FinalCD SRC With & Without Ultrasonic Filtering-Log
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(Links to all software used are at thee bottom.)
Objective:
Get "Best" sounding 96kHz to 48kHz and 44.1kHz Sample Rate Conversion Using FinalCD.
Description:
Demonstrating the various tradeoffs between sharp filtered SRC which limits bandwidth and introduces "Ringing" while eliminating aliasing intermodulation distortion, and moderate filtered SRC which retains more bandwidth and limits "Ringing" while introducing aliasing intermodulation distortion.
Ringing- An unwanted level of un-even brightness.
Aliasing intermodulation distortion- An unwanted distortion that "Muddys" the sound.

Software:
FinalCD v0.29 ©Tom Browne

TDR Ultrasonic Filter ©Tokyo Dawn Labs

Airwindows Hypersonic/HypersonX & Ultrasonic/Ultrasonx ©Chris Johnson

Airwindows "Dark" Dither ©Chris Johnson Set to 16bit on master buss. (This is my preferred 16bit dither as of this test.)

[At this time FinalCD filter options are: 48kHz- Sharp (f0), Light (f1) and 44.1kHz Sharp(f0), Light (f1) , Goldilocks (f2) Inbetween Other 2 filters]
FYI: All of the mentioned software is available freely and can enable anyone to conduct similar tests without hindrance. *******

Apllication:
Test file is 01Md_32-96.wav a 24bit/96kHz wave sound file Converted to 32-bit float.

Test set 01 **96kHz -> 48 kHz this is a "simpler" integer conversion and resulting wave files are slated for MP3, AAC, and Opus conversions.**

Test set 02 **96kHz -> 44.1 kHz this is a "complex" integer conversion and resulting wave files are slated for Compact Disk creation.**

All SRC conversions will remain in 32bit negating application of dither/word reduction. Listening will be through Airwindows "Dark" Dither

Test Set 01
Candidate# 01: FinalCD Sharp
FinalCD.exe /32 /f0 /d0 /o48000 01Md_32-96.wav 01Md48_Can-01.wav

Candidate# 02: FinalCD Light
FinalCD.exe /32 /f1 /d0 /o48000 01Md_32-96.wav 01Md48_Can-02.wav

Candidate# 03: 01Md_32-96.wav -> TDR Ultrasonic Fq: 21kHz Slp: 75% Amt: 100% (Default) -> 01Mdu_32-96.wav
FinalCD.exe /32 /f0 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-03.wav

Candidate# 04: 01Md_32-96.wav -> TDR Ultrasonic Fq: 21kHz Slp: 75% Amt: 100% (Default) -> 01Mdu_32-96.wav
FinalCD.exe /32 /f1 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-04.wav

Candidate# 05: 01Md_32-96.wav -> TDR Ultrasonic Fq: 20kHz Slp: 100% Amt: 100% (Hard) -> 01Mdu_32-96.wav
FinalCD.exe /32 /f0 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-05.wav

Candidate# 06: 01Md_32-96.wav -> TDR Ultrasonic Fq: 20kHz Slp: 100% Amt: 100% (Hard) -> 01Mdu_32-96.wav
FinalCD.exe /32 /f1 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-06.wav

Candidate# 07: 01Md_32-96.wav -> TDR Ultrasonic Fq: 22kHz Slp: 50% Amt: 100% (Intermediate) -> 01Mdu_32-96.wav
FinalCD.exe /32 /f0 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-07.wav

Candidate# 08: 01Md_32-96.wav -> TDR Ultrasonic Fq: 22kHz Slp: 50% Amt: 100% (Intermediate) -> 01Mdu_32-96.wav
FinalCD.exe /32 /f1 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-08.wav

Candidate# 09: 01Md_32-96.wav -> TDR Ultrasonic Fq: 23kHz Slp: 30% Amt: 100% (Light) -> 01Mdu_32-96.wav
FinalCD.exe /32 /f0 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-09.wav

Candidate# 10: 01Md_32-96.wav -> TDR Ultrasonic Fq: 23kHz Slp: 30% Amt: 100% (Light) -> 01Mdu_32-96.wav
FinalCD.exe /32 /f1 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-10.wav

Candidate# 11: 01Md_32-96.wav -> TDR Ultrasonic Fq: 21kHz Slp: 100% Amt: 60% (Steep and reduced) -> 01Mdu_32-96.wav
FinalCD.exe /32 /f0 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-11.wav

Candidate# 12: 01Md_32-96.wav -> TDR Ultrasonic Fq: 21kHz Slp: 100% Amt: 60% (Steep and reduced) -> 01Mdu_32-96.wav
FinalCD.exe /32 /f1 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-12.wav

Candidate# 13: 01Md_32-96.wav -> TDR Ultrasonic Fq: 21.5kHz Slp: 65% Amt: 100% (User 01) -> 01Mdu_32-96.wav

FinalCD.exe /32 /f1 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-13.wav

Candidate# 14: 01Md_32-96.wav -> TDR Ultrasonic Fq: 20kHz Slp: 65% Amt: 100% (User 02) -> 01Mdu_32-96.wav
FinalCD.exe /32 /f1 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-14.wav

Candidate# 15: 01Md_32-96.wav -> TDR Ultrasonic Fq: 22kHz Slp: 100% Amt: 100% (User 03) -> 01Mdu_32-96.wav
FinalCD.exe /32 /f1 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-15.wav

Candidate# 16: 01Md_32-96.wav -> TDR Ultrasonic Fq: 22kHz Slp: 30% Amt: 100% (User 04) -> 01Mdu_32-96.wav
FinalCD.exe /32 /f0 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-16.wav

Candidate# 17: 01Md_32-96.wav -> Airwindows Ultrasonic Lite-> 01Mdu_32-96.wav
FinalCD.exe /32 /f0 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-17.wav

Candidate# 18: 01Md_32-96.wav -> Airwindows HypersonX G-> 01Mdu_32-96.wav
FinalCD.exe /32 /f0 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-18.wav

Candidate# 19: 01Md_32-96.wav -> FinalCD Dither
FinalCD.exe /16 /f0 /d1 /o48000 01Md_32-96.wav 01Md48_Can-19.wav

Candidate# 20: 01Md_32-96.wav -> TDR Ultrasonic Fq: 21.5kHz Slp: 65% Amt: 100% (User 01) -> 01Mdu_32-96.wav
FinalCD.exe /32 /f0 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-20.wav

Candidate# 21: 01Md_32-96.wav -> TDR Ultrasonic Fq: 20.5kHz Slp: 65% Amt: 100% (User 05) -> 01Mdu_32-96.wav
FinalCD.exe /32 /f0 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-21.wav

Candidate# 22: 01Md_32-96.wav -> Airwindows HypersonX E-> 01Mdu_32-96.wav
FinalCD.exe /32 /f0 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-22.wav

Candidate# 23: 01Md_32-96.wav -> Airwindows Ultrasonic-> 01Mdu_32-96.wav
FinalCD.exe /32 /f0 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-23.wav

Candidate# 24: 01Md_32-96.wav -> Airwindows UltrasonX E-> 01Mdu_32-96.wav
FinalCD.exe /32 /f0 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-24.wav

Candidate# 25: 01Md_32-96.wav -> Airwindows Hypersonic-> 01Mdu_32-96.wav
FinalCD.exe /32 /f1 /d0 /o48000 01Mdu_32-96.wav 01Md48_Can-25.wav

Test Set 01 **Conclusion Thursday, May 01, 2025:**
Listening tests were conducted over three days with long breaks in-between 1/2-hour sessions.

Though many of the candidates showed pleasing results and any conclusion would have to be fairly subjective, in this engineer's humble opinion, Candidate #23 gives the best overall compromise. Filtering with Airwindows Ultrasonic filter before FinalCD brickwall (f0 option) SRC, seems to mitigate "ringing" and comes closest to FinalCD gentle (f1 option) with the benefits of no IMD/aliasing. There were many options not tried, Airwindow UltrasonX and HypersonX have many settings and TDR Ultrasonic Filter is customizable with many more possibilities. As I understand it, Airwindows filters introduce minute phase shift while TDR does not; perhaps that is why the Airwindows filter seems more "Analog" to me.
Another finding was that some filter settings of both TDR and Airwindows introduced more "Ringing" when coupled with FinalCd Brickwall.

Test Set 02
Test Set 02 is not as comprehensive and is based on the findings of Test Set 01. A more concise investigation would require an equal amount of testing, which, was not done by this engineer.

Candidate# 26: 01Md_32-96.wav -> FinalCD Sharp
FinalCD.exe /32 /f0 /d0 01Md_32-96.wav 01Md44_Can-26.wav

Candidate# 27: 01Md_32-96.wav -> FinalCD Light
FinalCD.exe /32 /f1 /d0 01Md_32-96.wav 01Md44_Can-27.wav

Candidate# 28: 01Md_32-96.wav -> FinalCD Goldilocks
FinalCD.exe /32 /f2 /d0 01Md_32-96.wav 01Md44_Can-28.wav

Candidate# 29: 01Md_32-96.wav -> Airwindows Ultrasonic-> 01Mdu_32-96.wav
FinalCD.exe /32 /f0 /d0 01Mdu_32-96.wav 01Md44_Can-29.wav

Candidate# 30: 01Md_32-96.wav -> Airwindows Ultrasonic-> 01Mdu_32-96.wav
FinalCD.exe /32 /f1 /d0 01Mdu_32-96.wav 01Md44_Can-30.wav

Candidate# 31: 01Md_32-96.wav -> Airwindows Ultrasonic-> 01Mdu_32-96.wav
FinalCD.exe /32 /f2 /d0 01Mdu_32-96.wav 01Md44_Can-31.wav

Test Set 02 **Conclusion Friday, May 02, 2025:**
Listening test was conducted in a single session. In this engineer's humble opinion, Candidate #29 gives the best overall compromise.

*** *FinalCD Musings:***

It would be interesting if FinalCD offered a "Goldilocks" Setting For 48 kHz conversions especially in light of the ubiquitous 16bit 48 kHz format.

I may be wrong but Dark Dither (And all Airwindows Dithers) is/are open source code that could be incorporated into the Dither option in FinalCD.

FinalCD double precision (64 bit Float) rendering to 32 bit float can be dithered (Though is probably non-perceptible (?)). Airwindows Float Point plugin demonstrates a 64bit to 32bit dither, and again is open source.

Software used for this test:

FinalCD
http://www.sonicillusions2.co.uk/finalcd.htm

TDR Ultrasonic Filter VST
https://vladgsound.wordpress.com/2014/12/21/tdr-ultrasonic-filter-alpha-version/

Airwindows VST
(Note: Download the entire plugins package to be assured of the latest builds!)
https://www.airwindows.com