

Krell FBI

Fred Kaplan

INTEGRATED AMPLIFIER

DESCRIPTION Two-channel, solid-state integrated amplifier with 1 pair CAST inputs via 4-pin bayonet connectors, 1 pair balanced via XLR connectors, 3 pairs single-ended via RCA connectors, 1 pair tape via RCA connectors. Speaker outputs: 4 on binding posts. Preamp output: 1 pair single-ended via RCA connectors.

Preamplifier section: Frequency response: 20Hz–20kHz, +0.0/–0.05dB. Power amplifier section: Maximum output power: 300Wpc into 8 ohms (24.8dBW), 600Wpc into 4 ohms (24.8dBW), 1200Wpc into 2 ohms (24.8dBW).

Maximum output voltage: 138V peak–peak. Voltage gain: 36.4dB. Signal/noise ratio: 108dB, A-weighted.

THD: <0.04% at 1kHz, <0.3% at 20kHz. Input sensitivity: 0.741V RMS. Power consumption: 70W standby, 185W idle, up to 1800W operational.

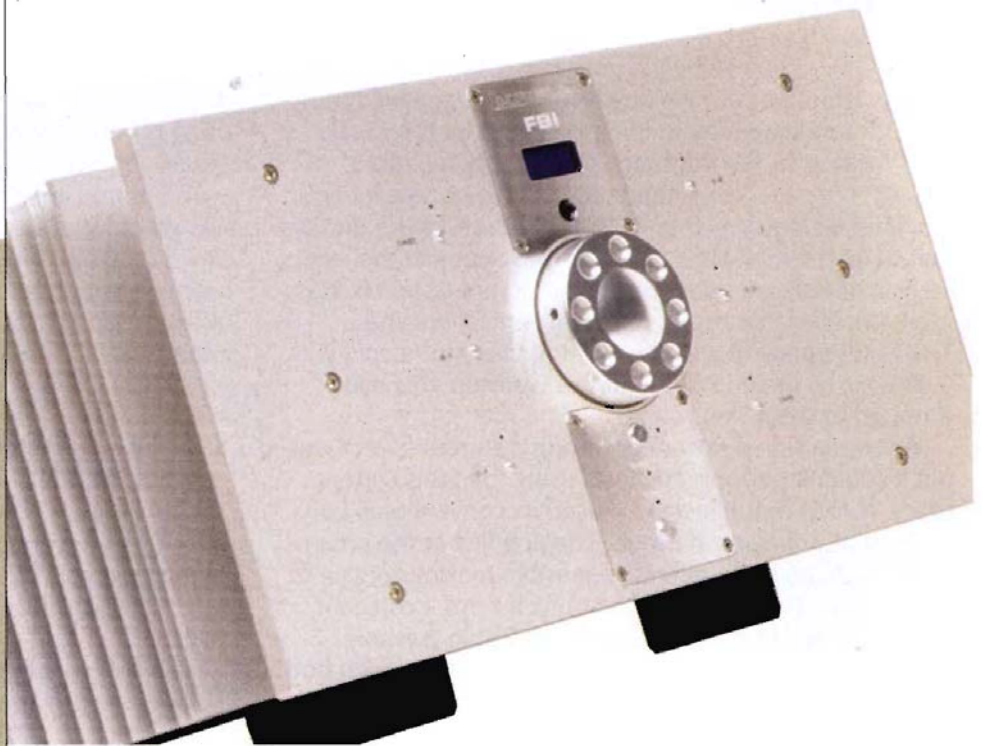
DIMENSIONS 17.3" (445mm) W by 10.3" (265mm) H by 20.5" (525mm) D. Weight: 124 lbs (56kg) shipping, 104 lbs (47kg) net.

SERIAL NUMBER OF UNIT

REVIEWED 514060200005.

PRICE \$16,500. Approximate number of dealers: 200. Warranty: 5 years parts & labor.

MANUFACTURER Krell Industries, 45 Connair Road, Orange, CT 06477-3650. Tel: (203) 298-4010. Fax: (203) 891-2028. Web: www.krellonline.com.



Krell FBI integrated amplifier

There's something a bit oddball about the notion of a \$16,500 integrated amplifier—until you stop to consider that the market is fairly drenched with preamps and power amps that, together, cost that much and more. And putting both pre- and power amp in a single chassis cuts down on storage (one less shelf), accessories (one less pair of cable), and electrical outlets (one socket freed up).

Still, it must be a tough sell; it seems a novelty, along the lines of the \$100 Kobe beef burger or the \$1000 caviar omelet offered at certain Manhattan restaurants. The kind of people who tend to stick with burgers and omelets think such prices are comically insane. The kind of people who don't chafe at these prices figure they might as well go all the way and order the dry-aged porterhouse or the blini and Beluga.

Maybe it's the categories—*burger, omelet, integrated amplifier*—that are off-putting—or, more to the point, the usual associations with these categories. I've never eaten Kobe beef, but some who have say that it tastes fabulous, as sumptuous as a good steak in its own way. Just because most burgers are diner food doesn't mean they have to be. Just because most integrated amps are designed as compromises doesn't mean they have to be, either.

So here we have Krell Industries, maker of no-holds-barred, power-pumping

behemoth amps, brazenly treading this uncertain terrain with the FBI—a Fully Balanced Integrated (hence the initials) amplifier that, judging from its appearance and design (to say nothing of that \$16,500 pricetag), aims to give no ground to its separate-components brethren.

Description and Design

The FBI isn't Krell's first stab at an integrated amp. In the mid-1990s they put out the KAV-300i, which evolved a decade later into the KAV-400xi. Priced at \$2350 and \$2500 respectively,

the KAVs were pitched to the entry level of the high-end market, a realm

THE FBI IS AN FPB-300CX WITH A LINE-STAGE PREAMP BUILT IN.

that until then Krell had largely bypassed. (The less expensive KAV-400xi was scaled down but not dumbed down; Wes Phillips, in the February 2005 *Stereophile*, called it his "favorite

Krell"—by which he *didn't* mean the "best Krell," but still...)

The FBI is something else entirely. It weighs 104 lbs, and puts out 300Wpc (600Wpc into 4 ohms, 1200Wpc into 2 ohms) with vanishingly low distortion at frequencies ranging from subway rumble to dog whistle. The preamp and amp sections have separate circuits and separate toroidal transformers; the preamp's is rated at 25VA, the amp's at 3000VA with a capacitance of 40,800 μ F per channel. Each channel has 20 TO-3-cased output transistors and 10 TO-3-

MEASUREMENTS

Before performing any test on an amplifier, I precondition it by running both channels for 60 minutes at one-third the specified power into 8 ohms, which is thermally the worst case for an amplifier with a class-B or-AB output stage. At the end of that hour, the Krell FBI's entire chassis—not just the large vertical heatsinks on its sides—was too hot to touch. This is an amplifier that needs plenty of ventilation. The THD+noise percentage with the amplifier stone cold was 0.0142%; by the end of the hour's warmup, this had dropped to 0.0067%.

Without a signal generator having a current-source output, I couldn't perform any tests using the FBI's current-mode (CAST) input; instead, I used its conventional balanced and unbalanced inputs. Looking first at the preamplifier outputs, these offered a sensible maximum gain of 4dB for an unbalanced signal, sourced from a constant 100 ohms across the audioband. The FBI as a whole offered a maximum gain of 36.4dB into 8 ohms with both balanced and unbalanced sources, which is as specified but lower than usual for an integrated amplifier. The input impedance was extremely high across most of the audioband, at 200k ohms unbalanced and 400k ohms balanced, these figures dropping slightly but inconsequentially at 20kHz. (These values are approximate, given the

degree of uncertainty in measuring very high impedances using our usual voltage-drop method.) All inputs preserved absolute polarity; *ie*, were non-inverting.

The output impedance (including 6' of speaker cable) was very low, at 0.08 ohm at low and midrange frequencies. It rose very slightly, to 0.11 ohm at 20kHz, but this will be inconsequential. The modification of the amplifier's frequency response due to the interaction between its source impedance and the modulus of the speaker's impedance

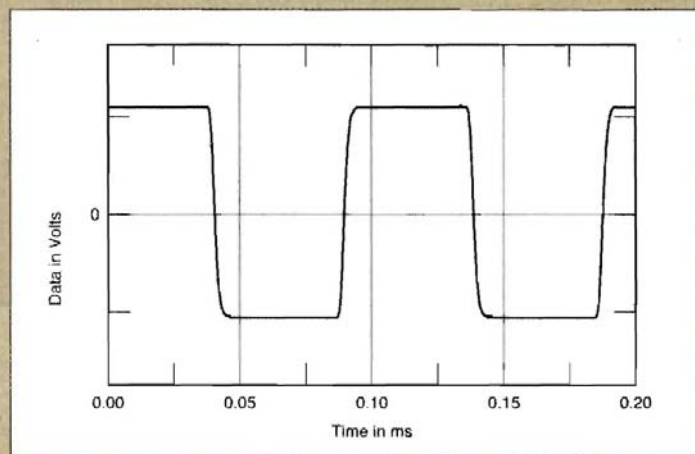


Fig.2 Krell FBI, small-signal 10kHz squarewave into 8 ohms.

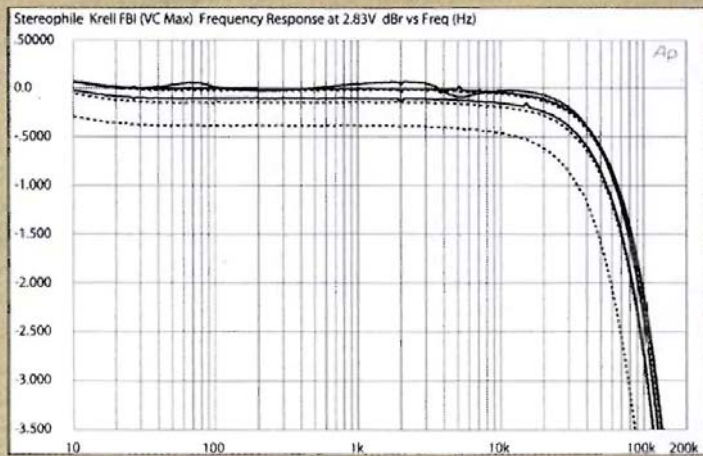


Fig.1 Krell FBI, frequency response at 2.83V into (from top to bottom at 2kHz): simulated loudspeaker load, 8, 4, 2 ohms (0.5dB/vertical div, right channel dashed).

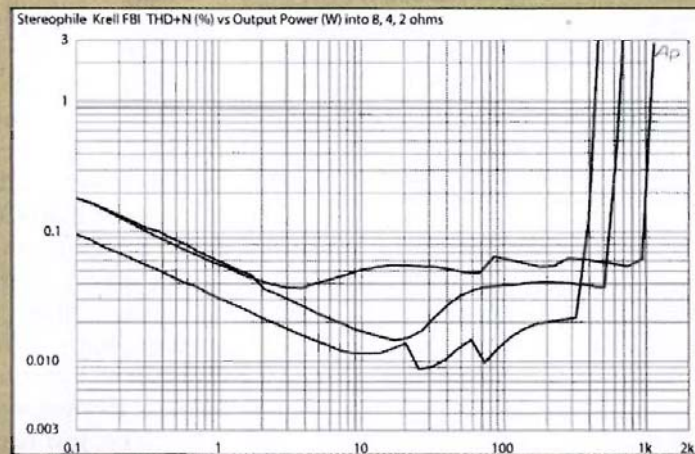


Fig.3 Krell FBI, distortion (%) vs 1kHz continuous output power into (from bottom to top at 100W): 8, 4, 2 ohms.

cased regulators.

The chassis—compact but beefy, an anodized aluminum faceplate covering massive heatsinks—looks like that of Krell's FPB-300cx power amplifier, with a huge, analog volume knob tacked on the front. This is no coincidence—the FBI is an FPB-300cx with a line-stage preamp built in.

Krell's cx series of amps, introduced in 2004, was a modification of the c series, which came to market in 2000 and featured two innovations: Krell Current Mode and Current Audio Signal Transmission (or CAST). The first

involved circuit topologies that manipulated the audio signal in the current domain as opposed to the standard voltage domain. Dan D'Agostino, Krell's proprietor, hit on this idea while designing A/V processors. The high bandwidth of video signals forced him to work in the current domain (voltage-based circuits aren't optimal for video's high bandwidth), which led him to wonder if the current domain might expand the bandwidth of audio signals too—and it did. According to Jim Ludoviconi, Krell's technical manager, the audio bandwidth in the cur-

rent domain exceeds that of the voltage domain by "an order of magnitude."

This discovery led to CAST, which used Krell Current Mode not only in the circuits *within* a component but also in the connection *between* components. This approach would have two advantages, in theory. First, there would be no need to convert the signal from current to voltage and back to current; it would flow as one continuous stream of current. Second, whereas signals in the voltage domain go from low to high impedance, signals in the current domain go from high to low

was less than $\pm 0.05\text{dB}$ (fig.1, top trace at 2kHz). This graph also shows that the small-signal audioband response is flat, with a sensible ultrasonic rolloff reaching -3dB at 122kHz. This bandwidth was identical with both balanced and unbalanced sources, and didn't change with the volume-control setting. The FBI's reproduction of a 10kHz square-wave featured very short risetimes and was commendably free from overshoot and ringing (fig.2). The 1kHz square-wave (not shown) was perfectly, er, square.

Channel separation was very good, at better than 96dB below 1kHz, though it did decrease 76dB at 20kHz, due to the usual capacitive coupling. The wideband, unweighted signal/noise ratio with the input shorted but the volume control set to its maximum was a good 76.5dB ref. 2.83V into 8 ohms, this improving to 87.1dB when A-weighted, which is close to the specified 108dBA ref. clipping power when you add the amplifier's voltage gain to the 2.83V figure.

The FBI is specified as being able to deliver 300Wpc into 8 ohms (24.8dBW). However, plotting the output power against the THD+N percentage (fig.3) shows that the FBI actually delivered 430Wpc into 8 ohms at 1% THD, which is a significant 1.6dBW higher. With both channels driven, the amplifier clipped at 667W into 4 ohms (25.2dBW). Even though the clipping power with one channel driven into 2 ohms was 1020W (24.05dBW),

slightly below the specified 1200W, I don't keep my AC wall voltage consistent for this test, which had drooped with the amplifier's current draw. The FBI will deliver all the power anyone could need.

Note from fig.3 that the THD level above a handful of watts into the lower impedances is higher than into 8 ohms. This can also be seen in fig.4, which plots the THD+N percentage against frequency at 8V, a level where

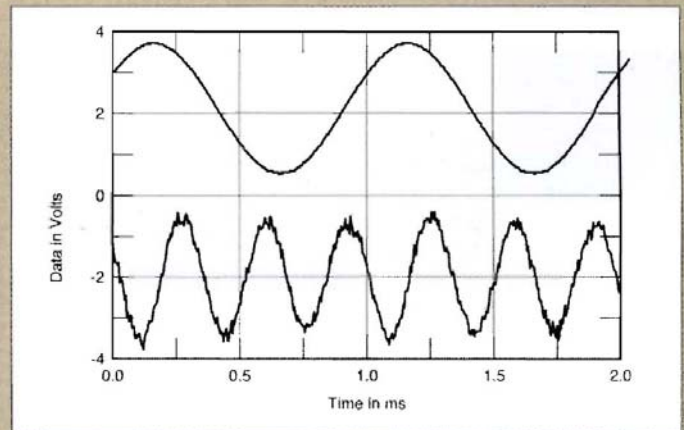


Fig.5 Krell FBI, 1kHz waveform at 13W into 8 ohms (top), 0.00975% THD+N; distortion and noise waveform with fundamental notched out (bottom, not to scale).

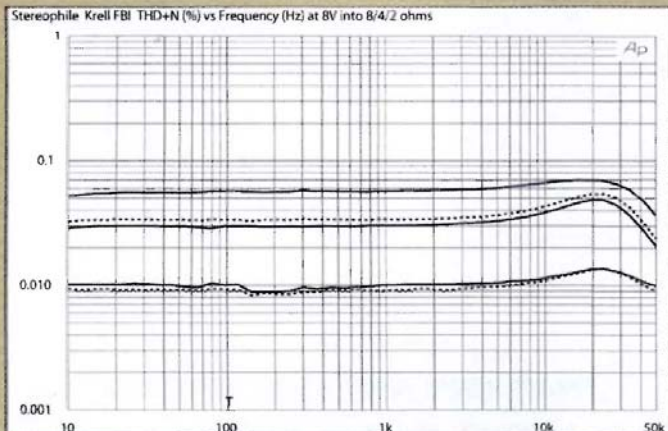


Fig.4 Krell FBI, THD+N (%) vs frequency at 8V into (from bottom to top): 8, 4, 2 ohms (right channel dashed).



Fig.6 Krell FBI, spectrum of 50Hz sine wave, DC-1kHz, at 120W into 8 ohms (linear frequency scale).

impedance. As a result, factors that inevitably (but unpredictably) corrupt an audio signal in the voltage domain would be sharply reduced, if not eliminated. These factors include stray capacitance and inductance, which build up on circuit boards, and strange interactive effects caused by the impedance of cables connecting a pre-amp and power amp. (D'Agostino has reportedly sent a signal through 5000 feet of Krell's proprietary CAST cable with minimal loss or distortion.)

In the c and cx power amps, the CAST input was moot at the time unless you happened to have a Krell KCT line-stage amp, the only preamp with a CAST output. In the FBI, the line stage and power amp are in the same enclosure; the signal between them goes down a multipinned header from one circuit board to the other. The CAST circuitry is activated as a matter of course. If you go further, and hook the FBI up to a CD player with a CAST output (more about that later), the signal passes in a continuous, unaltered stream from source to speakers.

No surprise, the FBI's line stage is

based on the KCT, though it also employs some of the circuitry in Krell's later Evolution 2 preamp. Especially notable here, according to Ludoviconi, is the Evolution's Current Mirror, which makes a "copy" of a signal in the input stage, in order to isolate it from the inevitably intruding noise from a high-bandwidth signal. The line stage, like the Evolution, also uses LEDs, which have a much higher tolerance than traditional diodes; as a result, Ludoviconi claims, circuits perform more predictably at the critical low-level stages.

The catch is that running in the current domain requires a lot of transistors—up to twice as many, watt for watt, as the voltage domain—which means that an amp like this must be heavier and more expensive, and run hotter, than it otherwise would.

A few convenience features: First, power is activated by a toggle switch on the back panel. Pushing the power button on the front panel turns the amp from stand-by to full-tilt; the warm-up time, before you hear its full sonic bloom, is negligible. Second, the

wireless remote has a 12-volt trigger, which lets you control other components in the system, even non-Krell ones. (I was able to select tracks from a Simaudio CD player, for instance.) Third, a "Theater Throughput" circuit (which I never used) allows the signal from a surround-sound processor to pass through the FBI at unity gain.

Setup

I did all of my listening through Verity Audio's Parsifal Ovation loudspeakers and Nirvana speaker cable. I listened to LPs, CDs, and SACDs. For a digital source, I began with the Simaudio Moon CD5.3, which has only RCA outputs. After I got used to the FBI's sound (it didn't take long; I've heard many Krell amps over the years, including, not long ago, the FPB-400cx), I switched to Krell's Evolution 505 SACD/CD player (borrowed from Wes Phillips), which has RCA, balanced, and CAST outputs. I began with the RCAs, to introduce the new elements one at a time. (I spent a few months last year with Krell's SACD Standard player, which is sonically

measurements, continued

the actual distortion is about to emerge from the background noise. The THD doubles with each halving of the load impedance, though in absolute terms it does remain low overall. There is only a small rise in the top two octaves of the graph, suggesting that the Krell FBI has a commendably wide open-loop bandwidth.

At moderate power levels into 8 ohms (fig.5) the distortion's harmonic content is almost pure third harmonic, which will be subjectively innocuous. Even at one-third the clipping power (fig.6), only the third harmonic is evident. However, not only does the third harmonic rise when the load impedance is reduced, the fifth and seventh harmon-

ics appear (fig.7), though it's fair to say that these remain low in absolute terms. And even with an equal mix of 19 and 20kHz tones close to clipping into 4 ohms, intermodulation distortion remains very low (fig.8).

It was a pleasure to measure such a well-engineered amplifier as Krell's FBI. Quiet, powerful, stable, and well-behaved even into low impedances, it is a paradigm of what an integrated amplifier needs to do. If only it weren't quite so heavy—carrying it down the steps of Fred's brownstone to my car, then down the stairs from my driveway to my test lab, I began to appreciate the virtues of amps with featherweight class-D output stages! —John Atkinson

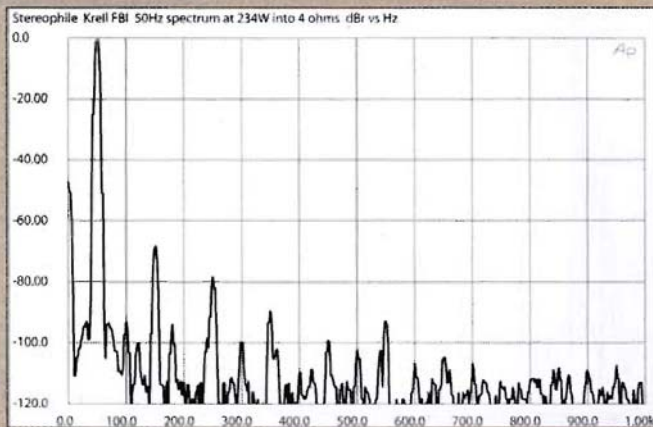


Fig.7 Krell FBI, spectrum of 50Hz sine wave, DC-1kHz, at 234W into 4 ohms (linear frequency scale).

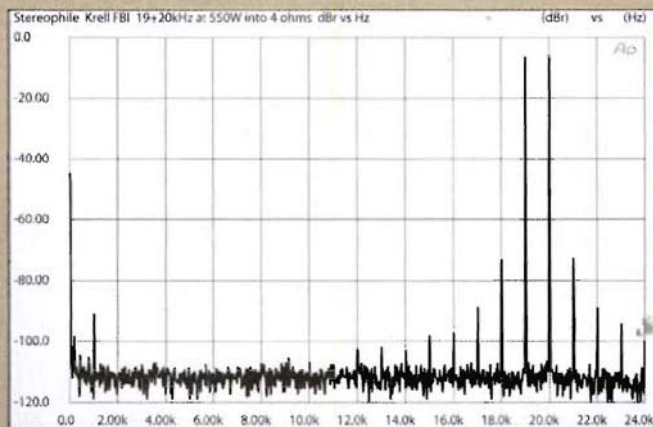


Fig.8 Krell FBI, HF intermodulation spectrum, DC-24kHz, 19+20kHz at 550W peak into 4 ohms (linear frequency scale).

similar.) Then I moved briefly to the balanced outputs. With my Nirvana interconnects, I've never noticed much, if any, difference between balanced and unbalanced hookups (after having adjusted the volume knob to compensate for the 6dB gain); the same was true here.

Finally, I switched to the CAST outputs, using Krell's proprietary CAST cable. That's when everything locked into focus.

Sound

As noted, I spent a few months last year listening to Krell's FPB-400cx, the beefier version of the 300cx that serves as the FBI's foundation. Certain things about the FBI sounded familiar: the tight deep bass, thunderous dynamics, and snappy transients. But, even at the outset, when I was using the single-ended inputs, there was something new: greater detail, even delicacy, in the timbres and textures of instruments.

Long gone are the days when Krell electronics were marred by what I felt was a cold glare in the upper midrange. In the last five or six years, Krell amps have warmed up in the middle octaves while preserving the pizzazz. But the FBI boosts Krell's traditional strengths while diminishing the weaknesses, both to new levels, in my experience.

For instance, even with the warmer midrange, silky violins weren't quite a Krell trademark. Yet when I put on Michael Tilson Thomas and the SFSO's recording of Mahler's Symphony 9 (SACD/CD, San Francisco Symphony 821936-0007-2), or Andrew Manze and Rachel Podger and the Academy of Ancient Music performing the solo and double violin concertos of J.S. Bach (SACD/CD, Harmonia Mundi HMU 807155), I heard not just silky, but *shiveringly* silky violins.

Some amps achieve tonal beauty at the cost of transient detail, but the FBI delivered both. With the Bach recording, it revealed the subtlest quivers of vibrato, the slightest ebb and flow of rhythm and dynamics. With Keith Jarrett's *Carnegie Hall Concert* (CD, ECM 1989/90)—a concert I attended—the FBI captured not only the creamy percussiveness of the Steinway grand, but also the slightest hesitations of Jarrett's *rubato* and the lightest shadings of his pedal work.

I've always put a high premium on how an audio component handles

microdynamic contrasts—the slight variations in loudness or softness when a singer stresses a note, a violinist bows a bit harder or softer, or a drummer hits a cymbal in some different way

bass. The London Symphony's recording of Górecki's Third Symphony, conducted by David Zinman (CD, Elektra/Nonesuch 79282-2), begins with a very low, rumbly bass

WHEN I SWITCHED TO THE CAST OUTPUTS, USING KRELL'S PROPRIETARY CAST CABLE, THAT'S WHEN EVERYTHING LOCKED INTO FOCUS.

that's barely perceptible. The FBI handled these as naturally as any amp I've heard. This isn't merely the sort of detail that audiophiles like to show off; it's the sort of detail that reveals the rhythm and the soul of music—and the presence of a human being blowing, bowing, singing, pounding, or otherwise playing it.

On Miles Davis' *Cookin'* (SACD, Analogue Productions LAPJ 7094 SA), when the band breaks into a faster tempo on "My Funny Valentine," listen to the way drummer Philly Joe Jones *lets up* on the hi-hat cymbal after he taps it with his stick. The effect adds an extra layer of rhythm and cool that I hadn't heard through other amplifiers the previous hundred or so times I'd played this album. Meanwhile, Miles' trumpet sounded golden, and Paul Chambers' bass was tightly strung and woody.

Bass, of course, is Krell's longstanding strong point, but I hadn't before heard such musical detail *within* the

line—the double basses state the melody—which, on many stereos, you can barely hear. Listening to this passage through various systems over the years, I'd thought I'd discovered everything there was to hear in it, but the FBI unveiled more: dynamic variations in the bowing, two contrapuntal bass lines about three minutes into the first movement that I'd never before noticed, and simply more clarity and focus in the bass section—and all other sections of the orchestra—throughout.

The FBI also unraveled subtle harmonic variations with ease. On jazz trumpeter Dave Douglas' *Charms of the Night Sky* (CD, Winter & Winter 910 015-2), when he plays in unison with Mark Feldman's violin and Guy Klucevsek's accordion, I could hear their distinctive harmonic overtones much more clearly than I had before; in other words, I could better distinguish the three instruments, tonally, spatially, and harmonically. Yet they didn't appear as some overly analytical Etch-a-Sketch; the overtones blended in the ambience, as I've heard them do in concert.

Voices were also uncannily clear. If you've ever found it difficult to decipher lyrics sung by Bob Dylan, Donald Fagen, Randy Newman, or Rickie Lee Jones, take a listen to their recordings through the Krell FBI; it should be a clarifying experience. Dylan's *Blood on the Tracks* (SACD, Columbia CH 90323) sounded so clean—his voice so naked and articulate, the guitar strums so propulsive, the bass line so distinct—I would have guessed the recording had been dramatically remastered, had I not heard this disc so many times before.

Lest I give the impression that Krell has crafted an instrument of mere litheness and delicacy—a chamber ensemble among amplifiers—I should emphasize that the FBI could also let loose and roar. At the crescendo in the

ASSOCIATED EQUIPMENT

ANALOG SOURCE VPI HW-19 Mk.14 turntable with JMW Memorial tone-arm, Clearaudio Victory H cartridge.
DIGITAL SOURCES Krell Evolution 505 SACD/CD player, Simaudio Moon CD5.3 CD player.

PREAMPLIFICATION Audible Illusions Modulus 3a (used only as phono-stage). **LOUDSPEAKERS** Verity Audio Parsifal Ovation.

CABLES Nirvana interconnects and speaker cables; Krell CAST interconnects.

ACCESSORIES Bybee Technologies Signature Power Purifier, Monster Cable AVS-2000 voltage regulator; Black Diamond Mk.4 Racing Cones, Mapleshade pucks; VPI HW-19 record-cleaning machine.

—Fred Kaplan

first movement of Mahler's Ninth, the FBI passed along the full force of the San Francisco Symphony without breaking up, backing down, or clutching in any way. Everything remained clear and distinct at high and low decibels.

I see that I haven't written anything about how the FBI handled soundstaging, so I'll say this: The soundstage was

49975-2 and 49975-1). My turntable (which, of course, has only single-ended outputs) was plugged into the FBI's RCA inputs. Yet in the case of both recordings, the LP-into-RCA was superior to the CD-into-CAST. The two formats were closer than I've heard in similar analog-vs-digital face-offs, but the LP's ambience was a bit

recalled as sounding pretty ordinary, with nowhere near this kind of presence. I popped it into the CD31, hit Play, and it was apparent within the first few notes that here, too, I was experiencing a kind of open window on and direct connection to the original performance. A few hours later, I looked at my forgotten list of the day's chores and scribbled in my notes that the Primare CD31 had "that little extra something that makes me ignore the world and remain in the listening room." The CD31's performance was beyond "good," "very good," "really good for the money," or even "excellent"—it was *sublime*.

The connection I felt with the Jackson Browne performances was re-created over and over in the next several weeks, as I worked through a variety of recordings. The CD31 didn't create a sense of realism where there was none, and never imbued the sound with any sort of hi-fi hyper-reality. Indifferent recordings usually sounded boring and bad ones often unlistenable, but with well-done recordings of any scale, the CD31 was magic. I could easily have been convinced that I was listening to some over-the-top, multi-box system instead of an unimposing \$2295 integrated player. In fact, most of my guests did assume that they were listening to one of the my more spectacular players—or even a record—rather than the Primare. Every one of those visitors immediately sat down and began requesting favorite discs.

Summing up

Primare's CD31 isn't a perfect CD player. It's not absolutely neutral, instead superimposing a slightly warm, slightly soft character on the sound. Nor is it completely transparent. It doesn't totally "vanish," as do such components as the VTL TL-7.5 line stage or the Halcro dm88 amplifiers. The CD31 "disappears" in a different way, conjuring up an open window on the original performance. It combines detail resolution, timing, harmonic structure—all of the components we use to describe a component's sound—in a mix in which subtleties and nuances are reproduced in just the right way. The CD31's reasonable price is almost irrelevant in light of its performance, but profound in that it makes that performance available to many more people than is usually the case. The CD31 isn't perfect—but it's *sublime*. ■

THE **BALANCED** AND RCA INPUTS DIDN'T REVEAL QUITE THE RHYTHMIC **AGILITY**, DYNAMIC DETAIL, OR BASS CLARITY OF THE CAST **CIRCUIT**.

as wide, deep, precisely imaged, and densely layered as the recording and the rest of my system allowed.

Was there anything wrong with the FBI? Well, the highest frequencies sounded a bit truncated—or, if not cut off, a little less transparent than all the other octaves. This shortfall wasn't immediately obvious; to the extent it was noticeable, it wasn't at all annoying—and I'm one who is annoyed by chopped-off highs. I'm scrounging here for flaws.

I do have one caveat: As suggested near the beginning of this review, the FBI sounded *much* better with Krell's CAST circuit fully activated—that is, when the music source was plugged into the amp's CAST inputs. Using the balanced or single-ended inputs, the FBI still sounded very good; I wouldn't disavow anything I've written about it so far, though I might tone down some of the accolades a bit. In an A/B comparison adjusted for volume differences, the balanced and RCA inputs (with Nirvana interconnects) were hard to tell apart. But in A/B comparisons with the CAST input, both the balanced and RCA inputs fell short. They didn't reveal *quite* the rhythmic agility, dynamic detail, or bass clarity of the CAST circuit: I didn't hear *all* of Andrew Manze's and Rachel Podger's subtle fingerwork in the Bach violin concertos, or the *full* force of Dylan's strumming, or the *obvious* distinction between violins and violas in the Górecki and Mahler recordings.

Then again, CAST doesn't work outright miracles. I compared the CD and 180gm vinyl pressings of Miles Davis' *Live Around the World* (Warner Bros. 46032-2 and 46032-1) and Donald Fagen's *Morph the Cat* (Reprise

airier, Miles' trumpet and Fagen's voice a bit breathier, the background instruments a bit more 3D.

This comparison pointed to two conclusions. First, very good analog still has it over very good digital, in certain respects. Second, CAST or no CAST, the Krell FBI is an excellent amplifier; the difference between its inputs is one of degrees of excellence.

Conclusion

I can't presume to know what an economist would call your "utility function." That is, I can't know whether or not a certain product at a certain price—say, \$16,500 for the Krell FBI integrated amplifier—is worth your money, given your tastes and income. But I can say that you won't hear everything the FBI has to offer unless you also buy a CD player that has CAST outputs, and the only such player that currently exists, as far as I know, is the Krell Evolution 505, which retails for \$10,000.

In for 16 grand, in for 26? If that's where you're sitting (and if it is, *mazel tov*), go for it. Alas, it's not where I sit. So I petition Dan D'Agostino, on behalf of my fellow well-heeled but not *that* well-heeled music-lovers and audiophiles: Please, sir, can you make a digital player with CAST outputs (or maybe some kind of CAST converter) for a bit less? That will make the full package of the FBI's magic tricks accessible to many more of us. ■