XiVero MusicScope

As file-based music libraries have grown in step with the plummeting price of storage, audio enthusiasts are increasingly faced with the questionable provenance of new and existing assets. Since the introduction of computer-based digital workflows, audio pros have also had to contend with myriad issues related to asset management. MusicScope is a cross-platform desktop application that addresses the need to know more—more about your music files. It plays digital audio in 10 different formats—from common to esoteric—and offers measurement and analysis functions tailored to professionals and modern audiophiles.

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It all started with oscilloscopes. Back in my youth, if you were making a record, you would often park an oscilloscope near the patch bay. That Lissajous pattern, with the left channel deflecting vertically and the right deflecting horizontally, enabled you to, at a glance, keep tabs on phase relationships since vinyl doesn't like phasey low frequency. Much later, enterprising engineer/programmers built general-purpose, real-time measurement and analysis packages for pros (e.g., Metric Halo's powerful but inscrutable SpectraFoo).

As pro audio DAWs and mastering tools moved from their Mac OS bastion across platforms to include Windows, some developers, including Merging Technologies and SEK'D, focused on a pro audio niche. The latter built the Windows–only Sonoscope, releasing it in 2001, four years after M–H Lab's 'Foo.

Sonoscope is long gone but SpectraFoo, still amazingly comprehensive, has been joined by a horde of competitors. Today's desktop and mobile computing ecosystems accommodate a wide range of measurement and analysis tools. I use excellent real-time utilities on my Android phone, but the desktop is still where most of my high-resolution audio (HRA) listening starts.

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$27.15 (€ 24.37)

XiVero's Beginnings

A relative newcomer to the pro and consumer electronics (CE) software space is XiVero GmbH with its MusicScope utility. A very small company, just three guys in Düsseldorf, Germany, XiVero was formed "…to build the first fully mobile Software Defined Radio (SDR)," said co–founder Stephan Hotto. The company's Indiegogo campaign for the SDR wasn't fully funded so, being hi–fi enthusiasts, "…it was a natural decision to extend our business into the audio world." As XiVero's DSP geek, Hotto had been developing audio DSP solutions since the 1990s and, as a bonus, the algorithms used in their radio frequency work were similar to audio frequency DSP. As a result, MusicScope was born.

XiVero bills MusicScope as a "…high precision measuring tool that works as an Audio-Microscope to visualize the different quality aspects of a music collection." Far from a singular tool, MusicScope is a multi–tool of epic proportions. It includes display of sample rate, word length, file format, plus individual and batch whole file measurement of RMS amplitude

and peak sample amplitude for both stereo and mid/side, L/R phase relationship, spectral makeup via a spectrogram, plus crest factor and peak–to–loudness ratios.

Since MusicScope also acts as a player, most of these measurements are available in real time as a file plays or as audio streams in. After you have run an analysis of a file, you can mouse around the spectrogram and receive specific metrics relative to time (see **Figure 1**).

Useful Functions

MusicScope has several useful functions for pros as well as audio enthusiasts. One is a bitscope, what XiVero calls a "bit monitor," which displays activity in each cell of the 24-bit AES data word. XiVero's bitscope has a nice additional feature, a DC offset indicator. This is especially useful with old digital recordings. In the Bad Ol' Days, consumer–class ADCs—especially Electronics Industries Association of Japan (EIAJ) adapters typified by Sony's F1—were designed with DC offset to improve their crossover distortion performance.

Cepstrum analysis is a tool that detects periodicity or repeating patterns in a frequency spectrum, which makes it useful for differentiating features that are difficult to notice in other ways. Though print through and echo are two phenomenon that cepstrum analysis can reveal, our ears are usually just as useful for that.

Another pro feature is crest factor measurement, the relationship between peak and RMS values as measured in decibels. A pure sine has a crest of 3 dB in comparison to a square wave, which has a crest factor of 0 dB. According to the documentation, heavily "…compressed and limited music can reach values below 4 dB. A good native studio master should have a maximum crest (factor) larger than 10 dB." Indeed, "The Unforgiven III," track seven of Metallica's infamous *Death Magnetic* measured a file-based crest factor of 7.6 with momentary values dropping well below 5.

Unique Features

Some of XiVero's mastering customers asked for a way to measure the momentary divergence of peak amplitude to relative loudness (PLR). MusicScope's PLR measurement is the relationship between peak amplitude to Loudness in decibels, and an indication

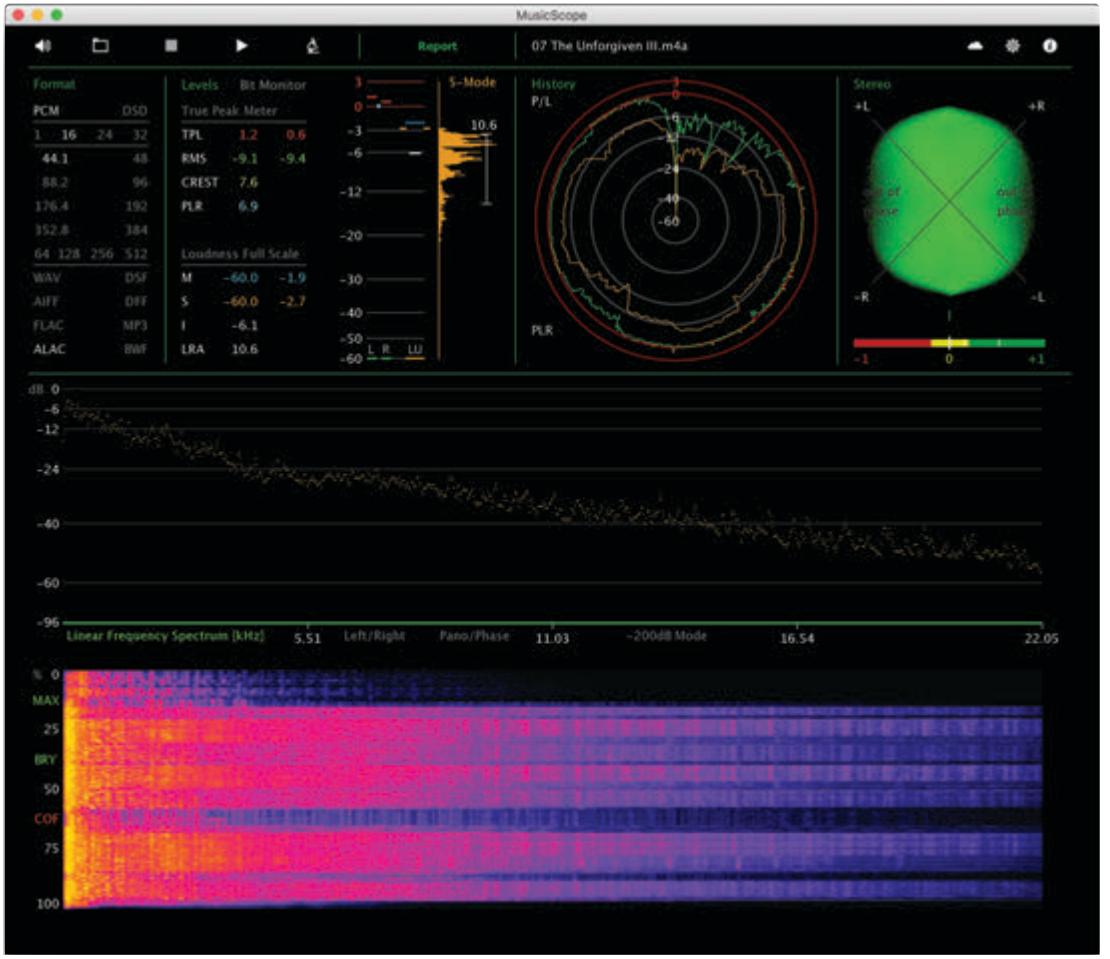

Figure 1: MusicScope's main window is rich with information.

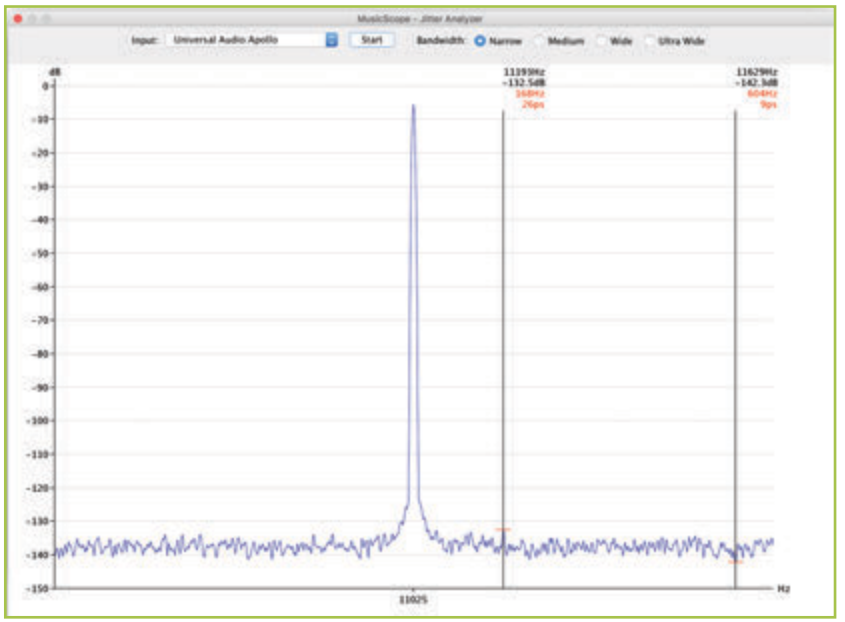

Figure 2: MusicScope's jitter measurement of Universal Audio's Apollo Twin Duo

of momentary dynamics. Hotto explained that the PLR calculation is similar to crest factor. "The crest (factor) is simply (sample) peak divided by the (instantaneous) RMS value, whereas the PLR is calculated by peak divided by (R 128) Momentary Loudness." Regarding R 128, MusicScope provides all the standard EBU–mandated loudness metrics; True Peak, Momentary, and Short Term, along with Integrated Loudness and Loudness Range (LRA).

A really useful feature which is, I think, unique to MusicScope is the free VST/AU plug-in XiVero developed to route audio to MusicScope via TCP/IP from any computer on a LAN. Hotto emphasized that MusicScope can run on one host while a DAW or plug-in-capable high-resolution audio (HRA) player is running elsewhere. As I mentioned, MusicScope can perform real-time analysis of a digital input or analog source via an external ADC or the host's line input. You can also analyze streaming services "... by routing their output via virtual audio devices into the MusicScope."

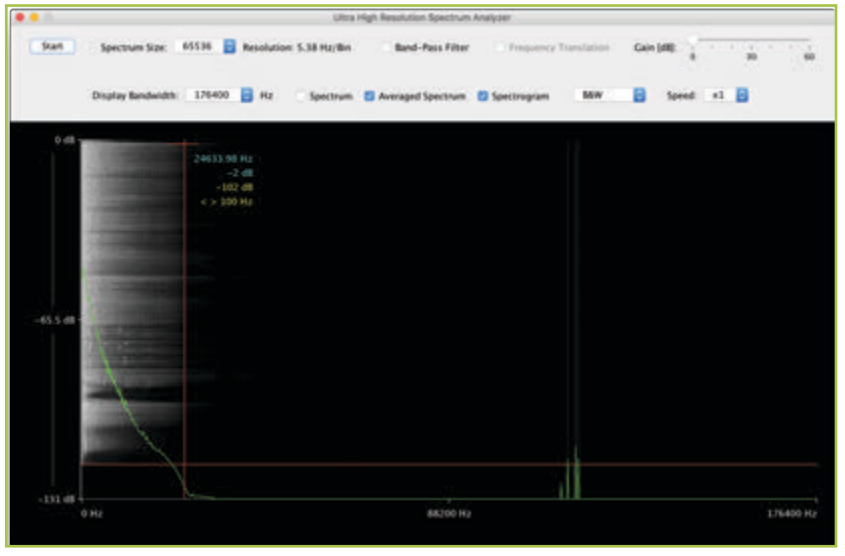

Figure 3: MusicScope's spectrum analyzer in monochrome mode

There are several functions, including a jitter estimator, a total harmonic distortion (THD) analyzer and a turntable speed measurement module, that actually require an ADC. I'm saving my turntable rebuild for this coming winter, so I really didn't want to know just how far off speed it really is, but I did try the jitter measurement function. I assumed this function, measuring a DAC's jitter, would require an ultra-clean ADC of which the user has intimate knowledge not available to the public in terms of the ADCs contributions to the parameters being measured.

I asked Hotto what practical good this feature is, and he replied that I'd be surprised to see just how good the quality of a standard sound card's line input really is. "Actually, an analog to digital converter is not that prone to jitter and it is in fact possible, due to smart averaging, to measure the harmonic spectrum of periodic jitter down to -130 dB (frequency selective). The resulting 'pico seconds' are displayed in a quite precise manner." So, I pressed my trusty Apollo Twin Duo Thunderbolt interface into service, set up the measurement, and received the graph shown in **Figure 2**.

I composited two cursor positions in that screenshot, one for a maxima at 26 pS and a minima of 9 pS. Both values aren't extraordinary but quite respectable. Though I've provided a static snapshot, the function is dynamic and provides a real-time display, once the filter settles, of the current jitter spectrum.

Testing the UHR Spectrum Analyzer Function

Another function that provides a plethora of useful information once you master it is the ultrahigh resolution (UHR) spectrum analyzer. Though not higher resolution than other ones I have, its maximum setting of 64,000 "bins" or frequency analysis bands does provide high enough visual resolution to allow you to associate short duration audible events and trends with their visual counterpart on screen (see **Figure 3**).

In **Figure 3**, the green trace is the average amplitude versus frequency. The red cursor is parked at 24.634 kHz, at the very start of the recording, where the audio is 102 dB down from 0 dBFS. Why did I pick that? To illustrate one of the many ways MusicScope enables you to determine the provenance of your music. The DXD file I analyzed, Astrognosia & Aesop (2L-111) DXD.flac downloaded from 2L's Test

THE EXPLORER

The Explorer represents the evolution of portable audio, and our refusal to accept the limitations of digital audio. Smartphones, with their mediocre DACs, integrated, noise-prone circuitry and lossy files, just don't do justice to the emotion behind our favorite music — that's why we've carefully crafted the Explorer using nothing but the the highest quality components to recreate a portable listening experience that's as close to real vinyl as it gets on-the-go.

Genuine Wood — Every Explorer is crafted from solid blocks of real hardwood, ensuring a timeless, one-of-a-kind design.

Authentic Sound — TI Burr Brown PCM1792 DAC and TPA6120A2 amp section recreate a rich, smooth, unusually spacious listening experience.

Connected — WiFi and Bluetooth connectivity allow use of apps, streaming services, and cutting-edge peripherals.

TIDAL — Every Explorer comes with a free three month trial of TIDAL HiFi, giving you unlimited access to 40 million CD-quality tracks via streaming and locally stored audio.

Echobox

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Echobox is a company founded and run by music lovers and audio geeks who believe that most portable audio gear is either low quality or overpriced, and we want to help audiophiles step into the digital age. We know that people who truly love their music are never satisfied with "good enough," and listening on-the-go should be no exception.

As a company, we believe in the power of music to change the world for the better. That's why we donate 1% of all company profits to charities that use music to make the world a better place.

Find us on **www.echoboxaudio.com.**

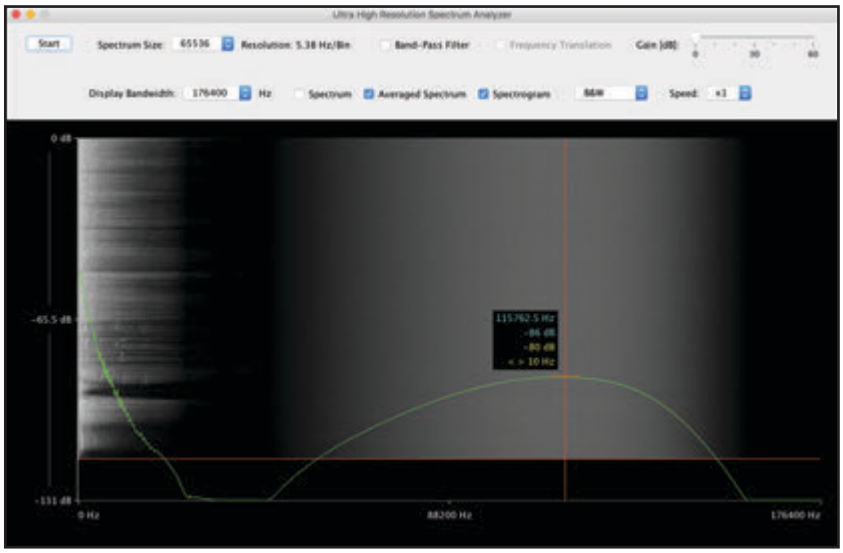

Figure 4: MusicScope illuminates the broadband ultrasonic dither that's a hallmark of the DSD format.

Bench, clearly has harmonics extending past 20 kHz. Not possible with a 44.1 kHz "Red Book" recording, this is the beauty embodied in true, born-digital HRA content.

Also notice in the DXD version, the cluster of steady state tones centered around 118.518 kHz. They are the pale vertical lines that run the length of the entire recording to the right of the red 88.2 kHz marker. That very high frequency, very low amplitude contamination (-143 dBFS at its loudest), also shows up as spikes in the averaged spectrum, in bright green, at the bottom of the trace. When asked about these artifacts, 2L's Morten Lindberg told me he has localized the phenomenon as appearing "…prior to the mic-pre in our signal path, originating either in the microphones or on transport to the Horus (ADC)." Those faint and unlikely traces are a clear example of the strange and wonderful stuff you can learn about your music with MusicScope.

Speaking of strange and wonderful, let's look at the same file transcoded by 2L from LPCM to DSD2… The seldom-mentioned dark secret of DSD is the aggressive shaped dither injected into the audio (see **Figure 4**).

That cloud of noise, from 44 to 160 kHz, is the way DSD gets around the quantization noise inherent in the 1-bit process. In a baseband DSD recording, that dither noise starts at 22 kHz, and fills up the space to 80 kHz. Very wide band electronics can sometimes treat that noise as "signal," and pass it through, maybe as far as your speakers. The result can be problematic.

Notice the "Band-Pass Filter" and "Frequency Translation" check boxes. Together, these form an interesting feature of the spectrum analyzer, providing the option to pitch shift down a band–limited selection of ultrasonic content for listening with our decidedly nonbat-like human ears. Anytime you play back DSD, MusicScope transcodes it in real time to pulse code modulation (PCM) for output through any DAC. Hotto asked me to keep in mind that, "…the MusicScope is not an audio player. The audio output is just there for monitoring reasons, although the output quality on OS X is really quite impressive." Indeed, though it gets the job done, I'd opt for a dedicated player (e.g., Amarra or Audirvana Plus) if all you want to do is listen at highest fidelity.

Can of Worms

Recording in modern high-resolution audio (HRA) formats can be a formidable challenge, and I'm not just talking about the quantity of data and metadata that an album project generates. What used to be out of band is now part of the content.

As I mentioned, MusicScope revealed some ultrasonic cruft, the technical term for unwanted information, in a 2L DXD file. I was curious about where that noise originated, so I pinged Morten Lindberg, founder and chief engineer at 2L. I was a bit surprised by his response, which basically was that he doesn't know, but isn't ignoring it. Specifically, he told me that the high-frequency noise has been the subject of investigation, "…for some time now. ;-) Until the arrival of the latest generation of DXD A/D converters, this spectrum was buried in HF [high-frequency] noise. We have located the phenomena prior to the mic–pre in our signal path, originating either in the microphones or on transport to the Horus," which is Merging Technologies' workhorse multichannel converter set. "We use high-voltage transformerless DPA microphones that makes us a bit more vulnerable to environmental influence. The amplitude and frequency of the UHF [ultra-high-frequency] resonances varies from venue to venue, so it's definitely due to an external influence. I have four candidates: acoustic, RF [radio frequency], MR [master recording] , or the noise could be riding the PSU [power supply unit] feeding the pre-polarization to the membranes. Still researching!"

Additional Display Options

There are several circular displays in MusicScope. That simple Lissajous I used to rely on has morphed into a true goniometer, displaying phase and amplitude, along with a horizontal correlation meter beneath. Another circular meter shows the progression over time of peak values, Short Term Loudness, as well as PLR for a track. As with other plots in MusicScope, you can mouse around within the circle to see a callout of the instantaneous values at that moment in time.

A vertical Loudness Histogram provides a graphical representation, in standard R 128 Loudness Units (LU), of the distribution of Momentary and Short Term Loudness, labeled as M-Mode and S-Mode respectively. The Short Term S-Mode includes an overlay of LRA to "…make the value more tangible." Both the histogram and circular history can be toggled between stereo and M/S (mid/side) modes.

The MusicScope Cloud

All modern applications must have a cloud component, and MusicScope is no exception. MusicScope Cloud is a XiVero service that enables you to upload and store albums' worth of track name, track duration, sample rate, word length, and LRA data for public inspection. For enterprise environments, MusicScope is also available in a server version, offering hot folder monitoring to automatically vet incoming audio files. Cross-platform MusicScope is certified to run on Windows 7 through 10, plus Mac OS X 10.8.3 to 10.11. I ran it on Mac OS 10.11.4 without incident.

The Downside

Not all is wonderful in the world of MusicScope… Minor complaints include, in the Settings window, the input tab showing a list of sample rates from 44.1 to 384 kHz regardless of what sample rates the selected input actually supports. The application should query the OS and display only valid choices. The UHR spectrum analyzer has several user interface (UI) issues as well. First, the window is always "on top" and isn't resizable. This means it can obscure the main UI window, which contains the transport controls. Using the bandpass filter's controls were very difficult on my host, as you must click and drag on the horizontal frequency scale to change the value. It would be much easier to control and interpret if there were direct, and more traditional, knob or slider controls for center or resonant frequency and bandwidth. Last, I would prefer to see the M-Mode and S-Mode labels replaced with "Momentary" and "Short" so as not to be confused with Mid(dle) and Side. Stephan Hotto assured me that all of my dislikes "…will be optimized with further releases."

The Verdict

If you've read this far, you are definitely a certifiable audio maniac, which implies you're a bit OCD as well. This means MusicScope was designed just for you, allowing inspection, in minute detail, of almost every aspect of your or your client's prized music collection. For a reasonable price, less than $30, you can dissect a file's production path, verifying its provenance along the way. It's a highly recommended addition to any audio geek's toolkit, so download the demo and run it around for yourself.

About the Author

Oliver A. Masciarotte has spent more than 30 years immersed in the tech space, working on facilitation, optimization, marketing, and product development for clients. As an author and speaker, Oliver enjoys sharing information about technological best practices. For additional information, visit seneschal.net and othermunday.com.