Evaluations of USB-connected Echo-cancelling Loudspeaker/microphone systems for videoconferencing applications

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Introduction

USB-connected echo-cancelling loudspeaker/microphone systems are used in place of a headset/microphone combination in desktop or small room software-based videoconferencing systems. They allow natural hands-free two-way conversations, and are required when more than one attendee at an individual site is taking part in the videoconference.

The following products were evaluated and compared for ease of use, value for money, setup procedures, etc.:

ClearOne Chat 50
ClearOne Chat 150
Phoenix Duet
Phoenix Quattro
Phoenix Solo
Polycom C100S
Spreed Speakerphone
US Robotics
Yamaha PJP-10UR
Yamaha PJP-25UR

Testing was carried out using this equipment:

Test platform hardware Dual-core Dell PC
Local Video-conferencing software PolyCom PVX Ver. 8.0.4
Remote Venue Codec Tandberg C90 Ver. TC4.0.0.235115

ClearOne Chat 50

System ClearOne
Model Chat 50USB
Guide Cost £180
Test Date 18/11/2009
WebSite
http://www.clearone.com/personal-usbspeakerphone.html

A. Hardware Description
Dimensions ~100mm square; 35mm tall
Appearance Black soft glossy
Controls Volume Up; Volume Down; Microphone Mute
Connectors Mini USB; Minijack; 7V DC
Indicators/LEDs functions Mic Mute Status
Power USB or 7v DC adapter
Cables Supplied USB Type A -B
Warranty 2 year
Documentation Supplied A6 16 page quickstart guide; English Web Info
http://www.clearone.com/resources/library.php?content=main&product=94&submit=SEARCH

B. Setup / Installation
Procedure
Platform supported Windows XP (SP2); Windows Vista; Windows 7
Procedure + problems Plug and Go: immediately recognised by PC.
Time less than 5 minutes to set up.
Software Version Ver. 2.0.23; 2.1.6.0 available.
Firmware Version Ver. 25; Can be updated to ver. 27
Installation Documentation quality:
Helpful. Startup info provided. Comprehensive info available from WebPages.
Installation location:
No installation required. Vendor "Chat" software if required

Optional Software (not required to use device)
On CD; Chat Software; Quickstart guide; User manual; Support Docs.

C. Connectivity
Cables USB A to USB mini
Connectors USB mini
Comments 1.5m long

E. Audio measurements
Frequency response: MIC Very Acceptable; speaker: Very good for size for a small room; quite musical and "open"
Headroom: MIC Very Acceptable, Speaker OK
Levels: MIC Very acceptable; Speaker not too loud, but acceptable for small room
Echo Cancellation: Very good.
Adjustments? Volume; mic mute
Comments: Very acceptable for 1-4 people in small room.

Functions 1 low-5 high
Hardware & facilities 5
Setup procedure 5
Connectivity 5
Ease of Installation 5
Audio tests 5
Echo Cancellation 5
Value for Money 4
Total 34

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ClearOne Chat 150

System ClearOne
Model Chat 150USB
Guide Cost £245
Test Date 17/03/2010
WebSite
http://www.clearone.com/video-conferencespeakerphone.html

A. Hardware Description
Dimensions ~200mm square x 40mm tall;
Appearance Black soft glossy
Controls Volume Up; Volume Down; Microphone Mute
Connectors Mini USB
Indicators/LEDs functions Mic Mute Status; Volume

Power Through USB
Cables Supplied USB Type A -B
Warranty 2 year
Documentation Supplied A6 24 page quickstart guide; English
Web Info
http://www.clearone.com/resources/library.php?content=main&product=99&submit=SEARCH

B. Setup / Installation
Procedure
Platform supported Windows XP (SP2); Windows Vista; Windows 7
Procedure + problems Plug and Go; immediately recognised by PC.
Time less than 5 minutes to set up.
Software Version Ver. 2.0.23; 2.1.6.0 available.
Firmware Version Ver. 31; Can be updated to ver. 57
Installation Documentation quality:
Helpful. Startup info provided. Comprehensive info available from WebPages.
Installation location: No installation required. Vendor "Chat" software if required
Optional Software (not required to use device)
On CD; Chat Software for PV/Laptop/Phone.
Quickstart guide; User manual; Support Docs.

C. Connectivity
Cables USB A to USB mini
Connectors USB mini
Comments 3m length

E. Audio measurements
Frequency response: MIC Slightly harsh; Speaker Fairly balanced; aimed at voice
Headroom; MIC Very Acceptable, speaker fairly loud without noticeable distortion.
Levels; MIC Very acceptable; as with all systems, drops off with distance from mic.
Speaker loud enough for small-medium room
Echo Cancellation: Very good.
Adjustments? Speaker Volume on unit - adjusts PC system volume.
Comments: Very acceptable for 1-8 people in small/medium room.

Functions 1 low-5 high
Hardware & facilities 5
Setup procedure 5
Connectivity 5
Ease of Installation 5
Audio tests 5
Echo Cancellation 5
Value for Money 5
Total 35

Phoenix Duet

System Phoenix
Model Duet PCS
Guide Cost £150
Test Date 30/04/2010
WebSite
http://www.phnxaudio.com/products/duet/details/3-duet/26-duet-pcs.html

A. Hardware Description
Dimensions ~120 x 100 x 40mm
Appearance Matt Silver & light grey
Controls Volume Up; Volume Down; Microphone Mute
Connectors Mini USB; minijack for external speaker
Indicators/LEDs functions Connected; Mic Mute Status
Power Through USB
Cables Supplied USB A-Mini USB cable
Warranty n/a
Documentation Supplied Short quickstart guide.
Web Info http://www.phnxaudio.com/support/faq/23-faq.html

B. Setup / Installation
Procedure
Platform supported PC or MAC. Win 2K/XP/Vista; Linux; Mac OS X.
Procedure + problems Plug and Go; immediately recognised by PC.
Time less than 5 minutes to set up.
Software Version n/a
Firmware Version n/a
Installation Documentation quality:
Startup info provided. Fuller info available from WebPages.
Installation location: No installation software required.
Optional Software (not required to use device)
http://www.phnxaudio.com/support/downloads.html

C. Connectivity
Cables USB A to USB mini
Connectors USB mini
Comments 1.5m long

E. Audio measurements
Frequency response: MIC Bassy, not bright; changes off-axis; speaker acceptable; aimed at speech.
Headroom: MIC good, speaker good; not loud
Levels: MIC acceptable, speaker loud enough; slight rattle at full volume.
Echo Cancellation: Fair; clicks audible at start/end of speech
Adjustments? PC system volume; mic mute
Comments: Acceptable for 1-4 people in small room.

Functions 1 low-5 high
Hardware & facilities 5
Setup procedure 5
Connectivity 5
Ease of Installation 5
Audio tests 4
Echo Cancellation 4
Value for Money 4
Total 32

Phoenix Quattro

System Phoenix
Model Quattro VC; MT301
Guide Cost £435
Test Date 10/03/2010
WebSite http://www.phnxaudio.com/products/quattro2.html

A. Hardware Description
Dimensions ~200mmm round
Appearance
Silver "Flying Doughnut" with 4 microphones and 4
loudspeakers built-in.
Controls Power/Mute; Volume Up/down; Line inputs options
Connectors Mini USB; Minijack; 2 x Phono audio; DIN for daisychain

Indicators/LEDs functions Connected; Mic Mute Status
Power from USB; or from supplied (optional) power supply; both charge internal battery
Cables Supplied USB A - Mini USB; Power Supply Warranty n/a
Documentation Supplied A5 24 page User manual; English.
Web Info http://phnxaudio.com/images/files/Quattro2_WS_manual.pdf

B. Setup / Installation
Procedure
Platform supported PC or MAC. Win 2K/XP/Vista; Linux; Mac OS X.
Procedure + problems Plug and Go; immediately recognised by PC.
Time less than 5 minutes to set up.
Software Version n/a
Firmware Version n/a
Installation Documentation quality:
Very good; Webpage info also available. Also bottom of box.

Installation location: No installation software required.
Optional Software (not required to use device)
http://www.phnxaudio.com/support/downloads.html

C. Connectivity
Cables USB A to USB mini
Connectors Large USB A to Mini USB
Comments 2m long

E. Audio measurements
Frequency response: MIC mid-range prominent; not so pleasing. Off axis loses HF, speaker slightly boxy; aimed at speech.
Headroom: MIC Acceptable. Speaker rattles when loud, but can output considerable sound level.
Levels; MIC good at keeping a constant MIC level, speaker achieves a very loud level, suitable for large room.
Echo Cancellation Excellent
Adjustments? Volume buttons adjust own volume.
Comments: Has 4 mics, and 4 loudspeakers. Can be daisy-chained.

Functions 1 low-5 high
Hardware & facilities 5
Setup procedure 5
Connectivity 5
Ease of Installation 5
Audio tests 4
Echo Cancellation 5
Value for Money 3
Total 32

Phoenix Solo

System Phoenix
Model Solo USB
Guide Cost £100
Test Date 17/03/2010
WebSite http://phnxaudio.com/products/solo

A. Hardware Description
Dimensions ~115h x 80w x 65d mm
Appearance Upright vertical silver/grey.
Controls Mic Mute button on side
Connectors
USB A on captive lead; 3.5mm socket for required separate loudspeaker.
Indicators/LEDs functions Blue power/mic muted LED
Power Through USB
Cables Supplied Captive cable to USB A
Warranty n/a
Documentation Supplied A4 pages x2 of translated info
Web Info
http://209.59.154.150/~phnxaudi/images/files/SOLO_datasheet_v1.pdf

B. Setup / Installation
Procedure
Platform supported PC or MAC. Win 2K/XP/Vista; Linux; Mac OS X.
Procedure + problems Plug and Go; immediately recognised by PC.
Time less than 5 minutes to set up.
Software Version n/a
Firmware Version n/a
Installation Documentation quality:
Start up only info provided. Further information available from WebPages.

Installation location: No installation software required.
Optional Software (not required to use device)

Available Here;
http://www.phnxaudio.com/support/downloads.html

C. Connectivity
Cables Captive cable to USB A
Connectors Captive cable to USB A
Comments 1.5m long

E. Audio measurements
Frequency response: MIC Very acceptable for voice
SPEAKER No internal speaker; quality depends on external speaker.
Headroom; MIC OK for one or two users
SPEAKER 3.5mm Jack outlet only.
Levels; MIC Good at keeping a constant MIC level
SPEAKER Depends on external speaker connected to MiniJack output.
Echo Cancellation Acceptable.
Adjustments? None
Comments Mic only pickup suitable for 1-4 people

Functions 1 low-5 high
Hardware & facilities 3
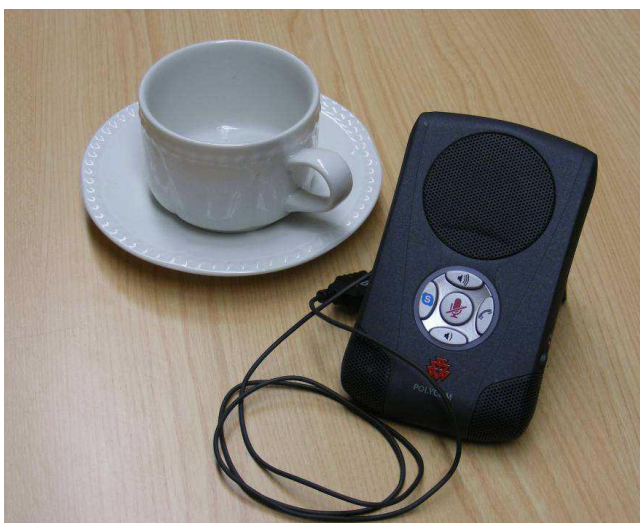Setup procedure 5
Connectivity 5
Ease of Installation 5
Audio tests 5
Echo Cancellation 4
Value for Money 3
Total 30

PolyCom C100S

System PolyCom
Model C100S
Guide Cost £90
Test Date 17/12/2009
WebSite
http://www.polycom.com/products/voice/desktop_solutions/pc_speakerphones/
communicator_c100.html

A. Hardware Description
Dimensions 135l x 83w x 23h mm
Appearance Charcoal
Controls Volume Up; Volume Down; Mic Mute; menu options
Connectors Permanently attached USB A cable
Indicators/LEDs functions Power; Mic Mute, Vol adjust; menus
Power From USB
Cables Supplied Permanently Attached; 80cms
Warranty n/a
Documentation Supplied
12 page A6 user guide. CD takes you to WebPages to
download drivers or software.
Web Info
http://support.polycom.com/PolycomService/support/us/support/voice/communicator/index.html

B. Setup / Installation Procedure
Platform supported Currently Win XP due to requiring Drivers.
Procedure + problems
Required drivers installed; Win XP only. Since Windows
only, less flexible than other options.
Time About 20 minutes to set up. Windows XP only.
Software Version n/a; Updated 2.1 software available can also update firmware.
Firmware Version Ver.1.01 unless updated.

Installation Documentation quality:
Acceptable; WebPages have considerable info, and software release notes.
Installation location On CD ROM; then website.
Optional Software (not required to use device)
Drivers; C100 Manager

C. Connectivity
Cables Captive cable to USB A
Connectors USB A
Comments 80cms long

E. Audio measurements
Frequency response; MIC
Mid-range prominent; ideal for speech. Off axis loses HF.
Speaker acceptable for speech and some music.
Headroom: MIC Acceptable.

Speaker Acceptable.
Levels; MIC Good level control; not obtrusive.
Speaker: Adequate for small room; increasing level produces greater echo problem
Echo Cancellation
Increasing speaker level increases echo; good unless driven loud
Adjustments? Volume up/down. Mic On-Off; Speaker On/Off.
Comments Acceptable for 1-4 people in small room.

Functions 1 low-5 high
Hardware & facilities 5
Setup procedure 4
Connectivity 5
Ease of Installation 3
Audio tests 4
Echo Cancellation 3
Value for Money 4
Total 28

Spreed SpeakerPhone

System Spreed
Model USB Internet Speakerphone
Guide Cost £31
Test Date 21/12/2010
WebSite
http://www.spreed.com/eu/prices/conferencespeaker/index.html/en/view

A. Hardware Description
Dimensions 100mm d x 35mm h
Appearance White & Green
Controls Mic Mute; Volume Up/down. Connect/Disconnect Call
Connectors
Mini USB; 3.5mm minijack audio out; minijack audio in for supplied headset.
Indicators/LEDs functions Connected; Mute status
Power From USB
Cables Supplied
USB A-Mini USB cable. Also comes with plug-in mic earpiece for personal use.
Warranty 1 year
Documentation Supplied

Paper Quickstart guide.
More Info Here
Web Info
http://www.spreed.com/eu/prices/conferencespeaker/index.html/en/view

B. Setup / Installation
Procedure
Platform supported PC or MAC. Win 2K/XP/Vista; Linux; Mac OS X.
Procedure + problems Plug and Go; immediately recognised by PC.
Time less than 5 minutes to set up.
Software Version n/a

Firmware Version n/a
Installation Documentation quality:
Acceptable shortform. Fuller info on web site.
Installation location Short document, English only.
Optional Software (not required to use device)
6 optional software; Part of Spreed WebMeeting Products.

C. Connectivity
Cables USB A to USB mini
Connectors USB mini
Comments 1.5m

E. Audio measurements
Frequency response; MIC Poor response; telephone quality

Speaker acceptable for speech.
Headroom; MIC acceptable.
Speaker acceptable
Levels; MIC
Gave best results when mic port pointed at participants - fairly directional.
Speaker: Sufficient for small room
Echo Cancellation Fair. Can hang on at tail end of speech.
Adjustments?
Vol Control very sensitive - small touch = large increase or decrease in gain.
Comments
Supplied single earpiece very clear; attached mic relatively insensitive.

Functions 1 low-5 high
Hardware & facilities 4
Setup procedure 5
Connectivity 5
Ease of Installation 5
Audio tests 3
Echo Cancellation 3
Value for Money 3
Total 28

US Robotics

System US Robotics
Model Model 9610A
Guide Cost £8
Test Date 21/12/2010
WebSite
http://www.usr.com/support/producttemplate.asp?prod=9610

A. Hardware Description
Dimensions 85mm d x 30mm h
Appearance Matt silver; black speaker grill
Controls Mic Mute; Volume Up/down.
Connectors Mini USB; 3.5mm minijack audio out.
Indicators/LEDs functions Connected; Mic Muted
Power From USB
Cables Supplied USB A-Mini USB cable
Warranty 2 years
Documentation Supplied
Paper Multi-language Quickstart guide; Full Manual on
CD.
Web Info
http://www.usr.com/support/9610/9610-files/9610-naig.pdf

B. Setup / Installation
Procedure
Platform supported Win 2k and XP
Procedure + problems Plug and Go; immediately recognised by PC.
Time less than 5 minutes to set up.

Software Version n/a
Firmware Version n/a
Installation Documentation
quality
Installation location User friendly. Quickstart on Paper and Fuller info on CD

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Optional Software (not required to use device)
4 x Optional software

C. Connectivity
Cables USB A to USB mini
Connectors USB mini
Comments 1.5m

E. Audio measurements
Frequency response; MIC Acceptable for voice.
Speaker: Acceptable for voice; limited frequency response.
Headroom; MIC Mic over-sensitive; obvious limiting on calibration.
Speaker: Rattled/buzzed annoyingly at louder settings.
Levels: MIC
Gave best results when mic port pointed at speaker - fairly
directional.
Speaker: Sufficiently loud, but rattled when volume higher.
Echo Cancellation
Echo feedback when talking loudly; colouration on incoming.
Adjustments?
Volume Up/Down buttons adjust system volume. Mic mute button operates OK.
Comments: Aimed for one person only.

Functions 1 low-5 high
Hardware & facilities 3
Setup procedure 5
Connectivity 5
Ease of Installation 5
Audio tests 2
Echo Cancellation 2
Value for Money 2
Total 24

Yamaha PJP-10UR

System Yamaha
Model PJP-10UR
Guide Cost £170
Test Date 21/12/2010
WebSite
http://www.yamaha.co.jp/english/product/projectphone/products/10ur/

A. Hardware Description
Dimensions 125h x 38d x 49mm wide
Appearance Black matt; soft cover supplied.
Controls
Mic Mute; Volume Up/down. Speaker Mute; Future Functions button.
Connectors Mini USB.

Indicators/LEDs functions
Connected; Mic Muted; Speaker muted; firmware updates status.
Power From USB
Cables Supplied USB A-Mini USB cable
Warranty 1 year
Documentation Supplied Full paper Manual.
Web Info
http://www.yamaha.co.jp/english/product/projectphone/download/manual/#manual_pjp10ur

B. Setup / Installation
Procedure
Platform supported
Windows® 7, Windows® Vista SP1+ (32bit), Windows®
XP SP2+ (32bit), Windows® 2000 SP4. Macintosh® OS
10.5 (with Intel® processor only)

Procedure + problems Plug and Go; immediately recognised by PC.
Time less than 5 minutes to set up.
Software Version n/a
Firmware Version 1.02 / 1.05 upgradeable
Installation Documentation quality:
Very good. Very good info on web.
Installation location 4 Language Comprehensive Quickstart Guide.
Optional Software (not required to use device)
No supplied software

C. Connectivity
Cables USB A to USB mini
Connectors USB mini
Comments 1.2m

E. Audio measurements
Frequency response; MIC Very acceptable for voice.
Speaker very acceptable for speech and some music.
Headroom; MIC Acceptable.
Speaker Very acceptable.
Levels; MIC Quality dependent on aiming at participants.
Speaker: Sufficiently loud for medium room.
Echo Cancellation Very Good.
Adjustments? Volume up/down. Mic On-Off; Speaker On/Off.
Comments Tripod screw in base.

Functions 1 low-5 high
Hardware & facilities 5
Setup procedure 5
Connectivity 5
Ease of Installation 5
Audio tests 5

Echo Cancellation 5
Value for Money 5
Total 35

Yamaha PJP-25UR

System Yamaha
Model PJP-25UR
Guide Cost £270
Test Date 24/03/2010
WebSite
http://www.yamaha.co.jp/english/product/projectphone/products/25ur/

A. Hardware Description
Dimensions ~230 x 150 x 35mm Triangular (when side arms closed)
Appearance Matt Black; with 2 speakers; 3 x 4 mic arrays.
Controls Mic Mute; Volume Up/down; menu buttons
Connectors
Mini USB; DC in; 3.5mm minijack audio out; minijack audio in
Indicators/LEDs functions
Connected; Mic Muted; Speaker muted; firmware updates status.
Power From USB

Cables Supplied USB A-Mini USB cable
Warranty 1 year
Documentation Supplied Multi-language Quickstart guide; Manual on CD
Web Info
http://www.yamaha.co.jp/english/product/projectphone/download/manual/
index.html#manual_pjp25ur

B. Setup / Installation
Procedure
Platform supported
Windows® 7, Windows® Vista SP1 or higher (32bit),
Windows® XP SP2 or higher (32bit), Windows® 2000 SP4.
Macintosh® OS 10.5 (with Intel® processor only)
Procedure + problems
Plug and Go; immediately recognised by PC. (PolyCom crashed)
Time less than 5 minutes to set up.

Software Version n/a
Firmware Version
Updateable from Web;
http://www.yamaha.co.jp/english/product/projectphone/download/firmware/index.html#pjp25ur
Installation Documentation quality: Very good. Very good info on web.
Installation location A4 manual, or on CD ROM
Optional Software (not required to use device)
No supplied software

C. Connectivity
Cables USB A to USB mini
Connectors Large USB A to Mini USB
Comments 2m

E. Audio measurements
Frequency response; MIC
Closed; toppy - suitable for clear speech. Opened out; bass
end increases to a more natural sound.
Speaker: Very acceptable for speech and some music.
Headroom; MIC Adequate level
Speaker: Loud enough
Levels; MIC Very good due to multiple configuration options.
Speaker: Sufficient for medium room. External supply available for higher volume requirements.
Echo Cancellation Very good.
Adjustments? Volume adjusts own level; well labelled.
Comments Tripod screw

Functions 1 low-5 high
Hardware & facilities 5
Setup procedure 5
Connectivity 5

Ease of Installation 5
Audio tests 5
Echo Cancellation 5
Value for Money 4
Total 34

Table of Results

System	ClearOne		Phoenix			PolyCom	Spreed	Yamaha		US Robotics
Model	Chat 50USB	Chat 150USB	Duet PCS	Quattro VC; MT301	Solo USB	C100S	USB Internet Speakerphone	PJP-10UR	PJP-25UR	Model 9610A
Scores; Very good = 5; Good = 4; Fair = 3; Poor = 2; Very Poor = 1.										
Hardware & facilities	5	5	5	5	3	5	4	5	5	3
Setup procedure	5	5	5	5	5	4	5	5	5	5
Connectivity	5	5	5	5	5	5	5	5	5	5
Ease of Installation	5	5	5	5	5	3	5	5	5	5
Audio tests	5	5	4	4	5	4	3	5	5	2
Echo Cancellation	5	5	4	5	4	3	3	5	5	2
Value for Money	4	5	4	3	3	4	3	5	4	2
Total	34	35	32	32	30	28	28	35	34	24

Summary

- All systems tested were easy to connect to the PC. However one required Windows drivers.
- All were recognised by the PC as USB Audio Hardware.
- All were recognised by the H323 Video-conference software used for this test.
- Most performed very well at their main task of providing an echo-cancelling loudspeaker-microphone combination – but see results.

- However, as with any echo-cancelling system, they were all sensitive to physical movement, and took a second or so to recover / relearn from major physical movement.
- All were aimed at good speech quality, but some were better at reproducing full-range music/PC audio.
- There is no reason to suppose that they would not work well with other software e.g. WebEx, Skype, Adobe Connect etc, but these were not tested in this trial.

Conclusion

We would have no hesitation in recommending the use of most of these systems for personal or small room video-conferencing applications – however see the detailed comments.

The larger more costly systems, as designed, will provide a better service for larger numbers of attendees and rooms.

Differences between them reflect their cost, and intended purpose. Also, some have better quality of sound reproduction than others.