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**APPENDIX C: PSYCHOACOUSTIC FILTER**

The psychoacoustic filter in the CS5396 is based on the paper: "Robert A. Wannamaker, Psychoacoustically Optimal Noise Shaping, Journal of the Audio Engineering Society, Vol 40, No 7/8, 1992 July/August." The default coefficients in the CS5396 are the FIR 9-tap filter coefficients described in Table 3 of the paper. Since the effective noise shaping function is (1-H), the CS5396 registers save the (1-H) function coefficients. Therefore, the negative of each filter coefficient is stored in the registers. Each coefficient is represented as a binary 2's complement number where the 4 MSB's represent the whole number of the coefficient and the 4 LSB's represent the fractional portion truncated to 4 binary bits.

Default Coefficients as listed in "Robert A. Wannamaker, Psychoacoustically Optimal Noise Shaping"

a1 = 2.412  
a2 = -3.370  
a3 = 3.937  
a4 = -4.174  
a5 = 3.353  
a6 = -2.205  
a7 = 1.281  
a8 = -0.569  
a9 = 0.0847

Coefficient conversion example 1:

a1 = 2.412

a1 = (0010.0110) binary representation with the fractional portion truncated to 4 bits.

-a1 = -(0010.0110) binary representation

-a1 = 1101.1010 in two's complement

this value is stored in register 10h.

Coefficient conversion example 2:

a2 = -3.370

-a2 = 3.370

-a2 = 0011.0101 binary representation with the fractional portion truncated to 4 bits.

-a2 = 0011.0101 in 2's complement

this value is stored in register 11h.

**PSYCHO-ACOUSTIC FILTER COEFFICIENTS**

7	6	5	4	3	2	1	0
MSB	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	LSB

Access:

R/W in I2C and write only in SPI

*Filter coefficient a1 (address 10h)*

*Filter coefficient a2 (address 11h)*

*Filter coefficient a3 (address 12h)*

*Filter coefficient a4 (address 13h)*

*Filter coefficient a5 (address 14h)*

*Filter coefficient a6 (address 15h)*

*Filter coefficient a7 (address 16h)*

*Filter coefficient a8 (address 17h)*

*Filter coefficient a9 (address 18h)*

Default:

a1 - 1101 1010

a2 - 0011 0101

a3 - 1100 0010

a4 - 0100 0011

a5 - 1100 1011

a6 - 0010 0011

a7 - 1110 1100

a8 - 0000 1001

a9 - 1111 1111