



# Microsoft Lync Devices Specification

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OPTIMIZED FOR

Microsoft® Lync™

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## Table of Contents

1.0	Revision History .....	4
2.0	Test Specifications.....	5
2.1	Additional References .....	5
2.2	Contacting Microsoft .....	5
2.3	Terms .....	6
3.0	Lync USB Device Categories and Requirements .....	9
3.1	Overview .....	9
3.2	Device Categories and Requirements Matrix .....	10
3.3	General Requirements for Lync Devices .....	11
3.3.1	Windows Operating Systems .....	11
3.3.2	USB 2.0 .....	11
3.3.3	Firmware Update .....	11
3.3.4	Bidirectional Device Enumeration .....	11
3.3.5	UC Qualification (UCQ) Descriptor for HID .....	14
3.3.6	Friendly Device Name .....	15
3.3.7	Power Management .....	15
3.3.8	No Driver Installation .....	16
4.0	Call Control Requirements .....	16
4.1	HOOK SWITCH with LED Notification.....	16
4.2	Volume Control .....	16
4.3	Mute Button and LED.....	17
4.4	Flash .....	17
4.5	Speakerphone .....	17
4.6	HID Usage Tables .....	18
5.0	Dial pad Requirements.....	19
Appendix A.	UCQ String and Device Selection .....	21
1.0	How is the UCQ Descriptor used in Lync?.....	21
1.1	UCQ and Device Functionality .....	21
1.2	Device selection in W13:.....	21

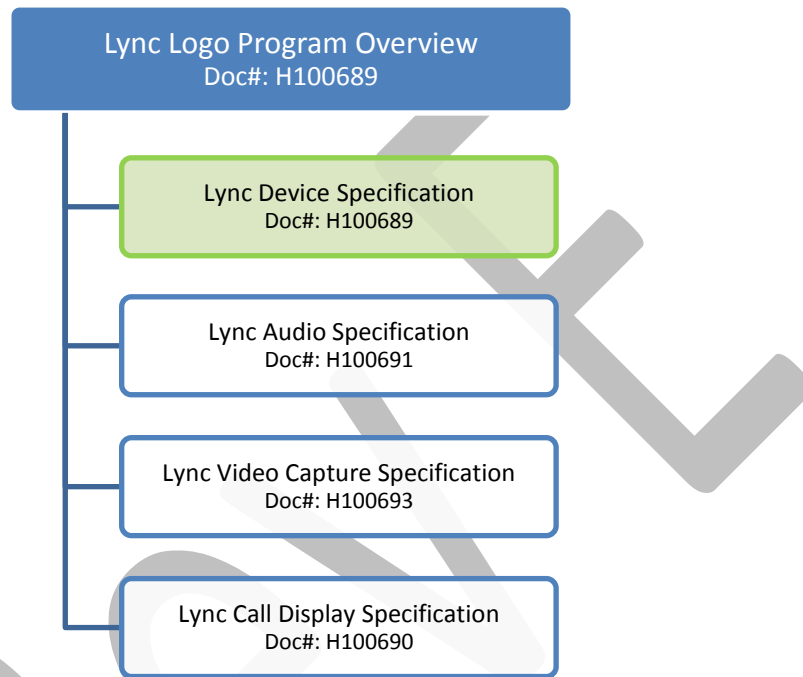
1.2.1	Configuring devices in W13: .....	21
1.2.2	Device Hierarchy in W13.....	23
1.3	Device Selection in W14: .....	23
1.3.1	Configuring Devices in W14 .....	23
1.3.2	Device Hierarchy in W14.....	25
1.4	How is the UCQ Descriptor used by the Operating System? .....	25
Appendix B.	HID & UCQ Conformance Report template .....	26
Appendix C.	Classification for Lync PCs with partial A/V functionality .....	28

## 1.0 Revision History

Revision	Date	Description	Author/Revised by
A	7/2/2009	Creation of initial <i>Office Communicator Devices Specification 2.0</i> and disseminated for review.	David Ramsey
B	11/25/2009	Updated TDA language and terms, Clarify AEC firmware and native OC AEC compatibility in 4.4.3; Changed UCQ requirement to "N/A" for OC webcams that do not support b-directional audio in Section 4.3.4. Rewrote for better clarity; clarified Flash button requirements and support in section 5.2.2; clarified firmware upgrade requirements in section 4.4.3; Include value-added software discussion; clarified call flow diagram language in Section 5.1.1; clarified webcam qualification process w.r.t. embedded audio capabilities in Section 4.1; clarified USB connected devices focus for the OC device specification in Section 4.1; clarified 201/301 waiver language, Headset Enumeration and added a table in Section 4.4.1; clarified USB connectivity language for TS and TRS connectors in Section 4.3.2; added language about how the UCQ string is used by the operating system and cited website to find the whitepaper; changed AEC requirement in Device Table to "Optional"	David Ramsey
C	4/15/2010	Requirements identified clearly. Restructured document for readability	Jyoti Black/ Doug Anderson
D Release Candidate	8/30/2010	incorporated review by document writer, added W14 content & screenshots, updated UCQ section, clarified requirements for Lync PCs with only audio or only video, added guidance on friendly name, Title and content changed to use Lync branding	Doug Anderson / Jyoti Black / Rachel An
D	10/21/2010	No changes from Release Candidate draft	Doug Anderson / Jyoti Black / Rachel An
E	4/29/11	Added note for Basic PC, Added LED Ring HID	Doug Anderson

## 2.0 Test Specifications

The family of Microsoft Lync (or simply Lync) documents supporting the Lync logo program is shown below and contains detailed requirements that candidate devices, being submitted to the *Optimized for Microsoft Lync Logo Program* (previously known as the OC logo program), must meet. The technical requirements listed herein have been derived solely for the purpose of maximizing interoperability and optimizing the functional and quality experience of devices used with the Microsoft Lync platform. The test specifications are split into the four categories shown below:



This *Lync Device Specification* document details the Lync functional interoperability and USB HID command usage for devices submitted for qualification to the Lync logo program. This document includes the following:

- Description of the device categories currently supported by the Lync logo program.
- General usage requirements to ensure that Lync users experience compatibility and ease-of-use.
- Device enumeration and UCQ extension required to identify capabilities of the device.
- Call Control HID telephony commands supported between Lync and the device.

### 2.1 Additional References

Additionally, this document references the following industry standard:

Document Name	Link
Universal Serial Bus Specification (v2.0)	<a href="http://www.usb.org/developers/docs/">http://www.usb.org/developers/docs/</a>

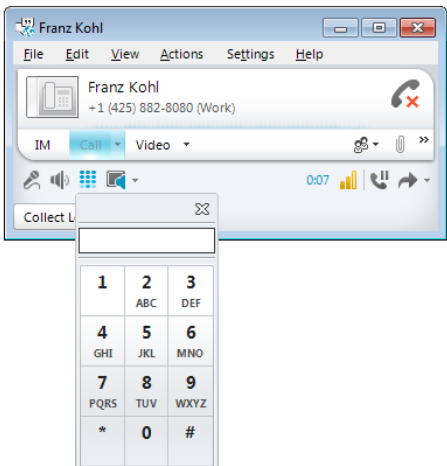
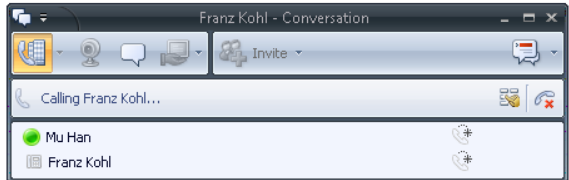
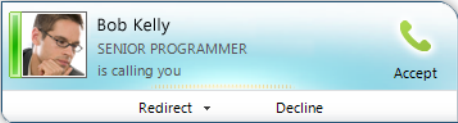

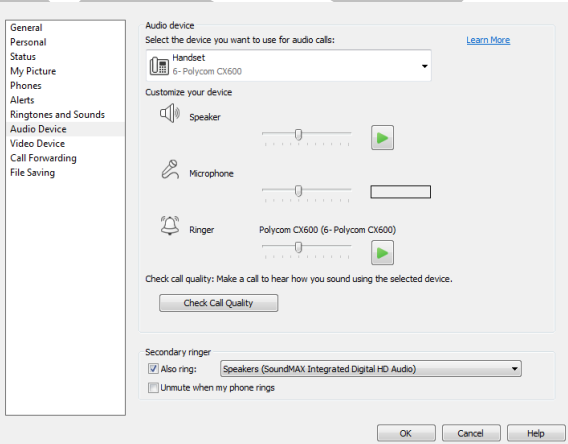
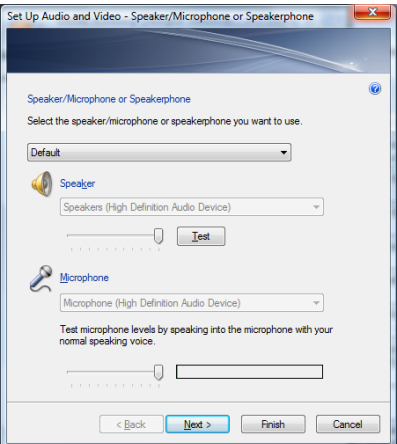
### 2.2 Contacting Microsoft

For any questions regarding the requirements detailed in this specification, please contact the Lync logo team by sending an email to [lynclogo@microsoft.com](mailto:lynclogo@microsoft.com).

## 2.3 Terms

This section describes standard terms and conventions used in this document.

W12	Abbreviation for “Wave 12”, Microsoft Office Communications Server 2007 platform launched in 2007 (prior to Lync rebranding).
W13	Abbreviation for “Wave 13”, Microsoft Office Communications Server 2007 R2 platform launched in 2009 (prior to Lync rebranding)
W14	Abbreviation for “Wave 14”, codename for the version of Microsoft Lync currently targeted for release in Q4 2010.
UC	Unified Communications, a set of products and services integrating non real-time and real-time communication services into a consistent and coordinated user interface and experience.
OC	Office Communicator, the Microsoft implementation of unified communications (prior to Lync rebranding)
Lync	The Microsoft implementation of unified communications released in 2010.
HID	Human Interface Device (HID)
AEC	Acoustic Echo Cancellation (AEC), a process by which echo is removed from voice communications to improve audio quality.
BT	Bluetooth Technology (BT), wireless technology typically using short-range radio links up to 30 feet (class2 BT range). Microsoft supports only wideband implementations of BT.
DECT	Digital Enhanced Cordless Telecommunications (DECT), an ETSI standard for digital portable phones (wireless home telephones) that specifies a means for portable wireless phones to access a fixed telecommunications network via radio. Only wideband implementations of DECT are acceptable for Lync Optimized devices.
Corded	A device is physically connected to a computer’s USB port, typically by using a 5 to 7-foot cord.
Wireless	A device that is not physically connected to the computer and relies on Bluetooth, DECT, or a proprietary radio frequency for audio and data communications to a USB dongle connected to the computer.
Handsfree	Refers to the scenario when a user or group is not required to physically hold the device to receive and transmit audio signals during a conversation.
Public Device	A device configuration option for 2007 R2 of communicator, intended for speakerphone type devices, in which audio communication may be audible to multiple individuals.
Private Device	A device configuration option for 2007 R2 of communicator, intended for handset or headset devices, in which audio communication is typically heard by a single individual.
UCQ	Unified Communications Qualification (UCQ) descriptor, the set of fields sent to Lync by a telephony HID device indicating the capabilities supported by the device.
OFF HOOK	The state of the telephone when the communication switch is open between the device and Lync client.
ON HOOK	The state of the telephone when the communication switch is closed between the device and Lync client.
Call Control Buttons	Refers to the physical buttons potentially present on a device manufacturer’s headset, handset or speakerphone or present on an inline call/sound control for corded devices to manage sound and call activities. These can vary depending on the specific feature set implementation and device partner terminology (e.g., Flash Button, Mute Button, Volume Control, Speaker Button, or Multi-function Control).
Conversation	Refers to the client window that is seen during a conversation.

<p>Window (Conversation window?)</p>	<div> <div>Wave 14</div> <div>2007 R2 (Wave 13)</div> </div> <div>   </div>
<p>Conversation Invite Window (CIW)</p>	<p>Refers to the client window that signals an incoming call. The CIW is known as a notification.</p> <div> <div>Wave 14</div> <div>2007 R2 (Wave 13)</div> </div> <div>   </div>
<p>A/V Tuning Wizard</p>	<p>Refers to the Tuning Wizard in the Lync client. In W13, one can get to it from the client's main menu by selecting Tools and then Setup Audio and Video. In Lync 2010, the tuning wizard is a section in the Options window.</p> <div> <div>W14</div> <div>2007 R2 (Wave 13)</div> </div> <div>   </div>

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119.

REVEAL



## 3.0 Lync USB Device Categories and Requirements

### 3.1 Overview

Lync USB Device Categories are classes of devices grouped by usage scenario and by typical functionality that is specifically intended with USB connected devices. Categories may have sub-types or additional categorization to allow for additional feature and usage differentiation.

The *Lync Logo Program* recognizes and supports different device categories, as follows:

- **Lync Handsets** – A Lync handset is a corded or wireless device with a form factor resembling a phone hand bar that typically has a dial pad, but may or may not have a display. Handsets may support a speakerphone mode, but only handset (non-speakerphone) audio mode is evaluated by the Logo Program.
- **Lync Headsets** – This category comprises two sub-types of headsets: corded headsets and wireless headsets. A Lync corded headset is physically connected to the computer's USB port by the device's audio transmission cable. A Lync wireless headset consists of a handsfree headset with a boom microphone or a fitted ear device, the latter consisting of an ear bud speaker and a small boom fitted with a microphone. Wireless headsets connect to the computer by using a USB dongle.
  - **Lync Basic Headsets** – This sub-category describes a “no frills” headset that provides a quality audio experience.
- **Lync Speakerphones** – A Lync speakerphone is a USB or wireless device with a microphone and speaker that is designed for handsfree personal use, or for a small group in a limited office or conference setting. When a Lync speakerphone is used in a conference setting, it is designed with microphone pickup from any angle within the room.
- **Lync USB Desk Phones** – A Lync USB desk phone is a corded device with a dial pad, display, speakerphone, and extensive call control features and is designed to replace a typical desktop phone.
- **Lync Webcams** – A Lync webcam is a camera that provides the resolutions and color formats as specified in the *Lync Video Capture Specification*. Audio transmit capabilities, if included, SHALL meet the *Lync Audio Specification*.
- **Lync PCs** – A Lync PC is a PC that has integrated web camera, microphone, speaker, and monitor functionality in a PC form factor without requiring additional devices or peripherals. Examples include laptops or all-in-ones.

Note: Lync Phone Accessories (e.g. devices used together with an IP phone or USB phone to enhance its function) should be presented on a case by case basis.

Additional categories may be added as devices deliver new experiences.

### 3.2 Device Categories and Requirements Matrix

The following table identifies mandatory and optional requirements for each of the Lync device categories.

M	Mandatory Feature
O	Optional Feature
-	Not Applicable

			Device Categories						
Requirements		Section	Handsets	Headsets	Basic Headsets	Speakerphones	USB Desk Phones	Webcams	Lync PC and Basic PC <sup>3</sup>
General	3.3.1	Windows Operating Systems	M	M	M	M	M	M	M
	3.3.2	USB 2.0 Support	M	M	O	M	M	M	M
	3.3.3	Firmware Update	M	M	O	M	M	M	-
	3.3.5	UCQ Descriptor	M	M	M	M	M	-	-
	3.3.7	Power	M	M	M	M	M	M	-
	3.3.8	No Driver Installation	M	M	M	M	M	M	-
	3.3.4	Bidirectional Audio Device Enumeration	M	M	M	M	M	-	-
Call Control	4.1	HOOK SWITCH with LED	M	M	O	M	M	-	-
	4.2	Volume Control	M	M	O	M	M	-	-
	4.3	Mute Button and LED	M	M	O	M	M	-	-
	4.5	Speakerphone	O	O	O	M	M		
	4.4	Flash	O	O	O	O	M	-	-
Call Indicators/LED	4.6	Off Hook, Speaker, Mute, Message Waiting, Call Forwarding	O	O	O	O	M	-	-
Dial Pad	5.0	Standard Telephone Keypad	M	O	O	O	M	-	-
Audio	See Lync Audio Specification		M	M	M	M	M	M <sup>1</sup>	M <sup>2</sup>
Video	See Lync Video Capture Specification		-	-	-	-	-	M	M <sup>2</sup>
Display	See Lync Call Display Specification		O	O	O	O	M	-	-

1 If webcam supports a microphone and/or speaker, the device must comply for send and/or receive requirements. If both microphone and speaker are present speakerphone requirements apply.

2. See appendix C Lync PCs with partial audio/video functionality (e.g. audio only with no webcam).

3. Rev E introduced a 'basic' level of performance for video capture. This level applies for PCs only and is a limited pilot as of April 2011. Please contact your Lync representative for details.

### 3.3 General Requirements for Lync Devices

This section lists the general requirements for all Lync device categories submitted to the Lync logo program. Note: Users must have an Enterprise Voice CAL to use any voice and video features in Lync 2010.

#### 3.3.1 Windows Operating Systems

**Requirement:** Devices SHALL support interfacing to the following versions of Microsoft operating systems:

- Windows XP SP3 or later versions version
- Windows Vista SP1 or later versions version
- Windows Server 2003 SP1, or later versions version
- Windows 7 with latest service pack

Note: currently WHQL is required for webcams and Lync PCs, but not for audio only devices (headsets, handsets, speakerphones)

#### 3.3.2 USB 2.0

**Requirement:** Devices\* SHALL support version 2.0 or higher of the USB interface.

\* It's optional for devices in the basic headset category to support this requirement.

See <http://www.usb.org/developers/docs>

All HID commands must be sent to Lync via the USB interface, which means wireless devices come paired with a compatible USB dongle to facilitate communication between the device and PC.

#### 3.3.3 Firmware Update

**Requirement:** Devices\* SHALL support a mechanism to update firmware in the field.

\* It's optional for devices in the basic headset category to support this requirement.

The tools and process that are used to provide the update are the responsibility of the device maker. These updates should be available for either the end user of the device or a systems integrator servicing the account. In the event that a firmware update is not the most effective support solution, device makers must provide an alternate solution for rapid resolution of support issues for devices in the field.

#### 3.3.4 Bidirectional Device Enumeration

**Requirement:** Audio devices SHALL enumerate as a telephony device supporting bidirectional audio (i.e., 0x40X enumerations) for proper use with Lync.

Devices that enumerate as a 0x201/0x301 are selected as the default system sound device by the operating system and are used to send audio alerts, such as application and message alerts. Additionally this type of enumeration does not provide accurate information about the device capabilities.

When using a bi-directional device such as a 0x402 headset, the user enjoys benefits such as:

- Windows 7 automatically selects 0x40X devices as default communications device.
- Audio Ducking: system volume (e.g. streaming music) is reduced when a call is answered on the 'communications device' in Windows7.
- Improved echo cancelling for headsets: the media stack in Lync recognizes 0x402 headsets and applies echo cancelling optimizations.
- System alerts are sent to the default speaker, avoiding missed alerts when user isn't wearing headsets.

Audio devices MUST correctly set the terminal type as defined in Table 2.4 of the Universal Serial Bus Device Class Definition for Terminal Types Release 1.0 dated March 18, 1998. These Terminal Types describe an Input and an Output Terminal for voice communication and require two Terminal descriptors. The two Terminals are linked together using the **bAssocTerminal** field. Additionally, the Associated Interfaces descriptor can be used to reference an HID interface for conferencing functions.

**Bidirectional Terminal Types from USB 2.0 Specification**

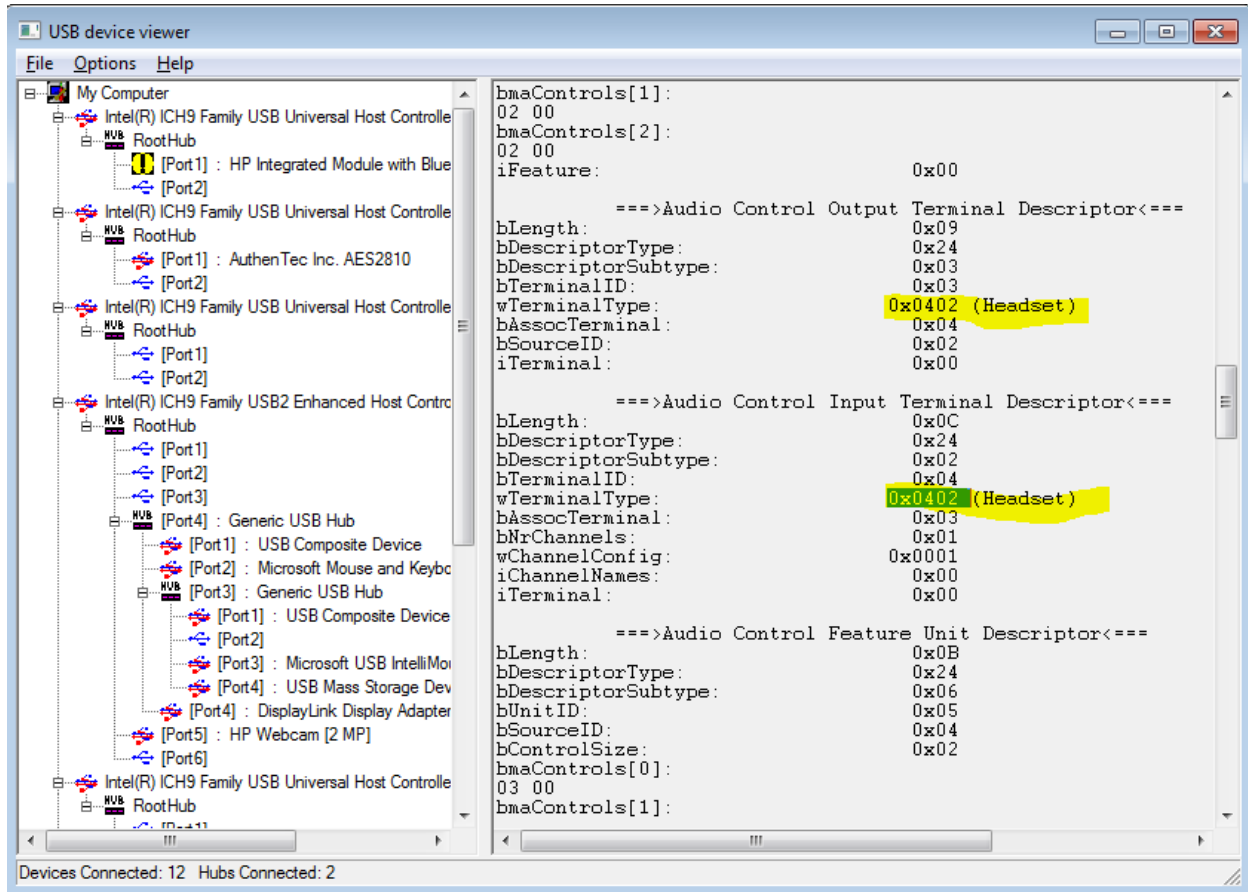
Terminal Type	Code	I/O	Description
Bidirectional Undefined	0x0400	I/O	Bidirectional Terminal, undefined Type.
Handset	0x0401	I/O	Handheld bidirectional audio device.
Headset	0x0402	I/O	Head-mounted bidirectional audio device.
Speakerphone, no echo reduction	0x0403	I/O	A handsfree audio device that is designed for host-based echo cancellation.
Echo-suppressing speakerphone	0x0404	I/O	A handsfree audio device with echo suppression capable of half-duplex operation.
Echo-cancelling speakerphone	0x0405	I/O	A handsfree audio device with echo cancellation capable of full-duplex operation.
Telephony Undefined	0x0500	I/O	Telephony Terminal, undefined Type.
Phone line	0x0501	I/O	Can be an analog telephone line jack, an ISDN line, a proprietary PBX interface, or a wireless link.
Telephone	0x0502	I/O	Device can be used as a telephone. When not in use as a telephone, handset is used as a bidirectional audio device.
Down Line Phone	0x0503	I/O	A standard telephone set connected to the device. When not in use as a telephone, it can be used as a bidirectional audio device.

**Note:** For convenience, this table is reproduced from the industry standard USB 2.0 Specification. Microsoft is not responsible for the maintenance of the information contained here.

To verify that the device correctly enumerates the bidirectional terminal type:

1. Start USBView.exe (can be obtained in the [Windows Driver Kit](#)).
2. Browse through the list of enumerated USB devices in the USB tree until you find the device being tested.

3. Scroll through the device descriptors until you find the 'Audio Control Input Terminal Descriptor' and the 'Audio Control Output Terminal Descriptor' as shown in the image below.
4. Verify that the 'wTerminalType' matches the requirement for the device type being tested (e.g. 0x402 for a headset)



### 3.3.5 UC Qualification (UCQ) Descriptor for HID

**Requirement:** Devices SHALL support the UCQ descriptor to inform Lync of their unique capabilities.

The UCQ descriptor is used by Lync to determine the basic capabilities of the audio device. The string is requested by Lync through a standard USB string descriptor request at index 0x33. The full UCQ string is 17 characters long (including the characters 'UCQ'). If the UCQ string is truncated, any missing elements will be treated as '0' values.

The following table presents the fields and associated values for the UCQ descriptor:

Qualified Lync Devices	Display Supported	Speakerphone	Handset	Headset	AEC	RESERVED	Wireless	Lync HID Version (major)	Lync HID Version (minor)	SIP endpoint
"UCQ"	"0" No "1" Yes	"0" No "1" Yes	"0" No "1" Yes	"0" No "1" Yes	"0" No "1" Yes	NOT USED	"0" No "1" Yes	0x01 2007 R2	0x00 2007 R2	Always "0"
UCQ	1	0	1	0	0	000	0	01	00	0

- The first 5 bit strings (after the characters 'UCQ') declare support for the named functionality.
- The RESERVED field is for legacy systems device vendors SHOULD set this to "000". Other values if used could cause problems with later Lync releases.
- The Lync HID Version (major) is used to determine Lync compatibility. USB devices implemented according to current Lync devices specifications SHALL declare Lync HID version as '01'. As of October 2010, 2 versions of Lync HID exist:
  - Version '00' for versions of Lync clients prior to the 2007 R2 client
  - Version '01' for versions of Lync clients from 2007 R2 client and beyond
- The Lync HID Version (minor) only has one option as of October 2010. Devices MUST set this element to '00'.

*Warning: newer HID functionality (such as for call display) will be limited if device reports version '00' for Lync HID version (major).*

Example 1: "UCQ10100000001000" string means that this UC device has a LCD display (following the Lync HID display protocol), is a handset and supports the Lync HID published for 2007 R2 client or later.

To verify the UCQ string, use a USB bus analyzer (e.g. Beagle 12 USB analyzer and Total Phase software).

1. Connect the device and the analyzer to a computer that is running the Total Phase software.
2. Launch Total Phase.
3. Select Connect To Analyzer from the Analyzer menu.

4. Start the capture.
5. Start Lync.
6. Stop the capture as soon as Lync is fully started and look for the record 'Get String Descriptor' with Data 'Index=33...'
7. Verify UCQ string vs. to those that are expected for device.

### 3.3.6 Friendly Device Name

**Requirement:** Devices SHOULD use a friendly name to identify the device appropriately for end-user selection.

Guidance is to provide at least the following fields *<brand> + <model> + <device category>*. The maximum string length displayed by the Lync client varies depending on user's resolution settings. As a best practice, the total length SHOULD be less than 28 characters.

Device maker SHOULD submit a device metadata package to provide proper icon in windows. Refer to the following URL for details:

<http://www.microsoft.com/whdc/device/DeviceExperience/CreateDevMetadataPkg.msp>

### 3.3.7 Power Management

**Requirement:** Corded devices (*handsets, headsets, webcams, and standard speakerphones*) SHOULD draw no more than 100 mA from a USB bus.

This allows the handset/headset to operate while connected to a bus powered USB hub.

**Requirement:** A conference-grade Lync speakerphone SHALL draw up to 500 mA of power. If a device draws more than 100 mA of power from the USB bus, then the device MUST support both suspend and resume power modes.

The device enters a low power suspend state when it detects no activity. The device resumes a normal power state on either of the following event occurrences:

- 1) detection of USB resume signaling from Lync, or
- 2) detection of a local wakeup event, such as the OFF HOOK notification or any other physical button press on the device. When a device wakes up because of a local wakeup event and enters a resume power mode, it must generate a remote wakeup event to awaken the computer.

**Requirement:** Any device that is classified as a 'high power' USB device MUST provide end user documentation stating that if the device is connected to an external hub then the hub must be self-powered in order to prevent performance issues due to insufficient power provided by a shared hub. Example text provided:

***"NOTE** the phone will not work correctly if it is connected to a bus-powered USB hub (such as a keyboard with an integrated USB hub). The USB connection between the phone and the computer not only provides the connection to Lync, but also supplies power from the computer to the phone."*

### 3.3.8 No Driver Installation

**Requirement:** Devices SHALL be fully compatible with the Windows USB class driver and require no additional driver installation to be initialized and successfully used with Lync.

Lync does not preclude a device maker from developing and distributing value-added software for use with Windows and Lync. However, it is the device manufacturer's sole responsibility to ensure interoperability and compatibility with Windows and Lync.

**Requirement:** If additional software is provided for the device then the device SHALL meet the qualification criteria for the Lync logo program with and without the additional software.

## 4.0 Call Control Requirements

### 4.1 HOOK SWITCH with LED Notification

**Requirement:** To be selected by Lync as a valid HID-enabled audio device, a device SHALL declare support for the HOOK SWITCH HID command, even if there is no hardware hook button on the device. The HOOK OFF LED SHOULD use a stand-alone HID output report (i.e. with no other usage defined).

An LED to display the hook state is recommended.

- Lync sends the device an OFF HOOK HID (with Off Hook LED=1) under the following conditions:
  - The user starts or accepts a phone call from the Lync Conversation Window (CW) and audio is directed to the handset or headset.
  - The device is activated by user changing the active device for the call (exact user interface varies by client version).
- Lync sends the device an ON HOOK HID (Off Hook LED=0) under the following conditions:
  - The calling party ends the phone conversation while the audio is directed to the headset or handset.
  - The user ends the phone call from the Lync CW while the audio is directed to the headset or handset.
  - The device is deactivated by user selecting a different device for the call (exact user interface varies by client version).

### 4.2 Volume Control

**Requirement:** The device's local volume control buttons SHALL do one of the following:

- Control the local volume on the device and SHALL NOT send any command to the PC to adjust gain.
- Support a dual mode functionality as follows:
  - If OS is Windows XP: Control the local volume on the device and SHALL NOT send any command to the PC to adjust gain.
  - If OS is Vista or higher: Control windows volume by sending a command to the PC to adjust gain and respond to changes from the OS.



The reason for the local volume requirement in Windows XP is because Windows XP SP3 and Windows Vista SP1, the HID volume control command as defined by the USB HID Usage Tables adjusts the volume on the default system sound, which may not be the audio device selected for use by Lync.

*Note: When Windows XP reaches end of Life, the requirement will be simplified to control windows volume exclusively.*

### 4.3 Mute Button and LED

**Requirement:** A Lync device with a dedicated MUTE microphone button SHALL use the “PHONE MUTE” HID command to indicate that there is no outgoing transmit audio (i.e., microphone muted) and to synchronize the state with the Lync user interface. Mute button SHOULD be implemented as a HID toggle rather than a HID mute state change.

**Requirement:** If the device supports an LED for indication of mute state, then it SHALL receive the LED Microphone from the Lync user interface. The device SHALL locally manage the mute state in such a way that when the mute button is selected on the device the transmit audio is muted by the device and the mute state is synchronized with Lync via PHONE MUTE.

A user can toggle the Mute state from either the device or the Lync user interface. Therefore, a device must respond to the “PHONE MUTE” HID command and LED Mute to successfully synchronize the Mute state between the device and Lync user interface.

**Requirement:** Lync PCs which have a button for mute speaker or mute microphone are required to communicate the mute state to the Windows operating system (e.g. volume icon in Windows system tray must reflect mute state).

### 4.4 Flash

**Requirement:** A device may implement the Flash feature by using a dedicated illuminated flash hardware button on the device.

The FLASH HID command can be used to put an existing call on Hold/Resume, or answer an incoming call while the user is in an active call. When one or more calls are on hold, the device SHOULD correctly implement the FLASH HID to ensure an intuitive user experience in multi-call scenarios.

### 4.5 Speakerphone

**Requirement:** the speakerphone command from devices is **deprecated** in Lync 2010, but should be supported by devices for backwards compatibility with 2007 R2 version of Office Communicator.

The speakerphone HID command was used in 2007 R2 for toggling the audio between the public and private device (e.g. speakerphone and headset). W14 version of Lync client is no longer restricted to only two communications devices (public and private). The speakerphone command is deprecated because Lync supports multiple-device HID and allows user to switch to a new active device either by pressing hook switch on the device they want to transfer to, or by selecting the device in the device switcher.

In 2007 R2 client, a user can switch the audio output from a headset/handset to handsfree mode by using the speakerphone HID from the USB device (if implemented) or the speakerphone toggle button in the client user interface, as highlighted in the image below (the button is visible only if a different HID headset/handset device is present).



If the device user presses the hook button while the audio is currently directed through a speakerphone, the streaming audio is switched to the headset/handset. Transferring audio back to the speakerphone is only possible via the speakerphone toggle shown above on the user interface. Pressing the hook on/off toggle while audio is switched to the headset/handset will terminate the call.

#### 4.6 HID Usage Tables

The telephony features of the device must be based on the USB HID Telephony Device page of the USB HID Usage table. The following table presents the subset of USB HID Usage commands supported by Lync.

##### Telephony Device Page (0x0B) Usages Supported by Lync

Usage ID	Usage Name	Usage Type	Comments
0x01	Phone	CA (Collection Application)	
0x04	Handset	CL (Collection Logical)	
0x05	Headset	CL (Collection Logical)	
0x06	Telephony Key Pad	Nary (Named Array)	
0x20	HOOK SWITCH	OOC (On/Off control)	
0x21	Flash	MC (Momentary control)	
0x24	Redial	OSC (One-shot control)	
0x2B	Speakerphone	OOC (On/Off control)	2007 R2 version only
0x2F	Phone Mute	OOC (On/off control)	Mutes only the outgoing transmit audio. When muted, the user can still hear incoming audio from the caller.
0x50	Speed Dial	OSC (Initiates Speed Dial)	Speed Dial supports the number "1" one for voice mail and the

Usage ID	Usage Name	Usage Type	Comments
			"O" translated to "+"

**Note:** For convenience, this table was reproduced from the industry standard USB 2.0 Specification. Microsoft is not responsible for the maintenance of the information that is contained in this standard.

The following table presents the current USB HID Usage commands supported by Lync on the Button Page.

#### Button Page (0x09) Usages Supported by Lync

Usage ID	Usage Name	Usage Type	Comments
0x01	Button 1 "Delete"	OSC (One-shot control)	

**Note:** For convenience, this table was reproduced from the industry standard USB 2.0 Specification. Microsoft is not responsible for the maintenance of the information that is contained in this standard.

The following table presents the LED usages that a device can use to illuminate different LEDs.

#### LED Page (0x08) Usages Supported by Lync

Usage ID	Usage Name	Usage Type	Comments
17	Off Hook	OOC	
1E	Speaker	OOC	
09	Mute *	OOC	
19	Message waiting (Voice mail indicator)	OOC	
24	Send_calls (Forwarding on)	OOC	

\* Note that the Lync client sends the Mute (09) Usage ID to the device to light up the Microphone Mute LED and not the Microphone (21) LED command as per HID Usage Table (0x08).

## 5.0 Dial pad Requirements

The following table presents the HID commands supported by Lync for dial pad functionality.

#### Telephony Device Page (0x0B) Usages Supported by Lync

Usage ID	Usage Name	Usage Type	Comments
0xB0	Phone Key 0	Sel (Selector)	
0xB1	Phone Key 1	Sel (Selector)	
0xB2	Phone Key 2	Sel (Selector)	
0xB3	Phone Key 3	Sel (Selector)	
0xB4	Phone Key 4	Sel (Selector)	
0xB5	Phone Key 5	Sel (Selector)	
0xB6	Phone Key 6	Sel (Selector)	
0xB7	Phone Key 7	Sel (Selector)	

Usage ID	Usage Name	Usage Type	Comments
0xB8	Phone Key 8	Sel (Selector)	
0xB9	Phone Key 9	Sel (Selector)	
0xBA	Phone Key Star (*)	Sel (Selector)	
0xBB	Phone Key Pound (#)	Sel (Selector)	

**Note:** For convenience, this table was reproduced from the industry standard USB 2.0 Specification. Microsoft is not responsible for the maintenance of the information that is contained in this standard.

## Appendix A. UCQ String and Device Selection

### 1.0 How is the UCQ Descriptor used in Lync?

The UCQ string serves 2 primary purposes:

1. Reports device functionality and versions of Lync HID protocol supported to Lync.
2. Allows Lync to manage device selection and stack ranking if multiple devices are present.

#### 1.1 UCQ and Device Functionality

Lync uses the device functionality reported by the UCQ to determine HID protocol to be used.

Note: Lync works with all audio devices identified by Windows but HID commands are only recognized if the USB device:

- is a composite device (send/receive audio in single unit)
- enumerates as a HID telephony device
- reports the Lync HID version (in UCQ string) required for the desired HID functionality (e.g. display requires major version '01')

#### 1.2 Device selection in W13:

The device used for a call is based on 2 factors:

1. Call mode: public or private (e.g. speakerphone vs. headset)
2. Device hierarchy (based on device type and UCQ string)

User can also configure a custom device.

##### 1.2.1 Configuring devices in W13:

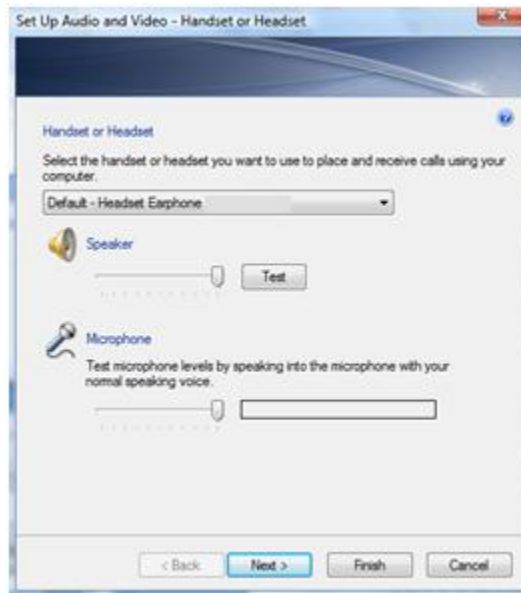
The tuning wizard in 2007 R2 client exposes up to 3 pages. The first page (if present) is **Headset or Handset**, the second page is **Speaker/Microphone or Speakerphone**, and the third page is **Sounds**.

##### 1.2.1.1 Headset or Handset device

The first page of the A/V Tuning Wizard is titled **Handset or Headset**. Any device with a UCQ string indicating handset or headset will automatically be selected as the default Lync device on the **Handset or Headset** page. If there are multiple devices that fit into this category, then the device with more capabilities is selected as the default device (see device hierarchy for details).

Devices selected in this page are considered to be *private devices*, similar to a handset from a typical desktop telephone.

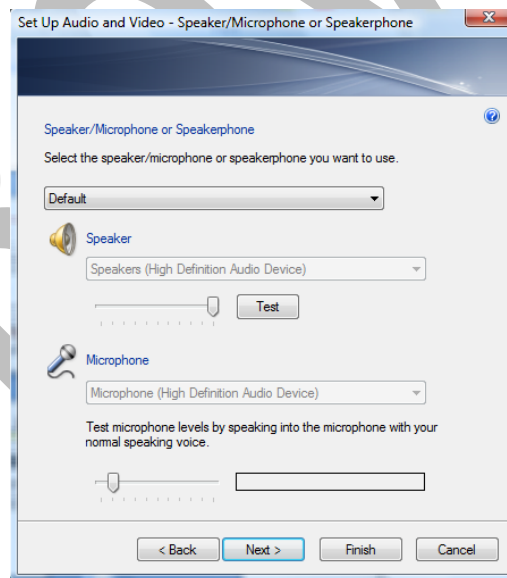
This page is visible only if a HID telephony device is available. Non-HID telephony devices are available for configuration and usage in the second page of the A/V Tuning Wizard as custom devices.



### 1.2.1.2 Speakerphone Devices

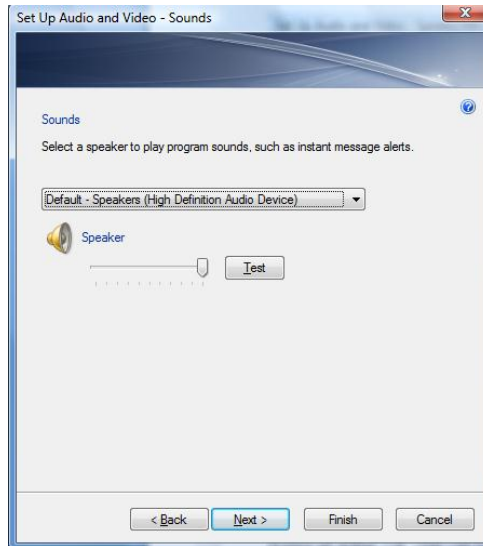
The second page in the A/V Tuning Wizard is titled ***Speaker/Microphone or Speakerphone***. An HID device with the UCQ speakerphone set to “1” will be automatically selected on this page. This is considered a *public device*, similar to the speakerphone on a desk telephone.

During an active call, the user can toggle between different *private* (headset) and *public* (speakerphone) devices.



### 1.2.1.3 System Sounds

The third page in the A/V Tuning Wizard is titled “Sounds” and is where alert sounds, notifications, and other system sounds are managed.



Many users prefer system sounds to be piped to a loud speaker device so that these sounds can be heard even when the user is not wearing a headset.

### 1.2.2 Device Hierarchy in W13

Simplified version of device selection hierarchy is as follows:

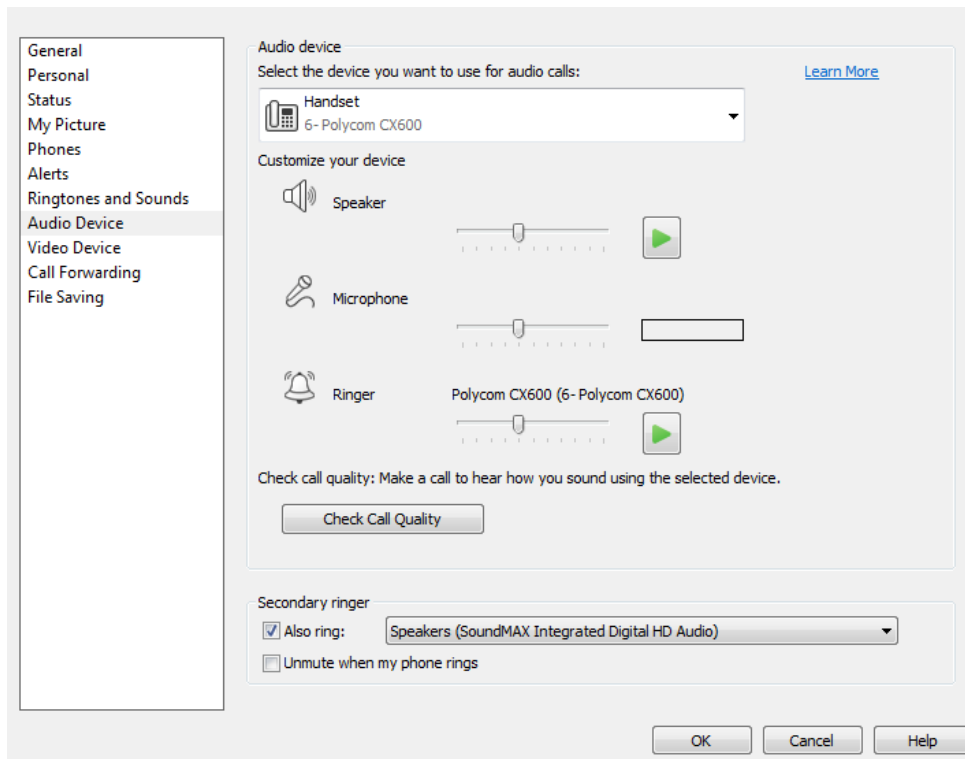
1. Roundtable device
2. Lync Optimized HID handset with display
3. Lync Optimized HID handset with speakerphone
4. Lync Optimized HID handset
5. Lync Optimized HID headset
6. Non Optimized USB HID device

## 1.3 Device Selection in W14:

W14 of Lync changes device selection by eliminating the toggle between public and private device. Instead, Lync supports multiple HID devices and a device switcher window has been added to the main communicator window as well as to conversation windows (if audio call is active).

### 1.3.1 Configuring Devices in W14

The 3-page A/V Tuning Wizard has been replaced by a single page **Audio Device Settings** window.

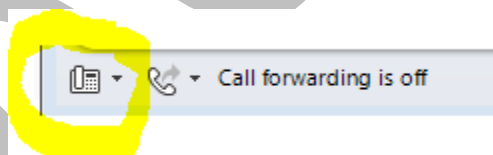


A user may configure multiple audio devices independently by simply selecting the device they want to configure. There is no longer a limit to only a single 'public' and single 'private' device.

#### 1.3.1.1 Configuring the active device

A user can easily change the default device for all future calls or change the active device within any given call. This will take precedence over the device hierarchy described in the next section.

To change the default device for future calls, the user should use the device switcher in the lower left corner of the main Lync window



To change the active device during a call, the user should use the device switcher in the lower left of the conversation window (only visible if audio is active on call):





### 1.3.2 Device Hierarchy in W14

Even though W14 allows multiple HID devices to be used on a single system, devices are still prioritized by default according to functionality.

The W14 Lync audio device selection hierarchy is as follows:

1. Roundtable device
2. Lync Optimized **wireless** devices with call display and/or dial pad
3. Lync Optimized **wired** devices with call display and/or dial pad
4. Lync Optimized **wireless** devices with NEITHER call display nor dial pad
5. Lync Optimized **wired** devices with NEITHER call display nor dial pad
6. “Default communication device” of Windows-7 OS.
7. Non Optimized USB HID device
8. The last device on the list is the custom device that is created by taking the Window’s default Voice playback device as the speaker and default voice recording device as the microphone

*Note: if multiple devices that match to the same hierarchy group are present, the priority will be as follows:*

- 1) *speakerphone + handset*
- 2) *handset*
- 3) *headset*
- 4) *speakerphone.*

### 1.4 How is the UCQ Descriptor used by the Operating System?

The Windows media stack has its own audio endpoint (device) ranking heuristics and does *not* use the UCQ Descriptor in the determination of device ranking within the Windows media stack. Guidance on the ranking mechanics of the Windows 7 audio stack is contained in the white paper “Default Audio Endpoint Selection in Windows 7” located at

<http://www.microsoft.com/whdc/device/audio/default.mspx>.

## Appendix B. HID & UCQ Conformance Report template

Metric	Measurement / Data	Pass/Fail
UCQ String		
Bi-Directional Terminal Type (input)		
Bi-Directional Terminal Type (output)		
<b>Functional tests 2007 R2 client</b>		
Mute from client	Observe Mute icon on both client and Device toggles ON, and verify mic audio is muted AND speaker is not muted.	
Mute from Device		
Mute speaker from OS	Observe mute icon in OS only (no change in client or on device) Verify speakers are muted (but mic is active)	
Unmute from client	Observe Mute icon on both client and Device toggles OFF, and verify mic audio is unmuted AND speaker is not muted.	
Unmute from Device		
Mute state after call hang up	Start w/ active call & device mic muted Hang up call: verify mute button turns off Start new call: verify new call is NOT muted.	
On Hook (hang up)	Verify call terminated in client and device LEDs turn off. Initiate new call and ensure mute state was reset.	
Off Hook (incoming call answer)	Verify call is answered and audio goes to device.	
Off Hook (transfer from speakerphone) *	Audio transfers from speakerphone to headset	
Volume Up	-NA-	
Volume Down	-NA-	
Flash	-NA-	
Dial pad Tests (call initiation mode)	Test each dial pad key prior to connecting a call. Make sure the key registers and with no unexpected keys	
Dial pad Tests (in-call mode)	Test each dial pad key while call is active. Make sure the key registers and with no unexpected keys	
<b>Functional tests Lync W14 client</b>		
Mute from client	Observe Mute icon on both client and Device toggles ON, and verify mic audio is muted AND speaker is not muted.	
Mute from Device		
Mute speaker from OS	Observe mute icon in OS only (no change in client or on device) Verify speakers are muted (but mic is active)	
Unmute from client	Observe Mute icon on both client and Device toggles OFF, and verify mic audio is unmuted	
Unmute from Device		

	AND speaker is not muted.	
Mute state after call hang up	Start w/ active call & device mic muted Hang up call: verify mute button turns off Start new call: verify new call is NOT muted.	
On Hook (hang up)	Verify call terminated in client and device LEDs turn off. Initiate new call and ensure mute state was reset.	
Off Hook (incoming call answer)	Verify call is answered and audio goes to device.	
Off Hook (transfer from other audio device) *	Audio transfers from other device to device under test.	
Volume Up	-NA-	
Volume Down	-NA-	
Flash	-NA-	
Dial pad Tests (call initiation mode)	Test each dial pad key prior to connecting a call. Make sure the key registers and with no unexpected keys	
Dial pad Tests (in-call mode)	Test each dial pad key while call is active. Make sure the key registers and with no unexpected keys	

## Appendix C. Classification for Lync PCs with partial A/V functionality

Case	Functionality			Qualification eligible	Notes
	Mic	Speaker	Camera		
1	X	X	X	Yes	Default scenario
2	-	-	X	conditional	Conditions for eligibility: A) Device has unique model for camera only or B) Device qualified for case 1 and device is clearly marketed as video only option (e.g. customer de-selects all audio components at system configuration time)
3	X	X	-	conditional	Same as above, but with bi-directional audio and no video.

All combinations with **only unidirectional audio** (i.e. only microphone or only speaker) are **not eligible** for qualification.

If a Lync Optimized PC allows customer configuration with unidirectional audio, the full model is still eligible for qualification but the depopulated model must not be marketed as Lync Optimized. The OEM must provide a clear mechanism for consumers to distinguish the Optimized model from the depopulated model. Microsoft recommends the OEM use distinct model numbers for such a configuration to avoid customer confusion.