

By Bob Carver

# The Emperor's New Encoding: My Futile Quest to Authenticate MQA

Human perception is easily fooled into imagining differences that don't stand up to empirical proof. **MQA** (Master Quality Authenticated), a new Tidal Music streaming audio format, takes its place alongside mystic resonating aura crystals, magnetic bracelets and countless other miracle schemes: It is much ado about nothing...for fifty cents extra per download! It's not what reviewers heard several years ago. It is provably smoke and mirrors.

I assert that MQA is perhaps **the biggest hoax, the biggest prevarication, the biggest deceit** ever foisted off on the music listening public. To prove it, I set out to use science instead of subjective listening to determine the extent of differences between MQA and a standard CD of the same song. The results were beyond disappointing to anyone hoping for, as Robert Harley extolled in a recent *The Absolute Sound* editorial, a "paradigm shift".

## First a Bit of Background.

Late in 2014, following an Audio Engineering Society convention, Bob Stuart, co-founder of Meridian Audio, demonstrated a new lossless format called MQA to key audio journalists, using specific musical tracks and equipment in controlled listening sessions.

Writers were told that MQA was a new digital system that eliminated "time smear," increased clarity, encoded signals better than the Nyquist-Shannon Theorem (which is indisputably the fundamental underpinning of all of digital audio) and could stream songs using a slow roll-off filter that let through important ultrasonic frequencies, allowing music to sound better. There was some consensus among journalists that it sounded better than conventional CD tracks (see the Original Flavor MQA Was Tastier sidebar at right).

At the 2017 Consumer Electronics Show, Tidal officially unveiled Tidal Master with MQA, a new "tier" above Tidal Hi-Fi, which they claimed would "fundamentally change the way we all enjoy music". I personally applaud Tidal's efforts to wean listeners off MP3... as well as offer a more generous artists' royalty policy (Tidal is partially owned by rapper Jay Z). But getting involved with MQA I'm not so sure about.

## Learning About MQA.

As an amplifier and speaker designer, I am often asked to address audio clubs. A dealer asked if I would be including an MQA decoder in a future preamp. I had heard of MQA, primarily due to Robert Harley's The Absolute Sound editorials, but paid little, if any, serious attention. But now I wanted to learn more.

My first thought was to contact Robert E. Greene, a reviewer who had written about my new loudspeaker, and a seasoned veteran of things audio. Surprisingly, Robert had no specific technical knowledge of the MQA process that he could pass on: I was left to my own devices.

So, I read reviewers' and tech writers' blogs, watched several videos on MQA and even waded through the 2014 AES Convention Paper 9178 that had launched the "new" technology. It claimed "improved time/frequency balance" using "loss-less buried-data signaling within the channel to carry instructions, metadata and authentication" and "innovation-rate concepts" for reducing temporal blur. What gobbledygook, I thought.

The patents that had been filed were of little additional help (see the Patent Medicine sidebar on the next page). It was time for some serious testing.

## The Null Test. She Don't Lie.

Now, it's difficult to view an audio waveform on even the finest electronic test equipment and know much about the music it represents. Beethoven looks the same on an oscilloscope as Mozart. Making mean assertions about MQA using standard tests would immediately get batted down by cynics.

Luckily, there is an incontrovertible way to compare two version of the same audio. Done

## Original Flavor MQA Was Arguably Tastier.

What you hear when you download a Tidal Master-encoded song is definitely *not what audio reviewers heard during initial demos* and wrote about a year ago. The original sample tracks — I call them "MQA-1" — were clearly stated to be "on loan" with instructions to return them to the company or destroy the files when finished. Or journalists heard MQA in the presence of the master, Bob Stuart, who gave a wonderful demonstration. I was fortunate enough to get access to some of these files.

I had been struck by journalists' exclamations of great sound and I had to agree when I critically listened to MQA-1. Each writer spoke of greater stage depth, clarity, and a more immersive listening experience, often with greater detail and realism. It was spooky because 35 years ago, a previous generation of highly respected audio writers had used all but identical language to describe a technology I developed.

Based on the descriptions, I concluded that MQA-1 used a mild form of my Sonic Holography, a psycho-acoustic analog circuit and not at all digital. I set out to dissect MQA-1. Hacking the digital side would have required the combined efforts of the CIA and the FBI; it was far beyond my ability. But hacking an analog signal is another, simpler matter. I found out with virtual certainty why MQA-1 sounds better than the original stereo audio file it uses an audio psychoacoustic circuit known as acoustic crosstalk cancellation. It was easy for me to hear because I have spent many years of my life designing and listening to exactly such a signal. While most people are unable to identify it, they do hear the results.

Acoustic crosstalk cancellation will, if implemented and demonstrated artfully, almost always sound better than straight stereo. It allows our ear-brain to hear things the way we hear live sounds in real space and in the real world. Acoustic crosstalk cancellation is not new. My implementation, called Sonic Holography, became the largest selling product at Carver Corporation, both in unit volume and revenue volume.

The critical take-away here is not a back-pat for something I once perfected. Rather it's the fact that MQA-1's "enhanced sense of depth, space and clarity" were far more likely to have come from the proven signal processing phenomenon of crosstalk cancellation than due to magic filters and bit depth tricks. Signal processing should be an optional process — like the on/off Sonic Hologram Generator button on my old preamps — not anonymously concealed in the encoding.

## MQA Patent Medicine.

Available on-line from the Patent Office, the first MQA-related patent shows a simple folding technique that trades bits for bandwidth. Folding is old hat, a simple scheme to trade signal-to-noise for extended bandwidth. This is done by reducing the bit depth from 24 bits to 13 bits, a huge hit for the signal-to-noise ratio.

What Stuart does is compact a 96k sample-per-second, 24-bit file down to only 13 bits. Worse, when it's un-compacted without the benefit of an MQA decoder, we are forced to listen at a mere 48k samples per second. Bottom line, Stuart has taken a perfectly good hi-resolution file of 24/96 and made it substandard at 17/96. And that's if you pay extra! If you don't pay extra, you are forced to listen at 13/48...probably worse than MP3, and substantially worse than CD quality at 16/44!

The second patent shows how to use Digital Management to recover the audio file using an MQA decoder. We get a 13-bit, 48k samples-per-second-file (13/48) for the standard price and we don't need an MQA decoder. Now, by paying extra we get to hear the file (though a hardware or software MQA decoder) at the "improved" 17 bits — but still substantially less than the 24-bit, hi-res file it started out to be.

Meridan calls this Versatile Music Distribution and it's worth a lot of money in terms of music rights and artists' royalties if MQA were to catch on.

Versatile maybe. Intrusive definitely. The remaining seven bits are used to keep track of each customer through a variety of interrogations of their computer including its IP address, time and place of streaming, time and place of any download (forbidden, and a felony in the US), computer registration and the computer's owner!

And of course, whether or not the customer has paid for Tidal Master or not. And you were just worried about Google and Facebook getting all your personal information...yikes!

properly, the Null Test is the perfect mathematical proof that two audio signals are identical. Also called a Difference Test, Null Testing demonstrates that two audio streams are identical when the difference signal is exactly zero.

On the surface, this is quite simple: Just mix two signals together while flipping the polarity of one of them. If the result is pure silence, the two signals are equal, bit by bit.

Actually, in the digital domain, this is more complicated than it might first seem. If two waveforms are off by just one sample — even at mind-boggling sample rates like 768 kHz — the null test won't be valid.

I turned to a very expert colleague, Ronald Brandt, to do the actual Null Test.

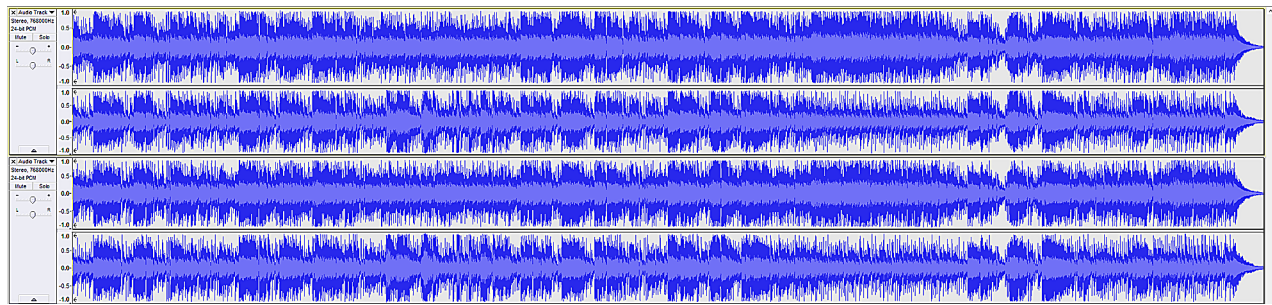
Tidal Master Track (MQA) and non-MQA Tidal Hi-Fi tracks were downloaded from the web; the identical songs were accessed from "traditional" 16-bit/44 kHz compact discs, and 24-bit/192 kHz versions.

Ron is meticulous and left nothing to chance. He spent far more hours in a Digital Audio Workstation program, recording, editing, eliminating timing drift and signal inverting than he did doing the actual comparison. After all this effort, he created a digital transfer recording of the resulting null that totally bypassed analog stages.

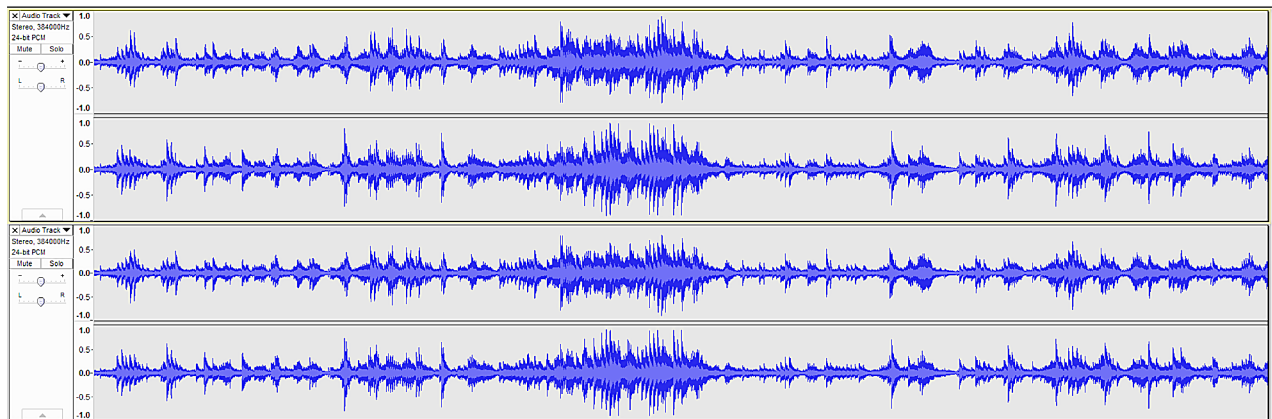
Before we go any farther, let's make sure you understand what we mean by "null". Null difference testing consists of combining two different signal sources with identical levels, but out of phase by exactly 180 degrees. If the two signal sources are 100% identical, no sound will be heard — they've perfectly cancelled each other out. If sound is heard, the two signals have different properties and the differences are what's audible. Null testing is absolutely indisputable. It's pure mathematics at work: 1 plus minus 1 equals zero.

Ron began with CD and Tidal MQA versions of

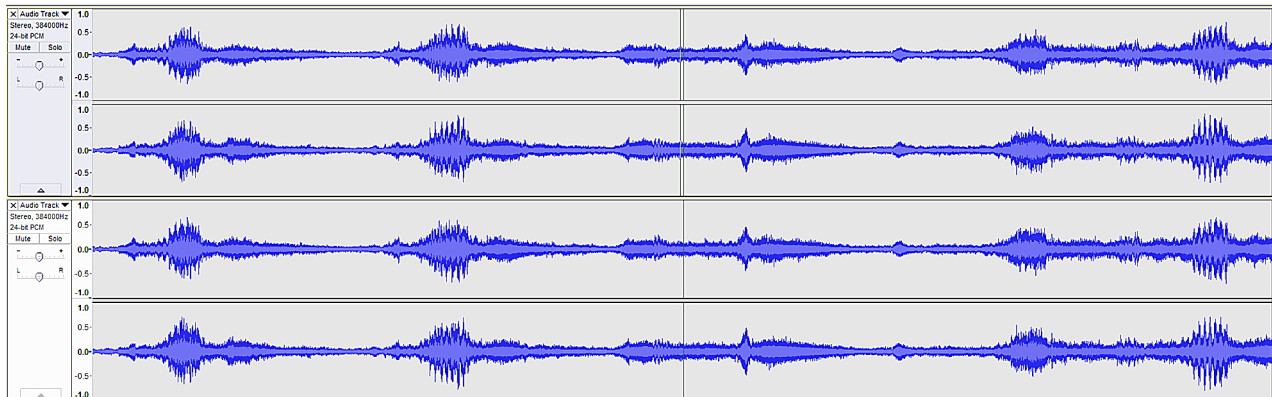
some different genres of musical material.



An Emmy Lou Harris track, CD (upper two waveforms) and MQA (lower two waveforms)



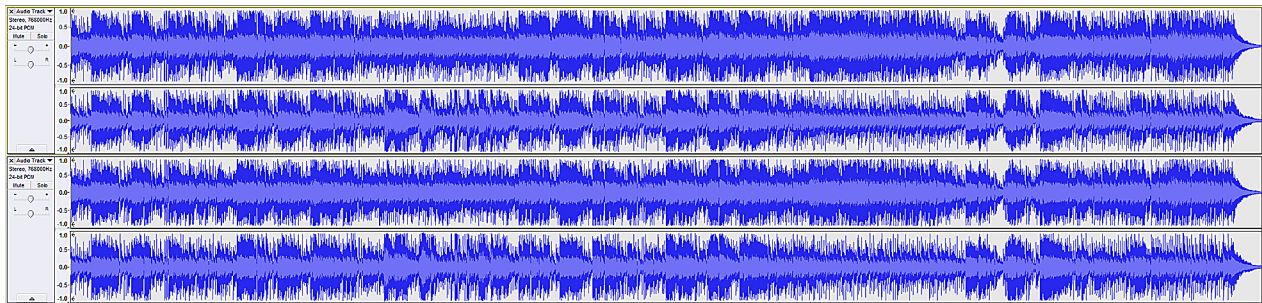
Piano improvisation, CD (upper two waveforms) and MQA (lower two waveforms)



Magnificat, CD (upper two waveforms) and MQA (lower two waveforms)

Both versions of the signals were then fed to both a Meridian Explorer 2 and Mytec Brooklyn DACs, MQA versus CD. MQA-on versus MQA-off. Care was taken to make sure the null was evaluated at the loudest part of recording where the brick wall limiter applied to the master was being ridden quite hard.

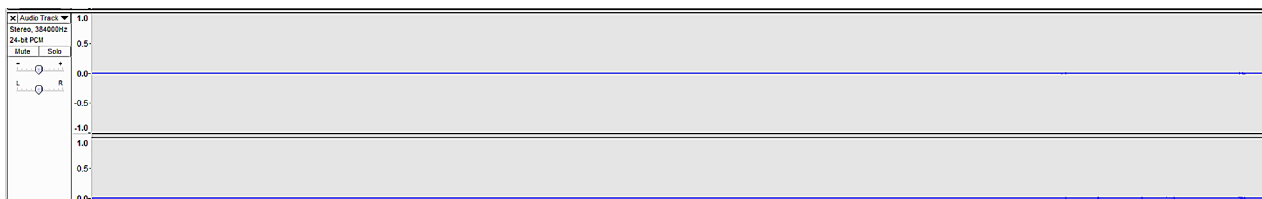
Then the actual null test was performed on the same test equipment. Any differences between the CD and MQA versions would result in a waveform consisting only of those differences. The null test results are not visually exciting, but VERY conclusive.



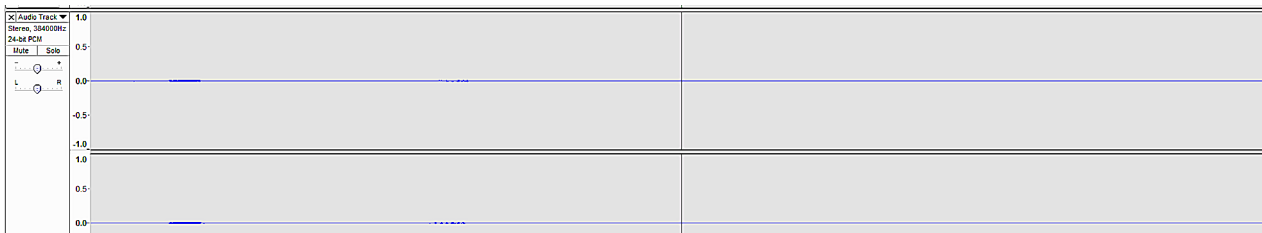
The two versions of Emmylou Harris yielded...



...a tiny but inaudible difference (the fuzzy parts of the blue lines).



There was even less difference between CD and MQA versions of our other examples. Those flat lines mean the signals were truly identical.



**BOTTOM LINE:** MQA was the same audio signal that was contained in the original signal source. By “the same”, I mean that it yields an approximate  $-70$  dB null when compared to the original source. Personally, I am unable to hear a difference between them once the null is  $-50$  dB. At  $-70$  dB, even a passing bat would not be able to hear any differences.

### Why My Attorney Had to Review This Before I Published It.

There is no enhancement and nothing special with Tidal Master MQA. If you listen to the streaming of a stock song and compare it to an MQA streaming of the same song, they sound the same.

The experiences reported by reviewers was an early version of MQA “doctored” with cross-talk cancellation. The signal available to the

public contains none of that. It's just an ordinary copy of the original. It does not work by getting rid of "pre-ringing". It does not work by "turning Shannon/Nyquist on its head," though several knowledgeable people that should know better. It is a pass-through with simple noise shaping (nothing new in itself) that reduces the apparent signal-to-noise ratio in a way that is good. MQA is a paradigm shift only in the sense that it allows Tidal to violate the listener's privacy.

I regret that the reviewers and audio journalists have been unwittingly caught in a big hoax — what they heard did indeed sound different. My fear is that customers now will think they are getting something very special like the sound the reviewers experienced and wrote about., but what they are really getting is nothing significantly different from the original. By that measure, MQA is a hoax and a big lie!

**Bob Carver • Fall 2017**

**Note: In order to maintain legibility of the null waveform screenshots, we saved this PDF with higher-than-normal image resolution. Sorry for the longer download time.**

The logo for Bob Carver Corporation features the name "Bob Carver" in a large, stylized, cursive script. To the right of the name, the word "CORPORATION" is written in a smaller, all-caps, sans-serif font. A horizontal line extends from the end of the cursive signature.

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