Windows Hardware Logo Program Requirements

November 20th, 2007

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This document contains technical requirement information from the LogoPoint database, available from within the Winqual site at http://winqual.microsoft.com. The information contained in this document is subject to change; the LogoPoint database itself should be considered the plan of record for Windows Logo Program requirements. This document is a *snapshot* of the data contained in the LogoPoint database as of November 20, 2007.

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.

Device and Driver

Logo Requirements - Audio Devices - Device and Driver

AUDIO-0001	Version 1	**Audio device driver is based on the Windows WaveRT miniport WDM driver model**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	I
Premium	R

Integrated or discrete audio device driver must be based on the Microsoft Windows WaveRT miniport WDM driver model.Requirement details are defined in the white paper titled "A Wave Port Driver for Real-Time Audio Streaming."

The legacy portsWaveCyclic or WavePCI are not used to support the audio device on Premium Windows Vista systems.

For device technologies such as USB Audio 1.0 based devices where the audio driver model is not specifically called out, any WDM audio driver model is allowed.

Design and Implementation Notes

See the white paper titled "A Wave Port Driver for Real-Time Audio Streaming."

AUDIO-0002	Version 2	**If an audio solution in a PC system has three stereo analog outputs on the back of the system associated together in a multi-channel logical device it must use the defined color coding for multi-channel connectors. Color coding is implemented as a colored dot, colored icon or a colored circle around the jack. In addition, the audio jacks in this association (3.55mm (1/8-inch) mini-jack connectors) must use defined tip/ring connections to**

		ensure proper audio channel path.
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	I
Premium	I

If-implemented definition: If the audio solution implements multi-channel analog outputs for 5.1 or 7.1 surround sound then the solution must use color coding and the correct tip/ring connections.

If the system exposes a multi-channel analog logical device using three or more analog jacks on the back of the system each analog output must have independent DAC resources that are used to enable six or more channels of PCM playback for 5.1 or 7.1 surround-sound experiences. It is up to system vendor to choose if the system exposes a multi-channel logical device and how many channels the logical device supports (typically 5.1 and/or 7.1).

If the system exposes a multi-channel logical audio device using three or more analog jacks the audio solution must use color coding defined in the below table. Color coding may be implemented as a colored dot or colored icon placed next to the connector or colored connectors (ring around each jack) for all analog audio connectors that are part of that multi-channel logical device available to the end user on the PC system.

In addition, the audio jacks in this association (3.55mm (1/8-inch) mini-jack connectors) must use defined tip/ring connections to ensure proper audio channel path.

Audio line in	Left line in	Tip of connector	Color: light blue RGB: 122: 171: 222 Hex: #7AABDE CMYK: 55:19:0:0 Pantone: 284C
	Right line in	Ring of connector	
Audio line out (front left and right)	Left front out	Tip of connector	Color: lime green RGB: 179: 201: 140 Hex: #B3C98C CMYK: 24:0:46:10 Pantone: 577C
	Right front out	Ring of connector	
Microphone in (mono)	Microphone in	Tip of connector	Color: pink RGB: 232: 140: 153

	4V Bias	Ring of connector	Hex: #E88C99 CMYK: 0:45:20:0 Pantone: 701C
Microphone in (stereo)	Left Mic in	Tip of connector	Color: pink RGB: 232: 140: 153 Hex: #E88C99 CMYK: 0:45:20:0 Pantone: 701C
	Right Mic in	Ring of connector	
Side surround left and right out	Left surround	Tip of connector	Color: grey RGB: 140:143:145 Hex: #D1CCC4 CMYK: 0:0:0:15 Pantone: 420C
	Right surround	Ring of connector	
Rear surround left and right out	Left back	Tip of connector	Color: black RGB: 43:41:38 Hex: #2B2926 CMYK: 0:0:0:100 Pantone: “black”
	Right back	Ring of connector	
Center speaker & LFE (subwoofer) out	Front center out	Tip of connector	Color: orange RGB:232:158:71 Hex: #E89E47 CMYK: 0:49:70:0 Pantone: 157C
	LFE (subwoofer) out	Ring of connector	

Design and Implementation Notes

See the Intel HD Audio Specification, Revision 1.0, and Microsoft HD Audio Pin Configuration Programming Guidelines.

See recommended requirements in the Universal Audio Architecture UAA Hardware Design Guidelines at http://go.microsoft.com/fwlink/?LinkId=50734.

AUDIO-0003	Version 1	**Audio device relies on Windows to support various throughput scenarios**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	
Premium	R

Audio device must not rely on analog circuitry designed to mix audio signals between the various device inputs and outputs or signals routing from one DAC to multiple output connectors or from multiple input connectors to one ADC for playback and capture operations in other ways than defined in the UAA HD Audio Pin Config Guidelines. The device must be able to rely on the operating system to support various throughput and monitoring scenarios and provide independent or otherwise pre-defined by Microsoft audio

device implementation guidelines audio connectivity on the PC.
This requirement does not prohibit a codec from having a mixer, it implies that the codec must not rely on the mixer for I/O. DAC's and ADC's must have direct I/O from jacks to the operating system.

Design and Implementation Notes

The PC streaming audio device should behave like a transparent entity without any processing, including mixing paths in the analog domain that the operating system is unaware of. This enables predictability and a uniform audio experience for all Windows users.

AUDIO-0004	Version 1	**1394 Audio device follows UAA 1394 Audio Design Guidelines**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	I
Premium	I

If-implemented definition: If audio device is a 1394-based audio device, then it must adhere to the requirement.

A 1394-based audio device in a stand-alone external form factor or in an AVR or in other permutations follows the Microsoft UAA 1394 Audio Design Guidelines.

Design and Implementation Notes

See Microsoft UAA 1394 Audio Design guidelines at http://go.microsoft.com/fwlink/?LinkId=50734.

AUDIO-0005	Version 1	**USB Audio Device follows UAA USB Audio Design Guidelines**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	I
Premium	I

If-implemented definition: If audio device is a USB-based audio device, then it must adhere to the requirement.

A USB audio-based audio device in a stand-alone external form factor or in an AVR or in other permutations follows the Microsoft

UAA USB Audio Design Guidelines.

Design and Implementation Notes

See Microsoft UAA USB Audio Design Guidelines at http://go.microsoft.com/fwlink/?LinkId=50734.

AUDIO-0006	Version 2	**Audio solution delivers a premium high-fidelity audio experience**
Effective Date:	01-Jun-2007	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	
Premium	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 A-weight	[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, 15KHz]
	Full scale output voltage	>= 1 Vrms	
	Noise level during system activity	<=-90 dB FS A-weight	
	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 A-weight	[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, 15 KHz]
	Full scale output voltage	>= 1 Vrms	
	Noise level during system activity	<=-90 dB FS A-weight	
	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	[100 Hz, 20 KHz]
	Dynamic range with signal present	<= 87 dB FS A-weight <= 67 dBFS A-weight at 32 Ohm Load	[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%.	
	Headphone output cross-talk	<= -60 dB <=-60dB for Front Panel HP at 32 Ohm load	[100 Hz, 15 KHz]
	Full scale output voltage	>= 1 Vrmsat 320 Ohm load >= 300 mVrms at 32 Ohm load	(6)
	Noise level during system activity	<=-87 dBFS A-weight	
	Interchannel phase delay	30 degrees or 12.5 microseconds, whichever is greater	[100 Hz, 20 KHz]
Analog Line In Jack	THD+N	<= -75 dBFS	[20 Hz, 20 KHz]
	Dynamic range with signal present	<= 85 dBFS A-weight	[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%.	
	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-weight	[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 FUTURE requirement date of June 1, 2008 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 a FUTURE requirement date of June 1, 2008, 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. FUTURE requirement date of June 1, 2008 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. Smaller output voltages (>=120mVrms) are permitted when required by regulatory and safety standards.

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 A-weight	[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	<= -50 dB	[20 Hz, 15 KHz]
	Full scale output voltage	>= .707 Vrms	
	Noise level during system activity	<=-80 dB FS A-weight	
	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 A-weight	[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	<= -50 dB	[20 Hz, 15 KHz]
	Full scale output voltage	>= .707 Vrms	
	Noise level during system activity	<=-80 dB FS A-weight	
	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	[100 Hz, 20 KHz]
	Dynamic range with signal present	<= -80 dB FS A-weight <= -60 dB FS at 32 Ohm Load	[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%.	
	Headphone output cross-talk	<= -50 dB	[100 Hz, 15 KHz]
	Full scale output voltage	>= .707 Vrmsat 320 Ohm load >= 300 mVrms at 32 Ohm load	(6)
	Noise level during system activity	<=-80 dB FS A-weight	
	Interchannel phase delay	30 degrees or 12.5 microseconds, whichever is greater	[100 Hz, 20 KHz]
Analog Line In Jack	THD+N	<= -65 dBFS	[20 Hz, 20 KHz]
	Dynamic range with signal present	<= 80 dBFS A-weight	[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%.	
	Full scale input voltage	>= .707 Vrms	
Analog Microphone In Jack	THD+N	<= -65 dBFS	[100 Hz, 20 KHz]
	Dynamic range with signal present	>= 70 dBFS A-weight	[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	>= 0.07 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 >= 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 FUTURE requirement date of June 1, 2008 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 a FUTURE requirement date of June 1, 2008, 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. FUTURE requirement date of June 1, 2008 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. Smaller output voltages (>=120mVrms) are permitted when required by regulatory and safety standards.

Design and Implementation Notes

For more information on the Audio Fidelity Testing Policy see http://go.microsoft.com/fwlink/?LinkId=72638.

AUDIO-0008	Version 1	**Standalone USB Audio based microphone array device complies with the Microsoft USB Audio 1.0 design guidelines and Microsoft Microphone Array Design Guidelines**
Effective Date:	01-Jun-2007	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	R
Premium	

An externally connected USB based microphone array device must comply with the UAA-supported technology standard, must comply with the USB Device Class Definition for Audio Devices 1.0, and must be implemented according to the guidelines in "Microphone Array Support in Windows Vista."

The device must report itself and its capabilities according to the design guidelines in the Microsoft USB Audio Microphone Array Design Guidelines.

AUDIO-0009	Version 1	**Audio device is compliant with one of the appropriate technology specifications supported by the UAA initiative**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	R
Premium	R

An audio device must comply with the appropriate standard as supported by the Microsoft Universal Audio Architecture Initiative. The supported standards are USB Audio, IEEE 1394 Audio, and High Definition Audio. The relevant Windows audio class driver loads, runs, and passes functionality tests on the implementation. This includes meeting minimum performance requirements as defined in the Microsoft UAA Hardware Design Guidelines.

Design and Implementation Notes

See "Universal Audio Architecture" at http://go.microsoft.com/fwlink/?LinkId=40631.

See "USB Audio Devices and Windows" at http://go.microsoft.com/fwlink/?LinkId=40632.

AUDIO-0010		**Audio device is designed to be WaveRT-port-friendly**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	R
Premium	R

A UAA HD Audio-compatible implementation meets this requirement automatically. To be considered WaveRT port friendly, the audio subsystem must support the following:

- Cyclic DMA engine with a scatter-gather list.
- Position register that is separate from other hardware registers (can be a copy).
- Ability to split samples between pages.
- Ability to loop on buffers without software intervention.

This requirement does not apply to external or internal USB audio and 1394 audio devices.

Design and Implementation Notes

See "A Wave Port Driver for Real-Time Audio Streaming" at http://go.microsoft.com/fwlink/?LinkId=40502.

AUDIO-0011	Version 2	**A single HD Audio codec port is used for a single connector**
Effective Date:	01-Jun-2007	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	I
Premium	R

Each HD Audio codec port connects to one and only one audio source, destination, or jack. For compatibility with the UAA class driver do not double-up on input or output ports in ways that cannot be exposed to the class driver through the information in the pin configuration registers.

Combination jacks (headphone/S/PDIF) are allowed if the digital output is exposed as a separate, independent always on device using the HD Audio pin configuration register values and the analog section of the jack supports jack presence detection.

Designs that use GPIOs under control of third-party function drivers must default to an appropriate hardware configuration when the UAA class driver is loaded.

Design and Implementation Notes

There is one exception to this requirement with regards to an audio device pin that feeds two different connectors intended for SPDIF protocol content. In the case where a system or device exposes an RCA jack (Co-ax) and an optical output for the SPDIF protocol stream from one codec pin this is permitted only if the audio driver exposes the pin as outlined below:

An array of jack descriptions can also be used to show that a pair of jacksis equivalent. The following example would indicate to the user that the yellow RCA jack and the black “digital optical” jack will carry the same signal:

```
KSJACK_DESCRIPTION ar_SPDIF_Jacks[] =
{
// jack 1
{
(SPEAKER_FRONT_LEFT | SPEAKER_FRONT_RIGHT), // ChannelMapping (L,R)
RGB(255,255,0), // Color (yellow)
eConnTypeRCA, // ConnectionType (RCA)
eGeoLocRear, // GeoLocation
eGenLocPrimaryBox, // PortConnection
TRUE // IsConnected
},
// jack 2
```

```
{
(SPEAKER_FRONT_LEFT | SPEAKER_FRONT_RIGHT), // (L,R)
RGB(0,0,0), // (black)
eConnTypeOptical, // (optical)
eGeoLocRear,
eGenLocPrimaryBox,
TRUE
}
};
```

Clarification: This exception has nothing to do with HDMI Audio, it only covers SPDIF on two physically different SPDIF connectors and this exception does NOT allow HDMI Audio outputs to share a codec pin with SPDIF. That isstill prohibited.

AUDIO-0012	Version 1	**HD Audio controllers comply with the Intel HD Audio specification**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	R
Premium	R

An audio or modem controller must be implemented as an HD Audio controller (except where noted otherwise within this document). The controller must:

- Be implemented according to Intel High Definition Audio Controller specification, Revision 1.0.
- Be updated to comply with future specification revisions.
- Comply with future HD Audio specification ECRs in accordance with WHQL policies around new hardware requirements.

AUDIO-0013	Version 1	**HD Audio 1.0 compliant hardware sets appropriate registers to specify the version number**
Effective Date:	01-Jun-2006	
Expiration Date:		

	Client Device

Status:	Approved	Basic	R
		Premium	R

HD Audio hardware that complies with HD Audio specification version 1.0 must set the correct version number in the appropriate registers. The VMAJ and VMIN registers must specify a major version number of 01h and a minor version number of 00h.

Design and Implementation Notes

In future HD Audio specification revisions the register values may be updated. It is assumed that any future requirements that reference an updated revision of the specification will also require using the VMAJ and VMIN registers defined by that revision of the specification.

AUDIO-0014	Version 1	**Audio device implements DRM support as defined in the Windows Driver Kit**	
Effective Date:	01-Jun-2006		**Client Device**
Expiration Date:		Basic	R
Status:	Approved	Premium	R

Audio devices must comply with Windows secure audio path forDRM.Hardware that complies with Windows DRM supports DRM Level = 1200.The audio drivers must not call DrmForwardContentToFileObject.

Design and Implementation Notes

See the Windows Driver Kit, "Digital Rights Management."

AUDIO-0015	Version 1	**HD Audio codec for audio complies with the Intel High Definition Audio specification**	
Effective Date:	01-Jun-2006		**Client Device**
Expiration Date:		Basic	R
Status:	Approved	Premium	R

If the codec is for an audio implementation, it must be implemented according to Intel High Definition Audio Specification, Revision 1.0, and updated when commercially possible to comply with HD Audio specification DCRs.

AUDIO-0016	Version 1	**HD Audio codec supports additional requirements not**

		specified in the Intel High Definition Audio specification
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	R
Premium	R

To be UAA compliant, an HD Audio codec must implement the following features, which are not necessarily required by Intel High Definition Audio Specification:

- Speaker compensation is the only valid scenario for audio signal processing of an audio stream by a codec, and then it is valid only if the speakers are hardwired to the pin complex that contains the processing node (such as integrated laptop speakers). This requirement does not apply to decryption of protected audio streams.
- When all of an HDAudio codec's widgets are configured in the benign processing state, the codec performs no nonlinear or time-variant processing on the audio streams that pass through it.
- Software must be able to set all processing nodes to the benign processing state, and the codec must function according to UAA baseline requirements while in this state.
- An HDAudio codec must be accessible only through the HDAudio bus controller. The codec must not expose registers or other hardware mechanisms that are accessible through either memory or I/O address space. This requirement does not encompass HDMI or other nonexistent hardware that may appear in the future. New requirements will be written to cover those technologies when they emerge.
- Modem and audio functionality must not be combined. Although the same piece of silicon can house both modem and audio devices, the functions must be separate devices and must not share any software or hardware resources (such as ADCs or DACs).
- When the HD Audio link is in a running state (HD Audio controller is in D0), UAA-compliant HD Audio codecs must respond to commands even when powered down in all required device power-management states. In effect, the digital section of the codec must remain powered.
- Codecs must respond to a verb even if addressed at a nonexistent widget or if the verb itself is invalid.
- Function group nodes must have node IDs in the range 0 to 127. This restriction does not apply to node IDs for widget nodes.
- In a system with one or more HDAudio codecs, the system BIOS must initialize the Configuration Default Register for each codec pin widget based on the system configuration/implementation of the HD Audio codec while considering the Microsoft Pin Configuration Programming Guidelines so that the UAA HDAudio function class driver's topology parser can create a functional device topology for the codec. The default data in the HD Audio codec pin configuration registers must not misrepresent the hardware capabilities, and the Configuration Default Registers must not be null (all zeros).
- A function group in an HDAudio codec must expose a nonzero subsystem ID. The BIOS overwrites the subsystem ID if

necessary. If the BIOS cannot program the subsystem ID or if it does so incorrectly, the hardware must supply a default, vendor-specific subsystem ID.

AUDIO-0017	Version 1	**HD Audio solution supports jack-presence detection for analog jacks**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	R
Premium	R

The HD Audio codec and the system board must implement HD Audio-compliant jack-presence detection for analog jacks. Presence detection implies that the codec with required system components (jack connector and jack detection circuit) must be able to detect the presence of jack insertion into and jack removal from the input/output connectors that the codec is using. When this occurs an unsolicited response is sent so that software can be notified without constantly polling the device. Implementation of unsolicited response support for jack detection events is required for Windows Vista Logo although it may be worded as optional in the HD Audio specification.

This requirement is unrelated to the feature of automatic sensing of what the peripheral might be. Sensing by using impedance matching is not required.

Design and Implementation Notes

This requirement specifically means that the codec implements presence detection on each exposed pin that is connected to a system connecter (jack) and that the system board implements an audio jack detection circuit (HD Audio Specification section 7.4.2) external to the codec for each jack on the system. This requirement does not apply to device types defined in the HD Audio codec's pin configuration register defaults as a Line Connector device using an RCA type physical connector.

See the Microsoft UAA HD Audio Pin Configuration Programming Guidelines white paper for additional clarifications on the specified jack connectors that require jack detection.
http://www.microsoft.com/whdc/device/audio/PinConfig.mspx

AUDIO-0018	Version 1	**HD Audio codec follows Plug and Play requirements for codec device identification**
Effective Date:	01-Jun-2006	

	Client Device

Expiration Date:		Basic	R
Status:	Approved	Premium	R

HD Audio codecs must comply with the Plug and Play requirements for proper identification that are described in Plug and Play Guidelines for High Definition Audio Devices, "HD Audio Codec."

Design and Implementation Notes
See Guidelines at http://www.microsoft.com/whdc/device/audio/HD-aud_PnP.mspx.

AUDIO-0019	Version 1	**INF file for HD Audio codec includes properly formatted device ID string for each supported codec device**	
Effective Date:	01-Jun-2006		**Client Device**
Expiration Date:		Basic	R
Status:	Approved	Premium	R

Vendors that supply custom HD Audio function drivers must include an INF file that follows guidelines for device identification strings that are defined in Plug and Play Guidelines for High Definition Audio Devices, "INF Files for HD Audio Codecs."

Design and Implementation Notes
See Guidelines at http://www.microsoft.com/whdc/device/audio/HD-aud_PnP.mspx.

AUDIO-0020	Version 1	**Pin configuration register for an HD Audio codec has specific settings for port connectivity field depending on implementation**	
Effective Date:	01-Jun-2006		**Client Device**
Expiration Date:		Basic	R
Status:	Approved	Premium	R

A pin widget's port connectivity value of 0x01 (No Connection) is valid only when a system in which the HD Audio codec resides has no jack or integrated device attached to the pin widget.A port connectivity setting of 0x02 (10b) should be used only in those cases where a trace on a circuit board directly connects the codec and an integrated device such as a speaker amplifier or microphoneA port connectivity setting of 0x03 (011b) is specifically disallowed. Each pin widget must connect to a single audio endpoint.

AUDIO-0021	Version 1	**Values in the Default Association field of the HD Audio codec pin configuration register are not set to zero (reserved value)**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	R
Premium	R

The value zero is reserved and must never be used as a default association value.

AUDIO-0022	Version 1	**HD Audio Codec Pin configuration register defaults: Sequence numbers within the same default association are unique**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	R
Premium	R

In the data configured by the BIOS or in the default values from the codec manufacturer, the sequence numbers within the pin configuration register's default association must be unique within the same association except for association 0xf, in which all instances should support Sequence ==0.

Design and Implementation Notes

See Pin Configuration Guidelines for High Definition Audio Devices, at http://go.microsoft.com/fwlink/?LinkId=58572.

AUDIO-0023	Version 1	**Audio subsystem supports basic data formats**
Effective Date:	01-Jun-2006	
Expiration Date:		

	Client Device

Status:	Approved	Basic	R
		Premium	R

When the Microsoft software sample rate conversion (SRC) is used, hardware SRC is not required. Windows provides software mixing and SRC, which eliminate the requirement for hardware to support multiple sample rates.

The audio device must support the sample rate of 44.1 and 48 kHz ormultiples of 48 kHz(such as 96, 192, or 384 kHz) because theseare the prevalent sampling rates for entertainment content.

Support for other rates (8, 11.025, 16, 22.05, 32, 96, 192, and 384 kHz) in hardware is optional.

Design and Implementation Notes

This requirement is valid for both input and output devices.

AUDIO-0024	Version 1	**Audio subsystem supports full duplex operation**	
Effective Date:	01-Jun-2006		**Client Device**
Expiration Date:		Basic	R
Status:	Approved	Premium	R

Full duplex audio is essential to support emerging communications applications such as IP telephony, conferencing, and network gaming. These applications require the audio system to play back and record simultaneously.

At least one audio subsystem in a PC system must support full-duplex operation.Secondary audio subsystems may be added to the system that support only half-duplex operation.

AUDIO-0025	Version 1	**Digital audio record and playback meet basic performance requirements for audio device**	
Effective Date:	01-Jun-2006		**Client Device**
Expiration Date:		Basic	R
Status:	Approved	Premium	

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.
Note that device submissions must pass the Audio Fidelity tests in Driver Test Manager (DTM) to receive Basic Logo.

ALL PC SKUs:

Device Type	**Requirement**	**Value**	**Frequency range** (4)
Analog Line Output Jack	THD+N	>= 65 dB	[20 Hz,20 KHz]
	Dynamic range with signal present	>= 80 dB A-weight	[20 Hz,20 KHz]
	Magnitude Response	<=+-.25dB 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	<= -50 dB	[20 Hz,15 KHz]
	Full scale output voltage	>= 1 Vrms	
	Noise level during system activity	>= 80 dB FSA-weight	
	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	[20 Hz,20 KHz]
	Dynamic range with signal present	>= 80 dB A-weight	[20 Hz,20 KHz]
	Magnitude Response	<=+- .25dB 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	<= -50 dB	[20 Hz,15 KHz]
	Full scale output voltage	>= 1 Vrms	

	Noise level during system activity	>= 80 dB FS A-weight	
	Interchannel phase delay	30 degrees or 12.5 microseconds, whichever is greater	[20 Hz,20 KHz]
Analog Headphone Out Jack	THD+N	>= 65 dB >= 45 dB at 32 Ohm Load	[100 Hz,20 KHz]
	Dynamic range with signal present	>= 80 dB A-weight >= 60dB A-weight at 32 Ohm Load	[100 Hz,20 KHz]
	Magnitude Response	<=+- .25dB 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	<= -50 dB	[20 Hz,15 KHz]
	Full scale output voltage	>= 1 Vrmsat 300 Ohm load >= 300 mVrms at 32 Ohm load	(6)
	Noise level during system activity	>= 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	>= 65 dB FS	[20 Hz,20 KHz]
	Dynamic range with signal present	>= 80 dB A-weight	[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%.	
	Full scale input voltage	>= 1 Vrms	
Analog Microphone In	THD+N	>= 65 dB FS	[100 Hz,20

Jack			KHz]
	Dynamic range with signal present	>= 70 dB A-weight	[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	

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.

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 -3dBV (ADC) in the context of WLP 3.0. This will change to a test signal at -1dBFS (DAC) and -1dBV (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.

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 +-.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 peaks can be .25dB.

6. These are two examples. Testing will occur at these two endpoints and anywhere within this envelope. Smaller output voltages (>=120mVrms) are permitted when required by regulatory and safety standards.

AUDIO-0026	Version 1	**Audio device complies with related power management specifications**
Effective Date:	01-Jun-2006	
Expiration Date:		**Client Device**

Status:	Approved	Basic: R Premium: R

Audio devices must comply with Audio Device Class Power Management Reference Specification, Version 1.0, which provides definitions of the OnNow device power states (D0–D3) for these devices. The specification also covers the device functionality expected in eachpower state and the possible wake-up event definitions for the class. The device and driver must implement support for power state D3. Support for other device power management statesisoptional.

Design and Implementation Notes

For implementation details, refer to Audio Device Power Management Reference Specification, Version 1.0, at http://go.microsoft.com/fwlink/?LinkId=58377.

AUDIO-0027	Version 1	**Audio driver reports render sample position with defined accuracy for stream synchronization**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	R
Premium	R

The audio driver must be able to report the current position of the buffer being rendered with an accuracy of 1/20000th of a second, or with frame accuracy (as defined in the HD Audio specification) the current position of the buffer being rendered, in relation to the samples given to the codec. This applies to both the compressed and uncompressed data.

This requirement does not imply that the compressed and uncompressed streams are synchronized. The requirement covers both types of streams but that is the extent of the interaction between the stream types.

For USB audio devices, the required accuracy is 1ms for USB Audio 1.0 implementations and 0.125ms for USB Audio 2.0 implementations.

AUDIO-0028	Version 1	**PCI-based audio device supports initiator, target, and block transfer**
Effective Date:	01-Jun-2006	
Expiration Date:		

	Client Device

Status:	Approved	Basic: R Premium: R

Full-duplex audio sample transport must be supported by using separate PCI bus-mastering hardware for playback and capture sample streams.

Design and Implementation Notes

See PCI Local Bus Specification, Revision 2.3 (PCI2.3) or later, "Bus Master."

AUDIO-0029	Version 1	**PCI-based audio device supports efficient audio buffer management**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	R
Premium	R

The audio device must be able to fully function when the system can provide only single 4K pages of contiguous memory. In other words, the audio device can require many 4K pages of memory, but it must not require the largest block of contiguous memory to exceed one 4K page.

The audio device and associated device-specific driver must not introduce unnecessary latency. If the audio driver adds more than 2 ms of computational latency between buffer transfer and queuing for rendering, the driver must provide a programmatic method for a latency-sensitive application to temporarily disable the computation. .

AUDIO-0030	Version 1	**Audio sources are available as digital streams without analog mixing to the audio subsystem**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	R
Premium	R

Audio sources must be available as digital audio streams that are accessible to the system-wide kernel; that is, they must not rely exclusively on any analog mixing stage between theDAC converter and the speaker jack as the only means for output. Sources that continue to offer an analog mixing output configuration must also provide the user a configurable digital option.

One model for providing the user such an option is Windows support for CD music.

This requirement covers the following audio sources, which must be available digitally to USB speakers if attached:

- CD-ROM or DVD
- TV tuner
- FM radio
- Voice modem

PC beep notifications are exempt from this requirement.

Design and Implementation Notes

Analog microphone and line in with available analog-to-digital converters (ADCs) are digital-ready by definition. Devices for which the operating system supports emulation equivalents, such as hardware-accelerated 3-D and MIDI synthesis (Microsoft DirectSound 3D emulation and the Windows GS Wavetable SW Synth) are acceptable.

AUDIO-0031	Version 1	**Audio device that supports digital output has at least two independent DMA engines and a separate physical connection for digital output using one of the available DMA engines**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	I
Premium	I

The audio controller that supports digital output must have two independent DMA engines, one that can be used for wave output and the other to make it possible to support AC-3 over S/PDIF at the same time. The digital audio output capability is supported through a separate physical connector identified for digital audio output and used only for digital audio output.

Design and Implementation Notes

With support for two independent DMA engines, a different signal can be streamed to each connector simultaneously. For example, sending a DVD player application's Dolby Digital stream to the S/PDIF connector while simultaneously sending a voice conversation to the analog connectors. The S/PDIF port needs to be represented as its own audio "device" separate from the analog outputs. Therefore, it will have its own policy configuration, including the preferred data format for a specific signal.

AUDIO-0032	Version 1	**Audio subsystem that implements native support for float32 and float64 supports it correctly**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	I
Premium	I

Microsoft strongly recommends native support for 32-bit and 64-bit floating-point data types but does not require it at this time. However, if native support is implemented, it must be supported in the following way: float audio data must be full scale between -1.0 and 1.0 (with silence at 0.0). This range allows the full use of 23 bits for the mantissa, while achieving the best precision. The Windows audio engine processes float audio data as normalized into this range.

Design and Implementation Notes

The audio system uses float for processing; converting between integer and float complicates the design and consumes unnecessary CPU cycles.

AUDIO-0033	Version 1	**The audio driver correctly reports all supported properties**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	I
Premium	I

If the audio device and driver support additional properties, the audio driver must report all supported properties correctly to optimize speaker configuration.

Design and Implementation Notes

If the driver has analog output, the driver exposes a DAC node in its topology.The driver must then support KSPROPSETID_Audio and KSPROPERTY_AUDIO_CHANNEL_CONFIG on that node through a filter handle. The driver then correctly reports support for this property (that is, BASIC_SUPPORT call with KSP_NODE.[node ID of DAC] must succeed) and reports the _GET and _SET capabilities. See the Windows Driver Kit, "Streaming Devices."

AUDIO-0034	Version 1	**Audio subsystem that includes an S/PDIF port supports**

		minimum sampling rates
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	I
Premium	I

The audio subsystemmust support renderingat the followingsampling rates over the S/PDIF port:

- 44.1 kHz
- 48 kHz
- 88.2 kHz (optional)
- 96 kHz

However, ifnative hardware support of sampling rates in the audiosubsystemis less than 96kHz or only up to 48kHz, rendering over S/PDIF port must be supported only for 44.1 and 48kHz.

AUDIO-0035	Version 1	Audio device that supports multichannel audio formats properly handles channel masks
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	I
Premium	I

If the audio device supports multichannel audio formats, the audio device driver must deal with channel masksconsistent with the content and the current selected speaker configuration.

Design and Implementation Notes

If supported, the device properly handles 5.1 and 7.1 PCM formats. The channels are routed to the proper analog lines, and these requirements apply for all the channels except LFE.

See the Audio Driver Support for Home Theater Speaker Configurations whitepaper at http://go.microsoft.com/fwlink/?LinkId=65430.

AUDIO-0036	Version 1	**Multichannel-capable audio device has phase delays that are less than 1 sample between any two channels**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	I
Premium	I

If the audio device supports multichannel audio, the phase delays between any two channels must be less than one sample at any given sample rate. This measurement ensures that phase cancellations do not cause surround degradation..

AUDIO-0037	Version 1	**Audio solution that implements topology volume nodes uses a resolution equal to or better than 1.5 dB**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	I
Premium	I

Topology volume nodes must have a resolution equal to or better than 1.5dB and implement driver support for volume level as defined in the Windows Driver Kit.

Design and Implementation Notes

See the Windows Driver Kit, "KSPROPERTY_AUDIO_VOLUMELEVEL."

AUDIO-0038	Version 1	**Audio driver that implements KSNODETYPE_VOLUME correctly supports the KSPROPERTY_AUDIO_VOLUMELEVEL property**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	I
Premium	I

If a driver implements support for KSNODETYPE_VOLUME, that node must correctly support the

KSPROPERTY_AUDIO_VOLUMELEVEL property whose value is a multiple of decibels.

Design and Implementation Notes

See the Windows Driver kit, "KSNODETYPE_VOLUME." The decibel values are documented on MSDN.

AUDIO-0039	Version 1	**Audio driver that implements KSNODETYPE_SUPERMIX correctly implements the KSPROPERTY_AUDIO_MIX_LEVEL_TABLE property**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	I
Premium	I

If a driver implements support forKSNODETYPE_SUPERMIX then that node must correctly support the KSPROPERTY_AUDIO_MIX_LEVEL_TABLE property whose value is a multiple of decibels.

Design and Implementation Notes

See the Windows Driver kit, "KSNODETYPE_SUPERMIX." The decibel values are documented on MSDN.

AUDIO-0040	Version 1	**Driver for audio device that exposes S/PDIF output supports the WMA PRO S/PDIF format tag**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	I
Premium	I

An audiodevicewith exposed S/PDIF output must implement WMA PRO S/PDIF format tag support. Support for the WMA PRO S/PDIF format tag is described in "Audio Driver Support for the WMA Pro-over-S/PDIF Format."

Design and Implementation Notes

Refer to "Audio Driver Support for the WMA Pro-over-S/PDIF" at http://go.microsoft.com/fwlink/?linkid=52305.

AUDIO-0041	Version 1	**Audio device supports S/PDIF output for PCM and non-PCM data streams**

Effective Date:	01-Jun-2006		**Client Device**
Expiration Date:		Basic	I
Status:	Approved	Premium	I

Audio device supports S/PDIF outputfor both PCM and non-PCM data streams.

Design and Implementation Notes

See recommended requirements in the Universal Audio Architecture UAA Hardware Design Guidelines at http://go.microsoft.com/fwlink/?LinkId=50734.

AUDIO-0042	Version 1	**Audio subsystem supports independent selection of input and output sample formats**	
Effective Date:	01-Jun-2006		**Client Device**
Expiration Date:		Basic	I
Status:	Approved	Premium	I

If the built-in or external audio device includes both input and output capabilities, the audio device must support independent selection of input and output sample rates.

AUDIO-0043	Version 1	**Audio subsystem supports time-synchronized sample rates if both input and output capabilities are present**	
Effective Date:	01-Jun-2006		**Client Device**
Expiration Date:		Basic	I
Status:	Approved	Premium	I

If the built-in or external audio device includes input and output capabilities, the timing relationship between input and output sample rates must remain constant (that is, no drift). For example, if 8 kHz is selected for both input and output sampling rate, audio hardware must ensure that the sampling rate for input and output is precisely matched.

Further, when input and output sample rates are set to integer ratios, the actual sample rate ratios must match (that is, no drift). For

example, if an 8-kHz input sampling rate and a 32-kHz output sampling rate are selected, the ratio of actual sampling rates must be precisely 8:32. This requirement can be accomplished by ensuring that both input and output sampling rates are derived from the same clock and that sample rate divisors are set correctly.

Design and Implementation Notes

This requirement helps ensure that AEC and NS algorithms maintain performance and convergence.This requirement does not apply to inputs and outputs where the input source sets a clock such as a digital S/PDIF input.

AUDIO-0044	Version 1	**USB audio device uses USB HID audio controls to keep the operating system informed of user interactions with the device**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	R
Premium	R

USB audio devices must use USB HID specification-compliant HID to control basic functions. If volume adjustment controls are implemented on the USB audio device, it must declare itself as a consumer control device (usage 0x01), as defined in Consumer Page (page 0x0C) in the USB Usage Tables for HID Power Devices, Release 1.1, and in Windows support for HID-based audio controls.

Design and Implementation Notes

See "HID Audio Controls and Windows" at http://go.microsoft.com/fwlink/?LinkId=40491.

AUDIO-0045	Version 1	**System effect in capture path provides RAW data from microphone array when requested by the client**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	I
Premium	I

If a microphone array processing algorithm is provided in a Windows Vista system effect audio processing object (APO) instantiated in system effect local effect (LFX) insert point in capture path, it must provide all the individual audio streams from the array when a client asks for a format greater than one stream/channel. This allows the APO to provide hardware compensation processing and microphone array processing to the client that takes advantage of the entire APO but allows clients that rely on the microphone array

processing that resides higher up in the audio subsystem to take advantage of hardware compensation in the APO but not the array processing in it.

AUDIO-0049	Version 1	**Display adapter or chipset with HDMI audio capabilities implements audio support as an HD Audio compliant audio solution**
Effective Date:	01-Jun-2006	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	I
Premium	I

A display subsystem that supports HDMI audio capabilities must implement the HDMI Audio support as an HD Audio compliant audio solution. Pending standardization of HDMI Audio through the HD Audio specification,the required method is to use an HD Audio compliant solution exposing an SPDIF Output with a static format support of Stereo PCM, 16 bit 48KHz.

Design and Implementation Notes

Additional information on how to expose an SPDIF Output in an HD Audio compliant controller/codec configuration can be found inthe Intel HD Audio specification. Also, see the UAA Hardware Design Guidelines that will be available in the future.

AUDIO-0052	Version 1	**Audio Device Driver provides kernel streaming topology according to the documentation in the Microsoft Windows Driver Kit**
Effective Date:	01-Jun-2007	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	R
Premium	R

If-implemented definition: If the device is an audio device this requirement applies as REQUIRED for all implementations.

Some important examples (not inclusive of all the driver has to adhere to, see the WDK for full disclosure):

- ***Check Pin KsDataRange***

If a datarange structure (KSDATARANGE structure) has a "Specifier" value KSDATAFORMAT_SPECIFIER_WAVEFORMATEX, then:

FormatSize must be sizeof(KSDATARANGE_AUDIO).

KSDATARANGE_AUDIO values must have:

– SampleFrequency is between 1 Hz and 2,000,000 Hz

– BitsPerSample are between 8 and 32 bits.

- ***Check Orphaned Pins***

All pins must have at least one internal connection and none can be orphaned.

Node Verifications:

- ***All Nodes Pin I/O Count***

For all node types specified in the MSDN, the following is a list of the required number of input and output connections.

KS Node	Number of Inputs	Number of Outputs
KSNODETYPE_MUX	>= 1	1
KSNODETYPE_SUM	> =1	1
KSNODETYPE_DEMUX	1	> 1
KSNODETYPE_ACOUSTIC_ECHO_CANCEL	2	2

KSNODETYPE_DEV_SPECIFIC	Not Specified	Not Specified
All other nodes	1	1

- ***Check Orphaned Nodes***

Checks to make sure that all nodes have connections to other nodes and no orphaned nodes are left.

All channel properties, including channels returning Boolean values, such as mute, must include one MembersHeader, and the MembersCount field must accurately describe the number of channels. This requirement also applies to mono controls.

Design and Implementation Notes
Test your device driver with the KS Topology test in the Windows Logo Kit to ensure compliance with this requirement.

AUDIO-0053	Version 1	**Audio driver does not perform undiscoverable stream redirection or perform other hidden stream handling that is unknown and/or uncontrollable by user or the Windows Audio System.**
Effective Date:	01-Jun-2007	
Expiration Date:		
Status:	Approved	

	Client Device
Basic	R
Premium	R

If-implemented definition: If the device is an audio device.

Audio driver does not perform undiscoverable stream redirection or perform other hidden stream handling that is unknown and/or uncontrollable by user or the Windows Audio System.

Audio driver does not perform hidden stream redirection, routing, switching, splitting, mixing, muxing to other exposed or hidden logical audio devices, applications or other entities but ensures the audio stream from the audio system endpoint for a particular logical device is only directed to that particular logical device that the application is streaming to, as set by the Windows user in the Windows Sound control panel.

The handling of streams is an application layer feature and must not be performed by audio drivers in fashions not discoverable to Windows.

Design and Implementation Notes
A Windows friendly audio driver exposes the capabilities and peculiarities of the independent logical audio endpoints the audio device or system audio implementation supports. The audio driver provides other hardware specific support enabling use of the device on Windows but