with a dummy 4 Ω load. Based on the measurement shown in Figure 1, the low-end response is -3 dB at 38 Hz while the high-frequency response exhibits a gentle roll-off of -0.2 dB at 20 kHz. Due to the available power budget of this amplifier, the low-frequency roll-off is perfectly reasonable, and shouldn't prove to be a serious issue when deciding on an appropriate loudspeaker mate. The slight roll-off on the top octave should prove pleasing to most ears during critical listening, while still remaining in the realm of neutrality.

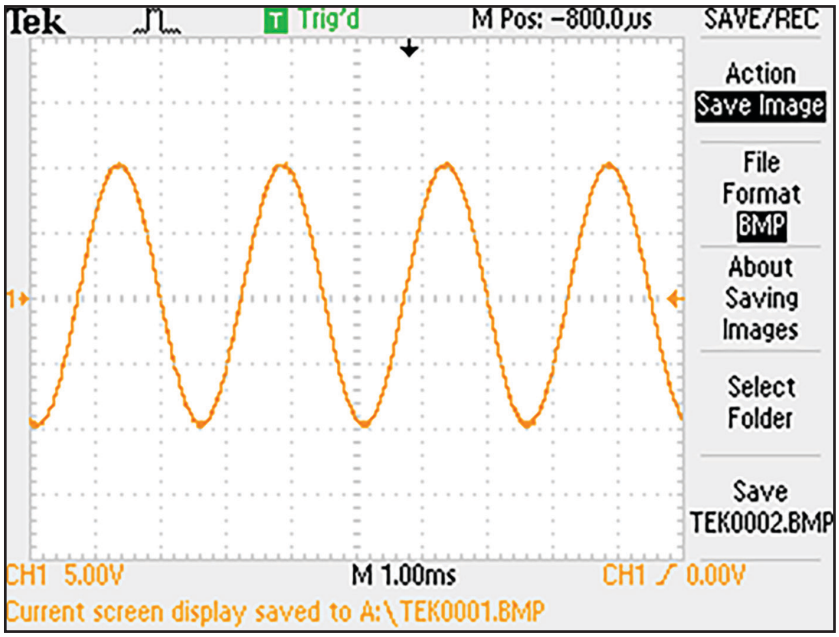

Figure 2: The oscilloscope capture displays a clean 12 W RMS output, with a 400 Hz sine wave driving a 4 Ω load, 25 W dummy load.

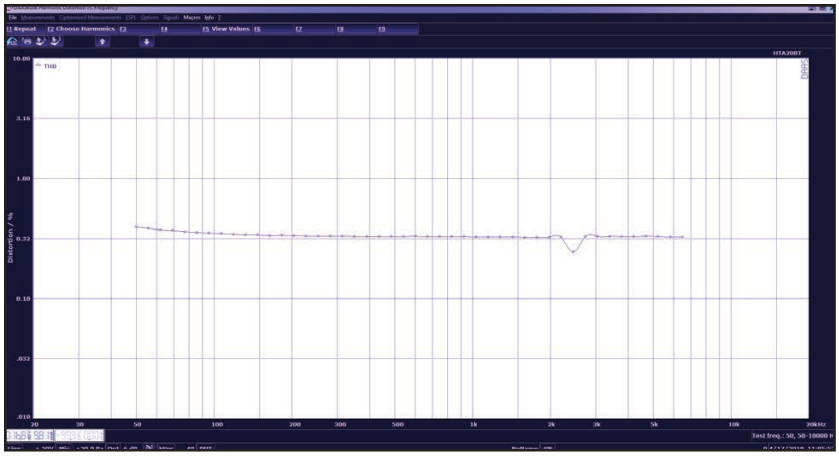

Figure 3: THD vs. Frequency is shown for 12 W per channel into 4 Ω.

Manufacturer data lists the output power as 12 W per channel at 4 Ω with THD of <0.1%. **Figure 2** shows a clean waveform, with a 7 V_{RMS} output, measured via my Tektronix oscilloscope. Each division is 5 V, providing 20.5 V_{PP}.

Given the available output power, I recommend matching this amplifier with speakers with sensitivities on the higher end of the spectrum, and lower impedances in the 4 Ω to 6 Ω range. For my tests, I used full-range 2.5-way towers, with a 4 Ω impedance and a 90 dB SPL sensitivity at 2.85 V_{RMS} at 1 m. This was a good way to take advantage of the strengths of this audio system.

Measurement data for THD vs. Frequency with 12 W per channel into 4 W shows a nominal value just over 0.32% (see **Figure 3**). Inspection of the spectral data (see **Figure 4**) with a 1 kHz fundamental, show that the typical vacuum tube influence on harmonic distortion is almost completely even order, and dominated by the second harmonic. In fact, the third, fourth, and fifth harmonic are of an order of magnitude smaller.

Dropping to a 1 W output, and THD vs Frequency is averaging around 0.17%. With a 1 kHz fundamental, THD is again is dominated by the second harmonic.

As mentioned in the initial inspection, the Dayton Audio HTA20BT is actually a tale of two amplifiers: a 12 W power amp for loudspeakers and a versatile headphone amplifier capable of driving headphones with impedances between 32 Ω and 600 Ω. The headphone amp output is specified at 7.8 mW at 32 Ω with a distortion limit of < 1% THD+N at 1 kHz.

Figure 5 provides the headphone amplifier distortion data for the maximum output with a 32 Ω load. With a 1 kHz fundamental, THD is measuring 0.78%, confirming the manufacturer's listed numbers. The only potential missing feature for this headphone amplifier is the lack of bass boost feature, which would have been a "nice to have." This appears to be an intentional design choice as the preamp stage is similarly missing any tone controls.

Audio Quality

For the wireless portion of my evaluation, I only used downloaded AAC files on my iOS device, to avoid any audio degradation issues due to network traffic. Bluetooth streaming of downloaded AAC files results in a 256 kbps bit rate.

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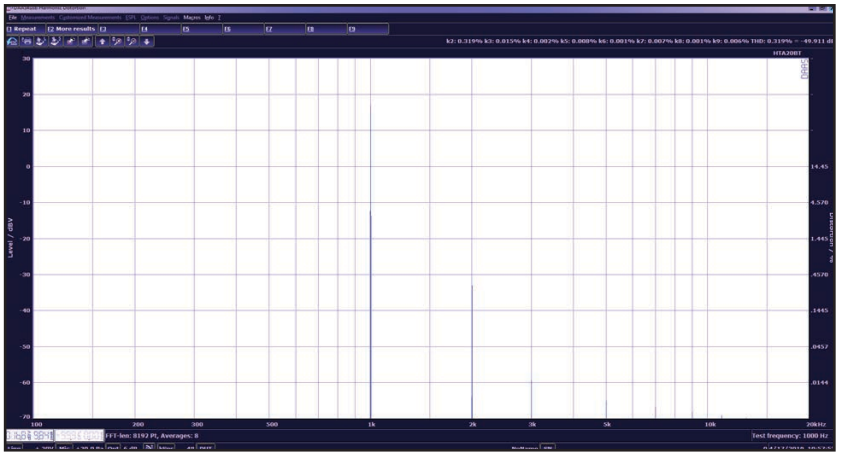

Figure 4: Harmonic distortion with 1 kHz input is dominated by the second harmonic for 12 W per channel into 4 W.

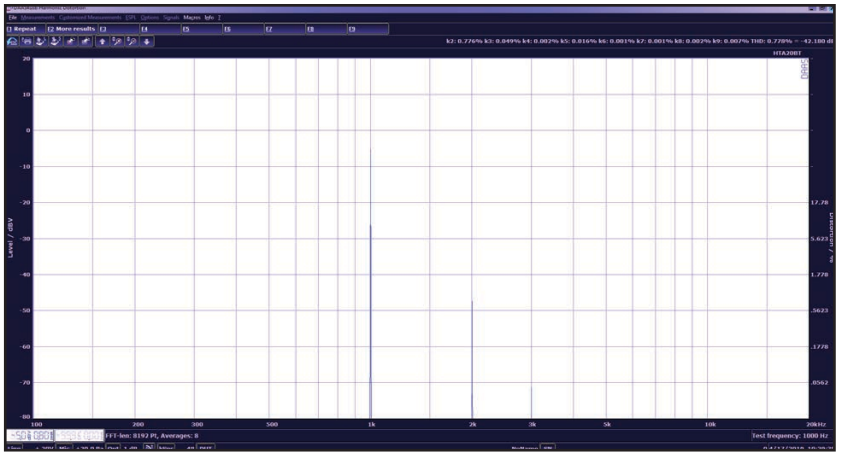

Figure 5: Harmonic distortion with 1 kHz input is 7.8 mW @ 32 W for the headphone amplifier.

Photo 3: The HTA20BT has a retail price of $181.84 USD and is packed with features such as Bluetooth 4.2, five-way binding posts, dual rear-mounted RCA inputs, a subwoofer, and headphone audio outputs, as well as a built-in USB media player.

On Kate Bush's legendary 1978 recording of "Wuthering Heights," her vocals were brilliantly reproduced, with no issues as her voice soared into the stratosphere. But while her vocals retained the purity one would demand, there was a slight smearing that was noted on the keyboard's upper register that slightly detracted from the expected harmonic content.

Next, I streamed a 2014 cover of the David Bowie classic "Ziggy Stardust," by Margot & the Nuclear So & So's. The natural presence and warm sound stage that this system produced was outstanding. This was a demonstration of the alignment where the speakers, source, and electronics all worked in harmony to deliver an engaging experience. Dynamics and output all felt natural, and without any signs of strain or artifacts.

To investigate the analog inputs, I moved on to a more recent recording, Sara Bareilles' "Love Song" (96 kHz FLAC), from the Live at the Variety Playhouse. The warmth of the preamp paid dividends in providing an engaging and pleasing experience. I did find myself wishing the amplifier section had a larger power output, as greater headroom would have enhanced the wide dynamic range that this recording demands for maximum enjoyment. When I listen to live recordings, my optimum experience is always listening at the sound pressure levels (SPL) that the audience would experience during that performance. This is my preference not only when I listen to orchestral music, but with any high-resolution recording such as this one.

Speaking of orchestral tracks, my next test was the San Francisco Symphony's 96 kHz FLAC recording of Bernstein's "America," from its 2014 *West Side Story* album. Dynamics, both micro and macro, were spectacular here. There were no issues dealing with high crest factor events and this too proved to be a good match between all the moving parts involved in reproducing a detailed musical experience.

The HTA20BT handled the many high crest factor events perfectly that are so prevalent on Santana's "Smooth" (256 kbps MP3). The natural character of the preamp stage was the perfect complement to Carlos Santana's guitar riffs.

In order to gain a better understanding of how the HTA20BT digital amplifier section responded, as well as how the tube preamplifier performed in different configurations, I also experimented with several other loudspeakers, both sealed and vented with nominal impedance loads between 4 Ω and 8 Ω. While the degree of influence did vary from speaker to speaker, the sonic signature of this integrated amplifier was consistent and in line with the expectations for vacuum tube electronics in the signal chain.

Presence on vocals was enhanced and sonically pleasing. Midbass and lower frequencies picked up an added warmth that made fundamentals sound more prominent, if not exactly precise. The added character did result in some smearing and loss of clarity in the top octave. This was most apparent on more exposed and open musical passages, particularly on chimes where harmonics and ringing overtones are critical.

I spent considerable time testing the headphone output as well, with my 32 W Grado SR60s as the headphone of choice for this study.

On Paul Simon's 25th anniversary 96 kHz FLAC remix of "Graceland," a solid soundstage was created, with depth and clarity to impress. This is a favorite track of mine due its complex and layered vision, and the experience lived up to expectations. Going further back in time, I also played Gram Parson's 1974 "$1000 Wedding," and on this cut, the positive delta was in the micro details in projecting the lower register of Parson's voice. Since the headphone output had plenty of headroom, there was not a need to push the gain higher and risk any signs of strain to the audio signal.

Final Thoughts

In aggregate, the Dayton Audio HTA20BT offers an intriguing set of features, as well as some thoughtful touches. It has no shortage of inputs, and the inclusion of an external omni-directional antenna ensures an outstanding Bluetooth experience, even in a noisy RF environment. This integrated device is handsomely packaged, with smooth lines and a good tactile feel on the knobs, as well the prominently featured pentode tubes for the preamplifier on the top panel (see **Photo 3**).

This device supports a myriad of varied use cases, with intriguing options for the technically minded users to whom it is squarely targeted. Whether it forms the basis of a headphone setup, 2.0, or 2.1 speaker system, it provides a variety of I/O options and an excellent sound quality offering. The Dayton Audio HTA20BT hybrid stereo tube amplifier is a standout in the world of consumer audio, aligning the most unlikely of product features under one housing.

About the Author

David Logvin is an acoustics engineer at TDK InvenSense, working in the MEMS microphone division. With more than 20 years of experience, he has designed loudspeakers and other products for Snell Acoustics, Outlaw Audio, ClearView Audio, Cambridge Sound Management, and others. During his 14 years at Snell Acoustics, he developed and designed dozens of high-end loudspeakers and amplifiers, as well as helped to create loudspeaker standards in close collaboration with THX. David then focused his efforts on R&D, creating innovative, award-winning piezo-driven membrane loudspeakers with ClearView Audio (formerly known as Emo Labs). At Cambridge Sound Management, he put his skills in room acoustics to use in the field of sound masking for corporate applications. Most recently, he rejoined his fellow Snell Acoustics alumni, Dr. Joseph D'Appolito, to design several new loudspeakers for Outlaw Audio. In addition to his lifelong love of music and acoustics, David is an active participant in the Boston tabletop game design community. He is a member of the Audio Engineering Society (AES) and the Boston AES Section and lives in Lowell, MA with his family.