

# Audio Devices

The support provided through the Microsoft Universal Audio Architecture (UAA) initiative, in combination with PC audio device technologies, is key to delivering a simple, yet compelling user experience with audio on Windows-based PCs. Compliance with one of the audio technologies such as USB Audio, HD Audio, and 1394 Audio, supported by the UAA initiative is required for Windows Vista logo.

These requirements focus on the implementation of specification-compliant PC audio technologies and UAA device class drivers. This section includes requirement details for both the HD Audio codec and controller and additional requirements not specified in Intel High Definition Audio Controller Specification.

For a list of applicable references for this section, see Appendix A.

## Audio Devices

Audio devices must meet all applicable requirements in the "Device Fundamentals" section of this document.

<b>AUDIO-0006</b>		Audio solution delivers a premium high-fidelity audio experience		
Effective Date:	June 1, 2006		<b>Client Devices</b>	<b>Server Devices</b>
Old ID:	AUD-DEV-67	Basic Logo		
Status:	Locked	Premium Logo	R	

Audio solution, either integrated or add-on discrete streaming audio device, must meet the following premium high-fidelity audio requirements. Measurements are performed electronically (not in-air) for all the below defined device types when they exist on the device/system. Frequency sweep and/or multi-tone test methods may be used when appropriate. The Device Types in the tables reflect those defined by the Intel HD Audio Spec and the Microsoft HD Audio Pin Configuration Programming Guidelines.

### For premium desktop implementations:

Device Type	Requirement	Value	Frequency range at 48KHz and above (4)
Analog Line Output Jack	THD+N	<= -80 dB FS	[20 Hz,20 KHz]
	Dynamic range with signal present	<= 90 dB FS <i>A-weight</i>	[20 Hz,20 KHz]
	Magnitude Response	<=+- .25 dB ripple (.5dB peak to peak delta), 1 dB at upper band edge, 3dB at lower band edge	[20 Hz,20 KHz] (5)
	Sampling frequency accuracy	0.02%.	
	Line output cross-talk	<= -70 dB	[20 Hz,20 KHz]
	Full scale output voltage	>= 1 Vrms	
	Noise level during system activity	<=-90 dB FS <i>A-weight</i>	

Device Type	Requirement	Value	Frequency range at 48KHz and above (4)
	Interchannel phase delay	30 degrees or 12.5 microseconds, whichever is greater	[20 Hz,20 KHz]
Analog Speaker Output Jack (Example: 125mW into 8 Ohm load)	THD+N	<= -75 dB FS	[20 Hz,20 KHz]
	Dynamic range with signal present	<= 90 dB FS <b>A-weight</b>	[20 Hz,20 KHz]
	Magnitude Response	<= +/- .25 dB ripple (.5dB peak to peak delta), 1 dB at upper band edge, 3dB at lower band edge	[20 Hz,20 KHz] (5)
	Sampling frequency accuracy	0.02%.	
	Line output cross-talk	<= -70 dB	[20 Hz,20 KHz]
	Full scale output voltage	>= 1 Vrms	
	Noise level during system activity	<=-90 dB FS <b>A-weight</b>	
	Interchannel phase delay	30 degrees or 12.5 microseconds, whichever is greater	[20 Hz,20 KHz]
Analog Headphone Out Jack	THD+N	<= -75 dB FS <=-55 dBFS at 32 Ohm Load	[20 Hz,20 KHz]
	Dynamic range with signal present	<= 87 dB FS <b>A-weight</b> <= 67 dBFS <b>A-weight</b> at 32 Ohm Load	[20 Hz,20 KHz]
	Magnitude Response	<= +/- .25 dB ripple (.5dB peak to peak delta), 1 dB at upper band edge, 3dB at lower band edge	[100 Hz,20 KHz] (5)
	Sampling frequency accuracy	0.02%.	
	Headphone output cross-talk	<= -70 dB <=-60dB for Front Panel HP at 32 Ohm load	[20 Hz,20 KHz]
	Full scale output voltage	>= 1 Vrms at 320 Ohm load >= 300 mVrms at 32 Ohm load	(6)
	Noise level during system activity	<=-87 dBFS <b>A-weight</b>	
	Interchannel phase delay	30 degrees or 12.5 microseconds, whichever is greater	[20 Hz,20 KHz]
Analog Line In Jack	THD+N	<= -75 dBFS	[20 Hz,20 KHz]
	Dynamic range with signal present	<= 85 dBFS <b>A-weight</b>	[20 Hz,20 KHz]
	Magnitude Response	<= +/- .25 dB ripple (.5dB peak to peak delta), 1 dB at upper band edge, 3dB at lower band edge	[20 Hz,20 KHz] (5)

Device Type	Requirement	Value	Frequency range at 48KHz and above (4)
	Sampling frequency accuracy	0.02%.	
	Full scale input voltage	>= 1 Vrms	
Analog Microphone In Jack	THD+N	<= -69 dBFS	[100 Hz,20 KHz]
	Dynamic range with signal present	<= 80 dBFS <a href="#">A-weight</a>	[100 Hz,20 KHz]
	Magnitude Response	<= +/- .25 dB ripple (.5dB peak to peak delta), 1 dB at upper band edge, 3dB at lower band edge	[100 Hz,20 KHz] (5)
	Sampling frequency accuracy	0.02%.	
	Full scale input voltage	>= 0.1 Vrms	

1. For 3.3 V codecs or for codecs on mobile systems regardless of voltage the full scale input and output full scale voltage requirement changes to >= 0.707 Vrms. Speaker output expected to be half into 8 Ohm for 3.3V codecs. More audio fidelity friendly analog power supply voltages in the range of 4V-5V are recommended.
2. [DR, FREQUENCY ACCURACY, CROSS-TALK and INTERCHANNEL PHASE DELAY](#) should be measured in accordance with [AES-17 audio measurements standards](#). THD+N will diverge from AES-17 and be tested with a test signal at -3dBFS (DAC) and -3dBFS (ADC) in the context of WLP 3.0. This will change to a test signal at -1dBFS (DAC) and -1dBFS (ADC) for the next version of the WLP requirements (4.0) and a test signal at 0dBFS (DAC) for the generation of WLP requirements after that (5.0). At that time PC audio output devices must be able to accept digital 0dBFS input. THD+N will be tested across the full frequency range but out of band harmonics (above 20Khz) will not affect test result. Since poorly designed filters may cause aliasing-generated distortion above 8KHz but below 20Khz measuring this range is still important even though any potential harmonics created above 8KHz are out of band.
3. Reference level: 1Vrms. Full Scale is defined as a signal that contains samples at the maximum digital value.
4. The range refers to analyzer bandwidth and the range of the sweeping tone used in measurements. Frequency sweep may not be used in all measurements. The frequency range in the table is for content at 48Khz sampling rate or above. 44.1KHz test content will sweep up to 17.6KHz in the context of WLP 3.0. We will sweep 44.1Khz across the 20Hz – 20KHz envelope for the next WLP version (4.0) as is expected to meet Redbook CD fidelity requirements. For Sample Rates at 88.2KHz or higher we recommend 30KHz bandwidth.
5. Frequency response in the transition band should be monotonic; transition band starts at the point where ripples exceed the magnitude response requirement and ends at the upper 1dB, lower 3dB frequency corner. The ripple value is measured peak to peak defined as the highest positive value and the lowest negative value outside of the transition region. The value +/- .25dB ripple means that the delta from peak to peak can be as much as .5dB. The next generation of WLP requirements (4.0) will tighten this requirement to +/- .125dB

ripple peak to peak; meaning the delta between the ripple peaks can be max .25dB outside of the transition region.

6. These are two examples. Testing will occur at these two endpoints and anywhere within this envelope.

### For premium mobile implementations:

Device Type	Requirement	Value	Frequency range at 48KHz and above (4)
Analog Line Output Jack	THD+N	<= -65 dB FS	[20 Hz,20 KHz]
	Dynamic range with signal present	<= 80 dB FS <i>A-weight</i>	[20 Hz,20 KHz]
	Magnitude Response	<= +/- .25 dB ripple (.5dB peak to peak delta), 1 dB at upper band edge, 3dB at lower band edge	[20 Hz,20 KHz] (5)
	Sampling frequency accuracy	0.02%.	
	Line output cross-talk	<= -60 dB	[20 Hz,20 KHz]
	Full scale output voltage	>= .707 Vrms	
	Noise level during system activity	<=-80 dB FS <i>A-weight</i>	
	Interchannel phase delay	30 degrees or 12.5 microseconds, whichever is greater	[20 Hz,20 KHz]
Analog Speaker Output Jack (Example: 125mW into 8 Ohm load)	THD+N	<= -65 dB FS	[20 Hz,20 KHz]
	Dynamic range with signal present	<= 80 dB FS <i>A-weight</i>	[20 Hz,20 KHz]
	Magnitude Response	<= +/- .25 dB ripple (.5dB peak to peak delta), 1dB band edges	[20 Hz,20 KHz] (5)
	Sampling frequency accuracy	0.02%.	
	Line output cross-talk	<= -60 dB	[20 Hz,20 KHz]
	Full scale output voltage	>= .707 Vrms	
	Noise level during system activity	<=-80 dB FS <i>A-weight</i>	
	Interchannel phase delay	30 degrees or 12.5 microseconds, whichever is greater	[20 Hz,20 KHz]
Analog Headphone Out Jack	THD+N	<= -65dB FS <=-45 dB FS at 32 Ohm Load	[20 Hz,20 KHz]
	Dynamic range with signal present	<= -80 dB FS <i>A-weight</i> <= -60 dB FS at 32 Ohm Load	[20 Hz,20 KHz]
	Magnitude Response	<= +/- .25 dB ripple (.5dB peak to peak delta), 1 dB at upper band edge, 3dB at lower band edge	[100 Hz,20 KHz] (5)
	Sampling frequency accuracy	0.02%.	
	Headphone output cross-talk	<= -60 dB	[20 Hz,20 KHz]

Device Type	Requirement	Value	Frequency range at 48KHz and above (4)
	Full scale output voltage	$\geq .707$ Vrms at 320 Ohm load $\geq 300$ mVrms at 32 Ohm load	(6)
	Noise level during system activity	$\leq -80$ dB FS A-weight	
	Interchannel phase delay	30 degrees or 12.5 microseconds, whichever is greater	[20 Hz,20 KHz]
Analog Line In Jack	THD+N	$\leq -65$ dBFS	[20 Hz,20 KHz]
	Dynamic range with signal present	$\leq 80$ dBFS A-weight	[20 Hz,20 KHz]
	Magnitude Response	$\leq \pm .25$ dB ripple (.5dB peak to peak delta), 1 dB at upper band edge, 3dB at lower band edge	[20 Hz,20 KHz] (5)
	Sampling frequency accuracy	0.02%.	
	Full scale input voltage	$\geq .707$ Vrms	
Analog Microphone In Jack	THD+N	$\leq -65$ dBFS	[100 Hz,20 KHz]
	Dynamic range with signal present	$\geq 70$ dBFS A-weight	[100 Hz,20 KHz]
	Magnitude Response	$\leq \pm .25$ dB ripple (.5dB peak to peak delta), 1 dB at upper band edge, 3dB at lower band edge	[100 Hz,20 KHz] (5)
	Sampling frequency accuracy	0.02%.	
	Full scale input voltage	$\geq 0.07$ Vrms	

- 1) For 3.3 V codecs or for codecs on mobile systems regardless of voltage the full scale input and output full scale voltage requirement changes to  $\geq 0.707$  Vrms. Speaker output expected to be half into 8 Ohm for 3.3V codecs. More audio fidelity friendly analog power supply voltages in the range of 4V-5V are recommended.
- 2) **DR, FREQUENCY ACCURACY, CROSS-TALK and INTERCHANNEL PHASE DELAY** should be measured in accordance with **AES-17 audio measurements standards**. THD+N will diverge from AES-17 and be tested with a test signal at -3dBFS (DAC) and -3dBFS (ADC) in the context of WLP 3.0. This will change to a test signal at -1dBFX (DAC) and -1dBFS (ADC) for the next version of the WLP requirements (4.0) and a test signal at 0dBFS (DAC) for the generation of WLP requirements after that (5.0). At that time PC audio output devices must be able to accept digital 0dBFS input. THD+N will be tested across the full frequency range but out of band harmonics (above 20Khz) will not affect test result. Since poorly designed filters may cause aliasing-generated distortion above 8KHz but below 20Khz measuring this range is still important even though any potential harmonics created above 8KHz are out of band.
- 3) Reference level: 1Vrms. Full Scale is defined as a signal that contains samples at the maximum digital value.
- 4) The range refers to analyzer bandwidth and the range of the sweeping tone used in measurements. Frequency sweep may not be used in all measurements. The frequency range in the table is for content at 48Khz

sampling rate or above. 44.1KHz test content will sweep up to 17.6KHz in the context of WLP 3.0. We will sweep 44.1Khz across the 20Hz – 20KHz envelope for the next WLP version (4.0) as is expected to meet Redbook CD fidelity requirements. For Sample Rates at 88.2KHz or higher we recommend 30KHz bandwidth.

- 5) Frequency response in the transition band should be monotonic; transition band starts at the point where ripples exceed the magnitude response requirement and ends at the upper 1dB, lower 3dB frequency corner. The ripple value is measured peak to peak defined as the biggest positive and the lowest negative outside of transition region. The value  $\pm .25\text{dB}$  ripple means that the delta from peak to peak can be as much as  $.5\text{dB}$ . The next generation of WLP requirements (4.0) will tighten this requirement to  $\pm .125\text{dB}$  ripple peak to peak; meaning the delta between peaks can be  $.25\text{dB}$ .
- 6) These are two examples. Testing will occur at these two endpoints and anywhere within this envelope

## Audio solution meets basic performance requirements

<b>AUDIO-0025</b>		Audio solution meets basic performance requirements		
Effective Date:	June 1, 2006		<b>Client Devices</b>	<b>Server Devices</b>
Old ID:	B3.1.4.4	Basic Logo	R	I
Status:	Locked	Premium Logo		

The audio device must be able to meet the minimum performance requirements as identified in the following table. Measurements are performed electronically (not in-air) for all the below defined device types when they exist on the device/system.. Frequency sweep and/or multi-tone test methods may be used when appropriate. The Device Types in the tables reflect those defined by the Intel HD Audio Spec and the Microsoft HD Audio Pin Configuration Programming Guidelines.

### ALL PC SKUs:

Device Type	Requirement	Value	Frequency range (4)
Analog Line Output Jack	THD+N	$\leq -65 \text{ dB FS}$	[20 Hz,20 KHz]
	Dynamic range with signal present	$\leq -80 \text{ dB FS A-weight}$	[20 Hz,20 KHz]
	Magnitude Response	$\leq \pm .25\text{dB}$ Ripple (.5dB peak to peak delta); 1 dB at upper band edge, 3dB at lower band edge	[20 Hz,20 KHz] (5)
	Sampling frequency accuracy	0.02%.	
	Line output cross-talk	$\leq -60 \text{ dB}$	[20 Hz,20 KHz]
	Full scale output voltage	$\geq 1 \text{ Vrms}$	

Device Type	Requirement	Value	Frequency range (4)
	Noise level during system activity	$\leq -80$ dB FS A-weight	
	Interchannel phase delay	20 degrees or 12.5 microseconds, whichever is greater	[20 Hz,20 KHz]
Analog Speaker Output Jack (Example: 125mW into 8 Ohm load)	THD+N	$\leq -65$ dB FS	[20 Hz,20 KHz]
	Dynamic range with signal present	$\leq -80$ dB FS A-weight	[20 Hz,20 KHz]
	Magnitude Response	$\leq \pm .25$ dB ripple (.5dB peak to peak delta), 1 dB at upper band edge, 3dB at lower band edge	[20 Hz,20 KHz] (5)
	Sampling frequency accuracy	0.02%.	
	Line output cross-talk	$\leq -60$ dB	[20 Hz,20 KHz]
	Full scale output voltage	$\geq 1$ Vrms	
	Noise level during system activity	$\leq -80$ dB FS A-weight	
	Interchannel phase delay	20 degrees or 12.5 microseconds, whichever is greater	[20 Hz,20 KHz]
Analog Headphone Out Jack	THD+N	$\leq -65$ dB FS $\leq -45$ dB FS at 32 Ohm Load	[20 Hz,20 KHz]
	Dynamic range with signal present	$\leq -80$ dB FS A-weight $\leq -60$ dB FS A-weight at 32 Ohm Load	[20 Hz,20 KHz]
	Magnitude Response	$\leq \pm .25$ dB ripple (.5dB peak to peak delta), 1 dB at upper band edge, 3dB at lower band edge	[100 Hz,20 KHz] (5)
	Sampling frequency accuracy	0.02%.	
	Headphone output cross-talk	$\leq -60$ dB	[20 Hz,20 KHz]
	Full scale output voltage	$\geq 1$ Vrms at 320 Ohm load $\geq 300$ mVrms at 32 Ohm load	(6)

Device Type	Requirement	Value	Frequency range (4)
	Noise level during system activity	$\leq -80$ dB FS <a href="#">A-weight</a>	
	Interchannel phase delay	20 degrees or 12.5 microseconds, whichever is greater	[20 Hz,20 KHz]
Analog Line In Jack	THD+N	$\leq -65$ dBFS	[20 Hz,20 KHz]
	Dynamic range with signal present	$\leq -80$ dBFS <a href="#">A-weight</a>	[20 Hz,20 KHz]
	Magnitude Response	$\leq \pm .25$ dB ripple (.5dB peak to peak delta), 1 dB at upper band edge, 3dB at lower band edge	[20 Hz,20 KHz] (5)
	Sampling frequency accuracy	0.02%.	
	Full scale input voltage	$\geq 1$ Vrms	
Analog Microphone In Jack	THD+N	$\leq -65$ dBFS	[100 Hz,20 KHz]
	Dynamic range with signal present	$\leq -70$ dBFS <a href="#">A-weight</a>	[100 Hz,20 KHz]
	Magnitude Response	$\leq \pm .25$ dB ripple (.5dB peak to peak delta), 1 dB at upper band edge, 3dB at lower band edge	[100 Hz,20 KHz] (5)
	Sampling frequency accuracy	0.02%.	
	Full scale input voltage	$\geq 0.1$ Vrms	

- 1) For 3.3 V codecs or for codecs on mobile systems regardless of voltage the full scale input and output full scale voltage requirement changes to  $\geq 0.707$  Vrms. Speaker output expected to be half into 8 Ohm for 3.3V codecs. More audio fidelity friendly analog power supply voltages in the range of 4V-5V are recommended.
- 2) [DR, FREQUENCY ACCURACY, CROSS-TALK and INTERCHANNEL PHASE DELAY](#) should be measured in accordance with [AES-17 audio measurements standards](#). THD+N will diverge from AES-17 and be tested with a test signal at -3dBFS (DAC) and -3dBFS (ADC) in the context of WLP 3.0. This will change to a test signal at -1dBFX (DAC) and -1dBFS (ADC) for the next version of the WLP requirements (4.0) and a test signal at 0dBFS (DAC) for the generation of WLP requirements after that (5.0). At that time PC audio output devices must be able to accept digital 0dBFS input. THD+N will be tested across the full frequency range but out of band harmonics (above 20Khz) will not affect test result. Since poorly designed filters may cause aliasing-generated distortion above 8KHz but below 20Khz

measuring this range is still important even though any potential harmonics created above 8KHz are out of band.

- 3) Reference level: 1Vrms. Full Scale is defined as a signal that contains samples at the maximum digital value.
- 4) The range refers to analyzer bandwidth and the range of the sweeping tone used in measurements. Frequency sweep may not be used in all measurements. The frequency range in the table is for content at 48Khz sampling rate or above. 44.1KHz test content will sweep up to 17.6KHz in the context of WLP 3.0. We will sweep 44.1Khz across the 20Hz – 20KHz envelope for the next WLP version (4.0) as is expected to meet Redbook CD fidelity requirements. For Sample Rates at 88.2KHz or higher we recommend 30KHz bandwidth.
- 5) Frequency response in the transition band should be monotonic; transition band starts at the point where ripples exceed the magnitude response requirement and ends at the upper 1dB, lower 3dB frequency corner. The ripple value is measured peak to peak defined as the biggest positive and the lowest negative outside of transition region. The value  $\pm .25\text{dB}$  ripple means that the delta from peak to peak can be as much as  $.5\text{dB}$ . The next generation of WLP requirements (4.0) will tighten this requirement to  $\pm .125\text{dB}$  ripple peak to peak; meaning the delta between peaks can be  $.25\text{dB}$ .
- 6) These are two examples. Testing will occur at these two endpoints and anywhere within this envelope.

Remark:

- 1.) All captioned information belong to Microsoft and can be found in Microsoft website.
- 2.) Suggested configuration:

**Audio Precision      SYS-2722A with S-AES17 Filter and A-Weighting Filter**

- 3.) Audio Precision distributor in HK / China:

**AP Technology Ltd.    Tel: 852 3114 6018      Fax: 852 3114 6038**

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