Subject: Is 16/44 high enough?
Posted by SASAudioLabs on Tue, 28 Jul 2009 22:27:14 GMT
View Forum Message <> Reply to Message

Dear Gents,

I created a new topic, so please disregard my response under "Vinyl vs CD".

If I may I would like to present some papers from Dr. Kunchur from the University of South Carolina. These papers took 5 years to complete and I will let Dr. Kunchur state the rigors of creating them. (I created more paragraphs to make it easier to read.)

"An experiment has to be carefully thought out and then submitted as a proposal to an Institutional Review Board (IRB) and approved by them before it can even begin. Then optimum equipment, methods, and a multitude of cross checks has to be developed (if you read my papers in their entirety, you will appreciated what went in).

The results, analysis, and conclusions are then carefully considered and discussed with colleagues who are experts in their related interdiscplinary fields; for this I went in person to various universities and research institutes and met with people in departments of physics, engineering, psychology, neuroscience, music, communications sciences, physiology, and materials science.

After that the results and conclusions were presented at conferences of the Acoustical Society of America (ASA), Association of Research in Otolaryngology (ARO), and American Physical Society (APS). Seminars were also made at numerous universities and research/industrial institutions (please see the list on my web site).

After each presentation, the audience is free to tear apart the conclusions and ask all possible questions. Eminent people such as presidents of the above mentioned societies and corporations (ASA, ARO, Bose corporation, etc.) have been present during my presentations.

After passing through this grueling oral presentation process, written manuscripts were then submitted to journals. There, anonymous referees are free to attack the submission in any way they want. More than a dozen referees and editors have been involved in this journal refereeing process.

Only after everyone is satisfied with the accuracy of the results and all statements made in the manuscript, are the papers published in the journals. The entire process took around 5 years from initial concept to refereed publications."

Here are a couple of quotes from "Probing the temporal resolution and bandwidth of human hearing".

"Furthermore the present work shows that typical instrumentation

used in psychoacoustic research may, for some purposes, have insufficient temporal speed and bandwidth. Also this
work proves that that digital sampling rates used in consumer audio are insufficient for fully preserving transparency."

"CONCLUSION
This research found audibility of temporal alterations on a
~5 US (microsecond) time scale. On the one hand this confirms
anecdotal claims in high-end audio that performance in the ultrasonic range is required to maintain fidelity in the
audible range. On the other hand it also points to the need for higher bandwidths in apparatus used in psychoacoustic
research for certain types of experiments, so that the thresholds measured are not affected by the limitations of the
equipment."

Here are some links to Dr. Kunchur's credentials.

Resume:
http://www.physics.sc.edu/kunchur/resume.pdf

Links page to papers.
http://www.physics.sc.edu/kunchur/Acoustics-papers.htm

http://www.physics.sc.edu/kunchur/

Further explanation of Papers.

http://www.physics.sc.edu/kunchur/papers/FAQs.pdf

Take care.

Steve

Subject: Re: Is 16/44 high enough?
Posted by Wayne Parham on Tue, 28 Jul 2009 22:53:03 GMT
View Forum Message <> Reply to Message

Interesting. I will read these later this evening when I have time. I am assuming there must have been DBT group studies done, and there was a statistically significant number of people that preferred higher resolution recordings. Is that the case, in a nutshell? If so, it makes a good case for higher bitrates and for analog. I know I definitely prefer BluRay and DVD sound to standard CD, and well recorded/mastered/pressed vinyl is even better still.

Subject: Re: Is 16/44 high enough?
Posted by SASAudioLabs on Wed, 29 Jul 2009 19:45:00 GMT
View Forum Message <> Reply to Message

Wayne Parham wrote on Tue, 28 July 2009 17:53
Interesting. I will read these later this evening when I have time. I am assuming there must have been DBT group studies done, and there was a statistically significant number of people that preferred higher resolution recordings. Is that the case, in a nutshell? If so, it makes a good case for higher bitrates and for analog. I know I definitely prefer BluRay and DVD sound to standard CD, and well recorded/mastered/pressed vinyl is even better still.

Yes, I agree Wayne. Many audiophiles/music lovers have known for years that ultra sonics was needed. Even the RCA Radiotron Designers Handbook indirectly approaches the subject back in the 50s or sooner.

Years ago I was experimenting in the ultrasonic region for several months, mainly above 100khz. In one experiment I was changing the response from -1db at approximately 200khz to -1db at approximately 150khz (added less than 100pf cap. for this change) and noted the sonic difference over and over.

Take care.
Steve

Subject: Re: Is 16/44 high enough?
Posted by Wayne Parham on Wed, 29 Jul 2009 20:18:22 GMT
View Forum Message <> Reply to Message

I wonder if it's the untrasonics or possibly the waveshape or distortion. In a way, these are all ways of saying the same thing because harmonics would be shifted up out of the (traditionally recognized 20-20kHz) passband and waveshape modifiers can be expressed as (Fourier series) harmonics.

On the other hand, it could be that the real issue is something like non-linearity, where it may be that the audible thing isn't so much the high frequency harmonics as it is the non-linearity itself - the harmonics are just one way of seeing the non-linearity, a side effect, if you will.

Subject: Re: Is 16/44 high enough?
Posted by SASAudioLabs on Thu, 30 Jul 2009 14:46:57 GMT
View Forum Message <> Reply to Message

Wayne Parham wrote on Wed, 29 July 2009 15:18

I wonder if it's the untrasonics or possibly the waveshape or distortion. In a way, these are all ways of saying the same thing because harmonics would be shifted up out of the (traditionally recognized 20-20kHz) passband and waveshape modifiers can be expressed as (Fourier series) harmonics.

On the other hand, it could be that the real issue is something like non-linearity, where it may be that the audible thing isn't so much the high frequency harmonics as it is the non-linearity itself - the harmonics are just one way of seeing the non-linearity, a side effect, if you will.

I can see other possibilities as well, such as overall rise time changes? Whatever it is, or combination you and I have pointed out, I would rather be on the safe side.

Here is some more information from Dr. Kunchur's papers.

"The temporal resolution and high-frequency audibility
of human hearing are complex issues of both fundamental
and practical significance. While the single-tone highfrequency
threshold fmax for airborne stimuli is around 18
kHz in individuals with good hearing (Pumphrey, 1950;
Hall, 2002), a much higher bandwidth and temporal acuity
can play a role in the complete perception of the timbre
of sound.

Neural processing beyond the cochlea can permit

expected for a linear system. In binaural localization by interaural
time difference, it is well known that differences in

1974; Nordmark, 1976). Monoaural experiments involving
iterated ripple noise (IRN) and inter-pulse gaps have
shown similar thresholds in temporal resolution (Krumbholz,
2003; Leshowitz, 1971).

A similar sensitivity for temporal
fine structure can be inferred from the discriminability
of the virtual pitch of complex tones (Moore et al., 2006;
Gockel et al., 2006).

It also appears that the cochlea may
sense ultrasonic stimulation if the latter manages to reach
the cochlea in sufficient intensity, both when presented
through the air (Henry and Fast, 1984; Ashihara et al.,
2006) but especially when presented through bone conduction
(Corso, 1963; Deatherage et al., 1954; Lenhardt et al.,
1991; Lenhardt, 1998).

It has also been conjectured that
such high level ultrasound may possibly change the perception
of timbre when superimposed on audible harmonics
(Oohashi et al., 1991; Yoshikawa et al., 1995). Additionally,
restricting the bandwidth by low-pass filtering necessarily
attenuates all frequencies to some extent, and hence
spectral amplitude changes can never be avoided absolutely

timbre will depend on their magnitudes relative to the
relevant just noticeable differences. For these reasons it can
be expected that limiting the bandwidth of an audio signal
by low-pass filtering may produce an audible change, even

well above fmax. The present work experimentally confirms
this to be true, and at intensity levels and time constants
much lower than suspected possible before."

Of all the possibilities both you, me, Dr. Kunchur have presented, I want to play it safe and go beyond the bare minimum.

Take care and thanks.
