



MOON BY SIMAUDIO 780D EVOLUTION SERIES REFERENCE DAC/STREAMER

Somewhere deep in the Canadian Rockies, there's a person responsible (or irresponsible!) for creating acronyms and abbreviations for Simaudio to use in its 'Moon' range of high-end hi-fi components. So you'll find this 780D Evolution Series DAC/Streamer is fitted with a 'MiND' (Moon intelligent Network Device), M-LoVo (Moon Low Voltage Regulation), I2DCf (Independent Inductive DC filtering), SimLink, and MHP (Moon Hybrid Power). And that's just Moon's contribution to acronym city. Also on board the 780D you'll find USB, AES/EBU, SPDIF, DSD, DXD, PCM, aptX, TIDAL, Toslink, 100Base-T and FRM-3... but these acronyms were created by the hi-fi industry, not Moon. Is it any wonder iPod docks are so popular?

But all these acronyms and abbreviations are not just meaningful, they're also what makes the Moon 780D state-of-the-art, as befits the flagship product in this Canadian company's line.

But it also means there's quite a lot to get through in this review, so without further ado...

THE EQUIPMENT

In a world that has a new way of delivering digital music popping up almost monthly, it's only a small stretch for me to say that Moon's 780D will be able to handle every format currently available, and every codec. It has nine inputs, which include USB, Ethernet, Wi-Fi, aptX Bluetooth, optical and coaxial SPDIF and AES/EBU and can handle lossy compressed formats (all flavours), lossless compressed formats (all flavours), PCM (all flavours), and DSD (all flavours including DXD). And each of these nine inputs can be re-programmed with a unique identifier, so that instead of the display showing 'D1' when you're listening to your CD player, it can instead show 'CD' or even the brand of your CD player... so long as it's less than eight characters.

Accessing the nine inputs can be accomplished in the traditional fashion, via the pushbuttons on the 780D's front panel, via the supplied infra-red remote control (known as the FRM-3, so that's another abbreviation out of the way), or by loading your iOS device ('phone, 'pad, or 'pod) with the Moon App, available for free from the iTunes store. As for Android, an Android app has been 'coming soon' for more than three years now, so it obviously was not a particularly high priority at Simaudio HQ, however just as we went to press, Australian distributor BusiSoft told us it was Beta-testing the Android app, so hopefully the app will be available by the time you read this review.

Because the 780D is obviously designed to be controlled by app, the 780D's very large—and very red—front panel display doesn't show much information, just the active input, and the sampling rate (44.1kHz up to 384) or, in the case of DSD, the data rate (2.82MHz up to 11.28MHz).

It really couldn't show much information anyway, since Moon is using its 'traditional' array of what appear to be full-sized LEDs to display this information. I was in two minds about this display. Sure it's easy to read, even from 'way across a room, but it really doesn't reflect the superior technologies that are used inside the machine. I real-

icant points are clearly labelled with a voltage and/or a purpose: a technician's version of heaven... who needs a schematic?

I must admit that I did rather miss not having a headphone output: fitting one would not have been hard, and to my mind would have made a lot of sense.



Internally, the 780D has two ESS9018S Sabre DACs in a dual-differential layout that support up to 24/384 PCM and quad-speed/256 DSD

IN USE AND LISTENING SESSIONS

In order to make the 780D easier to use during the review period, I renamed the inputs I was using and immediately experienced a little hiccup, which was that you always need to fill the

entire display memory, so that when I put in 'MiCDT' to describe my CD transport device, I had to add three blank spaces. Not a biggie, but a trap for young players.

My next hiccup was when I wanted to link the 780D to my network, which is done with the built-in MiND music streamer. There were no instructions for MiND set-up in the 780D manual: I had to download both the MiND SetUp Guide and the MiND App User Guide... and, since I use Windows (mostly), I also had to download Moon's USB HD DSD driver. All are located on Moon's website which, not intuitively, is located at www.simaudio.com. Also, not intuitively, the files are not under the 'Support/Manuals' tab, like all the other manuals, but under the 'Our Products/MiND' tab.

ly think it's time that Moon went OLED.

The rear panel has all the inputs you'd expect, but Moon has cleverly designed it so you won't need adaptors or special cables. For example, the digital inputs can be optical, BNC, RCA or XLR. There are two paralleled analogue outputs, one unbalanced (using gold-plated RCA terminals) and the other balanced (using XLR connectors). There are two other 'input' connectors that are not inputs at all, but power connectors. This is where you'd plug in Moon's optional 820S external power supply (which retails for \$10,999). There are also sockets for an IR input, a 12V trigger, and Moon's proprietary 'Sim-Link' which will allow you to use the 780D to remotely control other compatible Moon components, such as its CD transport. There's also an RS-232 socket to allow integration with an automated home system.

Internally, the 780D has two ESS9018S Sabre DACs in a dual-differential layout that support up to 24/384 PCM and quad-speed/256 DSD on their own plug-in PCB, which would allow for extremely easy hardware upgrades, should this be on the cards.

You can see from our photograph (on page 58) that Simaudio not fills almost the entire inside of the 780D with the main PCB and power supply, but in one place, three circuit boards are stacked on top of each other, presumably to minimise signal path lengths. As well as the PCBs being populated with state-of-the-art components, you can see that all signif-

Moon's MiND apps worked very well, with completely different layouts for iPad vs. iPod, so each was optimised for the available screen real estate. The iPad display was easily superior, showing a vast amount of information

Once I'd finished this lot of downloading, I then had to also download Asset UPnP onto my NAS drive, do a software update on the MiND, and finally load the MiND iOS app onto my iPad and my iPod... and that was all before I'd even started on linking the Moon to my wireless network... a process that took me more than two hours, including some false starts and back-tracks. Moon says it plans to develop its own music server software which would no doubt make things easier, but it's been three years so far, and no sign yet of any such software at the time of writing... or news of a Beta.

Regarding setting up the 780D, my advice is that if no-one in your house is an IT professional, you should ask your dealer to set it up for you, making sure that everything works as it should and that the 780D is correctly accessing your digital music libraries. (I should make it clear that this advice is not specific to Moon: I recommend this to everyone who is installing any type of music streaming device, from any manufacturer.)

Moon's MiND apps worked very well, with completely different layouts for iPad vs. iPod, so each was optimised for the available screen real estate. The iPad display was easily superior, showing a vast amount of information, and letting me search, program and play selections, with all album art beautifully rendered, no matter what size it was presented on-screen (which varied depending on what 'view' I was in). There were some quirks to using the iPod app that could have been me, or Asset, rather than the Moon itself, one being that I found it possible to overwrite an exist-





LABORATORY TEST REPORT

Newport Test Labs tested the Moon 780D Evolution with both CD standard (44.1kHz/16-bit) and AES standard (48kHz/24-bit) signals and for both formats, across all tests, the Moon delivered truly state-of-the-art performance, with almost-perfect test results across the board.

Output voltage (balanced output) was measured as 2.0802 volts for the left channel, and 2.0908 volts for the right channel, so there's more than sufficient voltage to drive any follower component, but these results also means channel balance was within 0.0025dB, which is one of the best results for this test *Newport Test Labs* has ever measured. Inter-channel phase was perfect at 1kHz (0.00°) and almost perfect at both 20Hz, where it was 0.02° and 20kHz, where it was also 0.02°. Although these results at the frequency extremes are so good that phase shift would be completely inaudible, the result of only 0.02° at 20kHz is, again, one of the best ever measured at this frequency.

Channel separation was also exceptionally good. Interestingly the results using a 16-bit/44.1kHz test signal—153dB at 20Hz and 1kHz, and 139dB at 20kHz—were slightly better than those obtained using a 48kHz/24-bit test signal, which are shown in Graph 9. However, as you can see from that graph, low-frequency separation is still better than 120dB, and high-frequency separation better than 110dB... several orders of magnitude in excess of what's required to deliver ear-perfect separation and imaging.

Frequency response also varied slightly with the test signal, with a CD-standard signal resulting in a response that was 0.1dB down at 20kHz (Graph 7), whereas the AES 48kHz/24-bit response (Graph 8) was flatter and more extended, as you'd expect. The Moon 780D's de-emphasis circuitry worked wonderfully well, returning perfect results at 1kHz and 4kHz, and was only 0.07dB astray at 16kHz. Full marks to Simaudio for including a de-emphasis circuit in the first place (many manufacturers don't) and bonus points for doing it so well.

Linearity error was also vanishingly low, with the Moon 780D returning some of the best results I can remember, as you can see from the tabulated results. Down at -94.24dB, linearity error was just 0.03dB, for example.

ing playlist with a new one: there was no warning of a 'same name' condition. I also didn't quite come to grips with how Moon's 'Dynamic Browsing' worked, because pressing 'Composer' got me all composers, then pressing 'B' got me all composers whose name began with B, but then selecting one of those composers returned me to the 'Dynamic Browsing' main screen, rather than to the set of that composer's works, as I would have expected. However, despite my enthusiasm for the iPad app, and that I preferred using it for 'serious' listening, I found that I used the iPod app more often in day-to-day use, so there's clearly a case to be made for using both!

Once everything was up and running and I'd checked out the software, I rewarded myself with a long, long listening session. But if I was rewarding myself, then the Moon 780D certainly rewarded me, because it was an absolute joy to listen to. Its sound was smooth, coherent and completely flawless. The music just flowed out of it seamlessly. One of the 'tells' of any great component is that you forget about it and start listening to the music itself, and that's exactly what happened to me. After only several minutes I started to relax, then settle back in my chair, as the aural vista opened up in such a way that I become totally focused only on listening to the music, and delighted that with each new track I was hearing tiny details and nuances I'd not previously heard, even though I was listening to music with which I was intimately familiar. The soundstage presented by the Moon 780D is completely seductive, not least the way in which the bass, the midrange and the treble are not distinct entities, but magically combine, completely unifying the sound field. The Moon also didn't play favourites with instruments, performers or musical genres: every single musical

piece I played was as beautifully presented as the piece that preceded it, from solo singer/guitarist through to full orchestral works. I was completely enchanted.

CONCLUSION

The 780D is indeed what Moon says it is: a 'Reference' Streaming DSD DAC... but it's not just Moon's Reference DAC, it's a true 'Reference DAC', one by which all other DACs should be judged. *greg borrowman*

MOON BY SIMAUDIO 780D DAC/STREAMER

Brand: Moon by Simaudio
Model: 780D Evolution Series
Category: DAC/Streamer
RRP: \$21,499
Warranty: Ten Years
Distributor: BusiSoft Pty Ltd
Address: Suite 4. 792 - 796 High Street
 Kew East VIC 3102
TF: 1300 888 602
T2: (03) 9810 2900
E: info@busisoft.com.au
W: www.busisoft.com.au



Incredible performance
 Ultimate flexibility
 Superb build quality
 Stunning App



Display
 Server software
 Headphone output

Distortion was very low, with overall THD+N at 0dB being measured by *Newport Test Labs* as being 0.0015%—a result that obviously speaks for itself, but is also shown visually in Graph 1. You can see there's a second harmonic at -122dB (0.00007%), a third at -101dB (0.00089%) and a fifth at -123dB (0.00007%), but that's really it. Although only of academic interest, it's likely that some of this distortion was in the output stage and will only occur with a 0dB signal, because you can see from Graph 2, which shows distortion at -20dB, which is more likely to be the signal levels with music, only a single third-harmonic component is visible, and it's at -121dB (0.00007%).

Graph 3 shows distortion with an undithered -60dB test signal, showing the spurae generated by LSB switching, but everything



In sum, the Moon 780D Evolution Series DAC delivered truly state-of-the-art performance

is more than 120dB down and would not be present with music signals, which are dithered, as illustrated in Graphs 4 and 5, which show an undithered signal at -91dB (Graph 4) and a dithered signal at -91dB (Graph 5). In both cases, the signal at far left of the graph is the -91dB test signal. When it's undithered there are odd-order distortion components visible, but with the exception of the third harmonic at -105dB (0.00056%), they're all more than 110dB (0.00031%) down. When the signal is dithered, all distortion disappears below the noise floor, though the noise floor itself has increased to -140dB where, although it's visible on the graph, it would be totally inaudible. [For more information on dither, see www.tinyurl.com/ahf-dither]

Newport Test Labs measured overall signal-to-noise ratio as being 118dB A-weighted (16-bit/44.1kHz) and 124dB (CCIR-RMS) using 24-bit/48kHz). Power line products, which are often an issue with digital, were measured at -149dB, so the attention Simaudio has paid to powering the 780D have obviously paid off.

Intermodulation distortion is shown in Graph 6 and, again, is one of the best results I have ever seen from a DAC. Down at 1kHz, where one nearly always sees some unwanted signal regenerated as a blip or a spike in the noise floor, there's nothing at all, just the noise floor. Perfect.

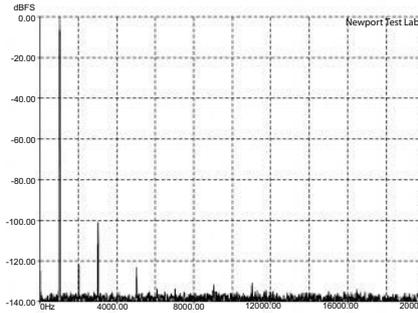


Figure 1. THD @ 1kHz @ 0dB recorded level. (16-bit/44.1kHz) [Moon Evolution 780D DAC]

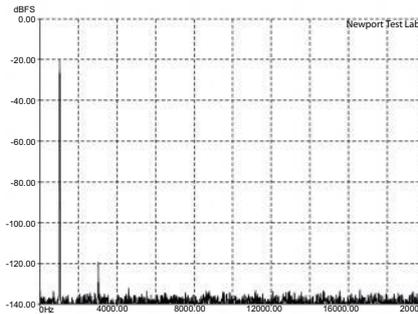


Figure 2. THD @ 1kHz @ -20dB recorded level. (16-bit/44.1kHz) [Moon Evolution 780D DAC]

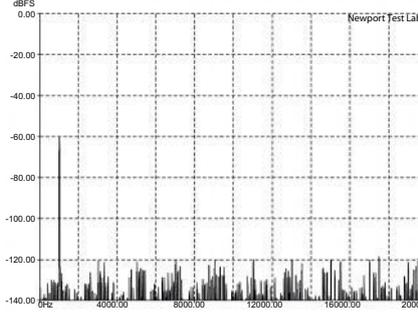


Figure 3. THD @ 1kHz @ -60dB recorded level. (16-bit/44.1kHz) [Moon Evolution 780D DAC]

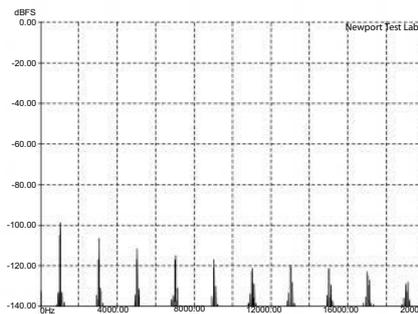


Figure 4. THD @ 1kHz @ -91.24dB recorded level. (16-bit/44.1kHz) (No dither) [Moon 780D]

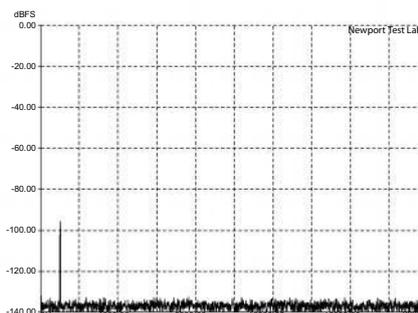


Figure 5. THD @ 1kHz @ -90.31dB recorded level. (16-bit/44.1kHz) (With dither) [Moon780D]

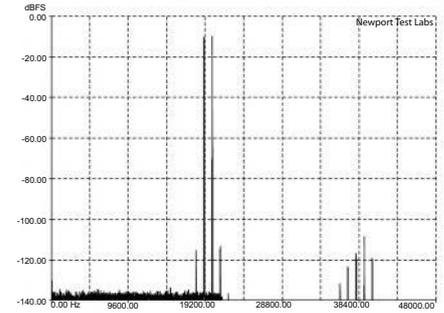


Figure 6. CCIF Distortion (Twin-Tone Intermodulation) @ 0dB using 19kHz and 20kHz test signals in 1:1 ratio. (16-bit/44.1kHz) [Moon Evolution 780D DAC]

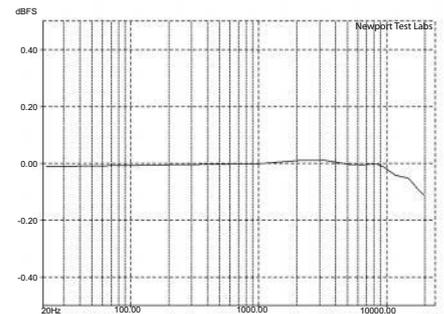


Figure 7. Frequency Response @ 0dB. (16-bit/44.1kHz). [Moon Evolution 780D DAC]

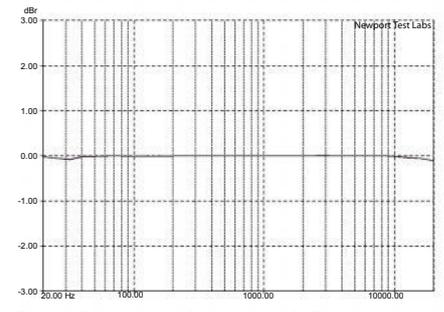


Figure 8. Frequency Response @ 0dB. (24-bit/48kHz). [Moon Evolution 780D DAC]

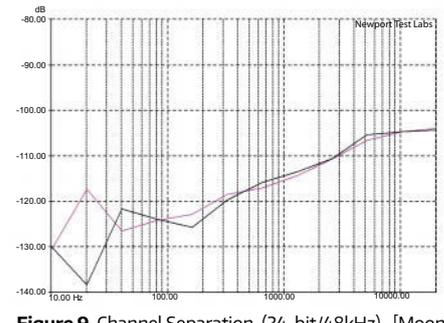


Figure 9. Channel Separation. (24-bit/48kHz). [Moon Evolution 780D DAC]

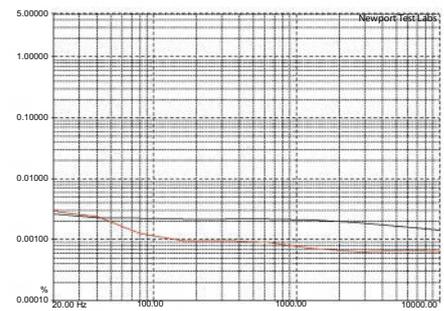


Figure 10. Total Harmonic Distortion & Noise (THD+N) vs Frequency at -20dB (Black Trace) and -1dB (Red Trace). (24-bit/48kHz) [Moon Evolution 780D DAC]

MOON BY SIMAUDIO 780D EVOLUTION SERIES REFERENCE DAC

And where there's normally a cluster of sidebands around the 19kHz and 20kHz test signals, only an upper and lower are present in the output of the 780D, and both are around -115dB (0.00017%) down. There are some sampling-related artefacts around 44.1kHz, but they're too high in frequency and too low in level to be audible. The square wave and pulse oscillograms show that the 780D does not appear to use any custom digital filtering, just the ESS ES9018Ss' default filter.

In sum, the Moon 780D delivered truly state-of-the-art performance, with almost-perfect test results across the board in all the tests conducted by *Newport Test Labs*. Outstanding in every respect. *Steve Holding*

Readers should note that the results mentioned in the report, tabulated in performance charts and/or displayed using graphs and/or photographs should be construed as applying only to the specific sample tested.



Moon Evolution 780D DAC – Test Results – (16-bit/44.1kHz)

Analogue Output	Test Result	Units/Comment
Output Voltage	2.0802 / 2.0808	volts (Left Ch/ Right Ch)
Frequency Response	See Graphs	dB (20Hz – 20kHz)
Channel Separation	153 / 153 / 139	dB at 16Hz / 1kHz / 20kHz
THD+N	0.0015%	@ 1kHz @ 0dBFS
Channel Balance	0.0025dB	@ 1kHz @ 0dBFS
Channel Phase	0.02 / 0.00 / 0.02	degrees at 16Hz / 1kHz / 20kHz
Group Delay	180 / 5.36	degrees (1–20kHz / 20–1kHz)
Signal-to-Noise Ratio	112 / 118	dB (unweighted/weighted)
De-Emphasis Error	0.00 / 0.00 / 0.07	at 1kHz / 4kHz / 16kHz
Linearity Error @ -60.00dB / -70.00dB	0.00 / 0.06	dB (Test Signal Not Dithered)
Linearity Error @ -80.59dB / -85.24dB	0.02 / 0.01	dB (Test Signal Not Dithered)
Linearity Error @ -89.46dB / -91.24dB	0.07 / 0.03	dB (Test Signal Not Dithered)
Linearity Error @ -80.70dB / -90.31dB	0.11 / 0.03	dB (Test Signal Dithered)
Power Consumption	15.32 / 16.57	watts (Standby / On)
Mains Voltage During Testing	237V – 252V	(Minimum – Maximum)

Moon Evolution 780D DAC – Test Results – (48kHz/24-Bit)

Digital Section	Laboratory Test Result	Units/Comment
Out of Band Spurious Components	-124.232	
Suppression of Imaging Components	-118.788	(Worst Case)
Level Dependent Logarithmic Gain	0.146	
Intermodulation Distortion (1)	114.520	18kHz/20kHz 1:1 Ratio
Intermodulation Distortion (2)	114.063	41Hz/7993Hz 4:1 Ratio
Low Level Noise Modulation	18.531	Worst Case
Idle Channel Noise	-123.67	CCIR-RMS weighting
Signal-to-Noise Ratio	124.011	CCIR-RMS weighting
Power Line Products	-149.303	50Hz
Non-Linear Interchannel Crosstalk (a)	-125.560	3kHz (2nd-order ref 17kHz/20kHz)
Non-Linear Interchannel Crosstalk (b)	-127.657	6kHz (3rd-order ref 17kHz/20kHz)
Non-Linear Interchannel Crosstalk (c)	-125.036	10.040kHz (2nd re 40Hz/10kHz)
Non-Linear Interchannel Crosstalk (d)	-111.740	10.080kHz (3rd re 40Hz/10kHz)
Absolute Phase	Switchable	Normal/Inverted

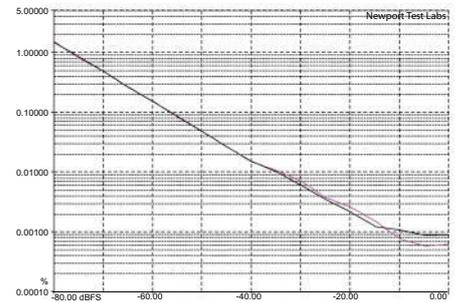
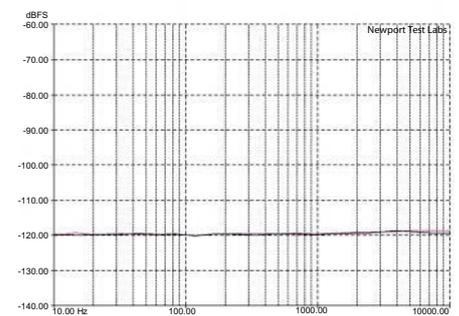


Figure 11. THD vs Level. Digital input. (24-bit/48kHz) [Moon Evolution 780D DAC]



Graph 12: Suppression of Imaging Components. Left channel (Purple Trace); Right channel (Black Trace). (24-bit/48kHz). [Moon Evolution 780D DAC]

Figure 12. Suppression of Imaging Components. Left channel (Purple Trace); Right channel (Black Trace). (24-bit/48kHz). [Moon Evolution 780D DAC]

