PolyCom HDX 6004

Manufacturer: Polycom

Model: HDX 6004

Software Version: 2.5.0.7

Optional Features and Modifications: People + Content

Date of Test: 15th – 19th February 2010

A: INTRODUCTION

The Polycom® HDX 6004 is a High Definition (HD) videoconferencing system for conferencing between Polycom HDX systems and other manufacturers HD CODECS. The maximum picture resolution is 1280 x 720 pixels (i.e. 720p), with basic CIF (352 x 288) available for compatibility with standard definition H.323 CODECS. Options include:

- People + Content
- IP 7000 Speakerphone integration

This room-based system supports a wide range of video and audio formats but offers limited input and output interfaces.

Feature Summary:

- A high definition videoconferencing system which supports variable resolution up to 1280 x 720 pixels (720p) at 30* frames per second.
- An IP (H.323)-only CODEC operating at connection speeds up to 2 Mbit/s.
- High definition pan and tilt camera.
- Supports H.261, H.263, H.263+ and H.264 video coding.
- Supports G.711, G.722, G.722.1, G.729, G.729A, Siren 14 and Siren 22, audio coding including Polycom® StereoSurround™.
- Multiple microphone pod option.
- DVI-I PC data input at these resolutions:

With an aspect ratio of 4 x 3

640 x 480

800 x 600

1024 x 768

1280 x 1024

With an aspect ratio of 16 x 9

1280 x 720

1680 x 1050

- Stereo analogue audio inputs for connection of PC audio.
- Stereo-surround audio.
- Far-end camera control and video source selection.
- Optional People + Content H.239 dual video

*During the evaluation only 25 frames per second could be achieved.

B: SETUP PROCEDURE

The Polycom® HDX 6004 system included a high definition camera unit that may be positioned either above or below the picture monitor. An external microphone and an infrared remote control completed the package. Cabling the system was straightforward and involved:

- connecting the supplied HDMI cable between the CODEC and a high definition display monitor with integrated audio.

- cabling the CODEC to the camera through the multi-core HDCI cable.
- plugging the microphone unit to the CODEC.
- establishing network connection through one RJ-45 to RJ-45 lead.
- connecting power to the unit.

System set-up was conveniently configured through the on-screen menus via the hand-held infrared remote control. IP address, Gateway and Gatekeeper addresses were all entered using this method.

Approximate set-up time: 20 minutes

Documentation quality: The documentation included: Setup, Quick Tips, User's and Administrator guides. As the main manuals were generic and covered the entire range of HDX CODECs, care had to be taken to identify the particular HDX 6004 CODEC details.

The set-up procedure was convenient and trouble free.

C: Hardware Description

General

The CODEC was supplied with a stand for vertical mounting but may also be placed horizontally on a shelf within an equipment cabinet by discarding the stand. No rack mount kit is currently offered. The system is an IP (H.323)-only unit with a single, 10/100 Mbit/s, auto-switching Ethernet connection.

Options include:

- People + Content
- IP 7000 Speakerphone integration

The CODEC has a maximum call bandwidth of 2 Mbit/s. The units supplied for evaluation included the People + Content (H.239) option.

The system offers several video resolutions including:

- CIF 352 x 288 pixels
- 2CIF 704 x 288
- 4CIF 704 x 576 pixels
- High definition w720p i.e. 1280 x 720

The received image resolution was dependent on the call connection bandwidth and whether the camera source was optimised for motion or sharpness:

Connection bandwidth	**Camera optimised for motion**	**Camera optimised for sharpness**
384 Kbit/s	CIF 352 x 288	4 CIF 704 x 576
768 Kbit/s	2 CIF 704 x 288	4 CIF 704 x 576
1 Mbit/s	4 CIF 704 x 576	720p 1280 x 720
2 Mbit/s	720p 1280 x 720	720p 1280 x 720

The HDX 6004 system only supported a single HD picture monitor with no standard definition second output available. This HD output, intended for high definition monitors, and data projectors may be configured as a DVI or HDMI signal. Both Picture in Picture (PIP) and Picture outside Picture (POP) single monitor modes are supported

Comprehensive picture monitor settings permit the video format and the aspect ratios for the People and Content images of both transmitted and received images to be selected

as follows:

- • **None**—Preserves the aspect ratio of the source video: the image is scaled (if necessary) to the largest supported resolution that fits on the display without cropping. Unused areas of the display are filled with black borders.
- • **Stretch**—Aspect ratio not preserved: the image is scaled horizontally and vertically to exactly match the display resolution.
- • **Zoom**—Preserves the aspect ratio of the source video: the image is scaled to exactly match one of the display dimensions while matching or exceeding the other display dimension. The image is centred and cropped.

The Picture outside Picture feature displays multiple images of near and far pictures together with transmitted or received content on a large widescreen monitor or data projector. Various layouts may be selected through the display button on the remote control:

(A) When no Content is being transmitted or received

1. Near and far sites, same size, side by side
2. Far site big, near site small
3. Near site big, far site small
4. Near site, full screen
5. Far site, full screen

Unless the setting is changed, the previously selected screen layout is stored as the default for subsequent calls.

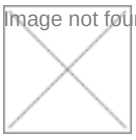
(B) When Content is transmitted or received.

Images of the near or far video appear alongside the larger content image, layouts may be altered through the display button.

1. Content and the far site, same size, side by side
2. Content big, near site small
3. Content big, far site small
4. Content, full screen

The Polycom® HDX 6004 system can only display two images simultaneously on the single monitor output. Other systems in the HDX range are capable of displaying three images on a single monitor output.

During the evaluation we did not select Stretch or Zoom but maintained the native aspect ratios of all images.



Point to Point Call, Picture outside Picture (POP) no content

Image not found or type unknown

Point to Point Call, Picture outside Picture (POP) no content, far end large.

Image not found or type unknown

Point to Point Call, Picture outside Picture (POP) with widescreen content

The Polycom® EagleEye high definition camera had a native resolution of 1280 x 720p and features pan, tilt and zoom functions with a wide horizontal viewing angle of 72 degrees. The camera connected to the CODEC through a single proprietary HDCI cable. The cable supplied was approximately 3 metres in length but this may be extended up to 30 metres without signal boosters. For lengths exceeding 10 metres a separate power supply is necessary to locally power the camera. Ten camera preset positions may be stored and recalled via the remote control at any time during a call.

During an H.323 call a second unidirectional video channel is provided through H.239, but without a second audio channel. Polycom® refer to H.239 as People and Content. The resolution of each channel is dependent on the CODEC settings and the call bandwidth. The bandwidth may be allocated automatically between the main video and the second H.239 Content channel or split in the ratios, 50/50, 90/10 or 10/90 up to the limits of the maximum available connection speed. Thus video from a camera and a second source e.g. a PC image could be transmitted simultaneously and displayed at the remote site. H.239 operates in point-to-point calls between high definition systems and interoperates with other manufacturers standard definition products.

Several audio formats are supported by the Polycom® 6004 HDX system. Polycom® has implemented the Siren 22 audio protocol with 22KHz analogue audio bandwidth, including StereoSurround™. The system captures stereo by using two of the three microphones within the desk microphone pod to create the stereo image. For faithful stereo the microphone pod must be placed as illustrated below with the Polycom® logo closest to the conference participants. Alternatively you can use the Stereo Autorotation feature to configure the microphone. This feature senses sound energy from the left and right speakers and automatically assigns left and right channels to the microphone elements. Autorotation only operates when a single microphone pod is connected.

In larger rooms additional microphone pods may be daisy-chained to provide improved coverage. Stereo is still supported with multiple microphone pods. Each pod has a mute button with light emitting diodes (LEDs) that indicate the status, changing from green to red when muted.

Image not found or type unknown

Microphone Pod (‘live’)

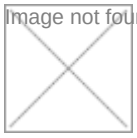
A separate stereo input using a 3.5mm mini jack connector allows straightforward interfacing of PC audio.

The CODEC could only be operated locally through the remote control as there was no facility to connect via an RS232 control to a room control system. It may also be configured and controlled remotely via a web browser from a network connected PC. For added security; this remote management system may be password protected. The comprehensive web interface provides control and configuration of the CODEC and displays diagnostic information if required

D: SYSTEM OPERATION

The remote control had a central “OK” button surrounded by two concentric rings. The outer ring controls near/far camera selection, zoom and volume controls; the inner ring selects the pan and tilt of the near or far cameras and the on-screen menu navigation.

Buttons are dedicated for: Call, Hang-up, Directory, Camera selection, Camera Presets, Media (Content) selection, Display layout and System Information/Help.



HDX Remote Control

The ‘Info’ button had dual functions, providing context sensitive help when not calling and a shortcut to Call Status information during a call. The display button was used to cycle between screen display options.

When the remote control is picked up the on-screen display indicates: near/far camera control, encryption status, far site name and call duration. If the remote is then put down, after several seconds the display disappears.

During the evaluation, on occasions, the system was slow to respond to remote control button selections.

An H.239 (dual video) conference was initiated and terminated by pressing the Media button. Each input source to the CODEC must be designated either “People” or “Content”. People images are transmitted on the main video channel at a high frame rate while Content images are transmitted on the second video channel at a lower frame rate. The Camera button on the remote control selects People images and the Media button Content. The second or Content image is restricted to a maximum of 5 frames per second which is satisfactory for PC still images but not for moving sequences e.g. PC images with embedded video or animation.

Successful H.239 conferences were established in both directions between Polycom ® HDX 6004 systems and in conferences with other vendors’ CODECs.

The Polycom® HDX 6004 CODECs support both remote camera control and remote video

source selection.

When viewing a group of conference participants i.e. with the camera in wide angle or zoomed out, the stereo audio (StereoSurround™) performed well. The stereo effect definitely helped to identify the position of the particular participant speaking in the group. When the camera was zoomed in (close-up) however the stereo image was not accurate i.e. it did not alter to suit the close up view of the presenter.

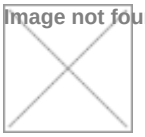
In other words, the video image showed the speaker ‘centre stage’ while the wide angle stereo audio ‘image’ remained with the speaker off to the right or left. This could be distracting.

The system takes 80 seconds to boot up from cold. When not in a call the system automatically reverts to sleep mode after a user definable period. An incoming call or movement of the remote control (picking it up) will return the system to active mode.

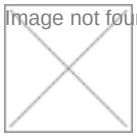
The comprehensive statistics menu displays call status data including resolution, connection speed, compression protocols and packet loss. The detailed suite of diagnostic menus includes audio level bar graphs for all audio input and output connections of the system. These features are particularly helpful in configuring the system and during fault diagnosis.

Remote configuration, monitoring and control are available via a web browser, with optional password protection security. This is a very useful tool for configuring the system and checking call status, it also includes the ability to initiate and terminate calls.

Web Interface Screen Shots

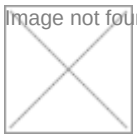


Call Status



System Configuration

Screen shots of the transmitted and received images are also available from the web interface, using either Remote Monitoring which provides snapshots of the near and far video images, or Web Director which provides additional CODEC control in addition to screenshots.



Remote Monitoring

Image not found or type unknown Web Director

(Screenshots reproduced by permission of Polycom®)

System Operation Problems Encountered

Infrared Remote Control

At times the system appeared slow to respond to remote control button selections.

Receive main video frame rate when transmitting H.239

During an H.239 widescreen conference, when content is transmitted from a Polycom® HDX 6004 end point, the frame rate of the main People images received by that same endpoint reduced from 25 to 12 frames per second. This effect was noticed when calling another HDX 6004 and also other manufacturer's CODECs. The cause of this problem was not apparent.

No Content	
Transmit People	720p at 25 frames per second
Receive People	720p at 25 frames per second
Transmit Widescreen H.239 Content	
Transmit People	720p at 25 frames per second
Transmit H.239 Content	720p at 5 frames per second
Receive People	720p at 12 frames per second

Image Layouts available from the system at Newcastle

The available image layouts were restricted on several occasions during the evaluation. Only a limited subset of layouts could be cycled through using the display button on the remote control. A reboot was required to restore normal operation.

Bandwidth allocation between People and Content

The bandwidth priority allocation and automatic adjustment did not operate consistently during the evaluation. We were unable to reliably replicate the problem.

Content Resolution

When transmitting widescreen content the resolution of the content remained consistent at 1280 x 720 irrespective of settings. The frame rate of the content however varied. If People and Content quality priority was set to “Both” and dynamic People and Content bandwidth was set to “off”, when the PC input was set to favour motion, the frame rate fell below 5 frames per second as soon as motion was introduced into the content images. Similar effects were also observed when XGA content was transmitted.

The table illustrates the relationship between call bandwidth and resolution:

	Main Channel Only		**Main Plus Content**		**Main Plus Content**	
Call Bandwidth	*Main set to Motion*	*Main set to Sharpness*	*Main set to Motion*	*Content set to Motion*	*Main set to Motion*	*Content set to Sharpness*
384 kbit/s	352x288	704x576	352x288	1280x720	352x288	1280x720
768 kbit/s	704x288	704x576	704x288	1280x720	704x288	1280x720
1Mbit/s	704x576	1280x720	704x576	1280x720	704x576	1280x720
2Mbit/s	1280x720	1280x720	1280x720	1280x720	1280x720	1280x720

E: VIDEO TESTS SUMMARY

High Definition Image Quality

In point to point tests between Polycom® HDX 6004 CODECs the resolution and overall image quality during calls at 2Mbit/s was very good. At lower bandwidths or when the available 2Mbit/s bandwidth was shared between people and content the overall quality of both main channel video and content images was reduced. The maximum available bandwidth of 2Mbit/s was a real restriction in delivering quality for H.329 conferences with both HD Video and Content Images.

F: AUDIO TESTS SUMMARY

Setup The echo canceller was fully automatic in operation. The quality of echo cancellation and doubletalk from the system was excellent.

	Lecture Theatre	Room
Audio levels adequate? (Yes/No)	Not tested	Yes
Audio quality acceptable? (Yes/No)	Not tested	Yes
Echo cancellation acceptable? (Yes/No)	Not tested	Yes
Quality of double talk	Not tested	Excellent

G: DATA TESTS

A PC may be directly connected CODEC via the DVI-I interface.

H: CONNECTIVITY

Connectivity between Like Machines

H.323

There were no problems in establishing connections between the Polycom® HDX 6004 units at Edinburgh and Newcastle over IP.

During an H.323 call the network connection was removed and reconnected after a specific time.

The normal 5 seconds test could not be checked as the calls dropped after two seconds. This is very unusual after such a short period as calls typically reconnect after up to a 30 seconds network disconnection/reconnection.

Time to Connect

H.323	
All speeds	Approx. 5 seconds

Connectivity with Other Machines (models listed with comments)

Successful connections were made in each direction with the following CODECs at their maximum connection speed.

H.323

CODEC	Call Bandwidth	Resolution Transmitted by the HDX6000	Resolution Received by the HDX6000
Polycom® PVX	2 Mbit/s	CIF	QVGA
Polycom® VS4000	2 Mbit/s	CIF	CIF
Tandberg 6000 Classic (B version hardware)	2 Mbit/s	CIF	CIF
Polycom® VSX7000	2 Mbit/s	CIF	CIF
Polycom® VSX8000	2 Mbit/s	CIF	CIF
Tandberg 990 MXP	2 Mbit/s	4CIF	448p
Tandberg Edge 95	2 Mbit/s	4CIF	720p
Tandberg 6000 MXP	2 Mbit/s	4CIF	720p
Polycom HDX 9002	2 Mbit/s	720p	720p
Lifesize Team	2 Mbit/s	720p	720p
Lifesize Room 200	2 Mbit/s	4CIF	720p

Connectivi

H239 was shared successfully between the systems listed above with one exception.

* When H.239 was transmitted from the Lifesize Team to the HDX6000 the main video channel received by the Polycom® HDX 6004 reduced in resolution from 720p to 1200 x 672 and the H.239 channel was received at a resolution of 4CIF. The content quality was therefore very poor.

Connectivity with JANET Videoconferencing Switching Service (JVCSS)

H.323 Standard Definition

The Polycom® HDX 6004 connected using H.263 Video and G.722 audio in both directions, the negotiated resolution was CIF. Dual video H.239 was shared in both directions.

Received audio level was measured as peaking to -4dBm.

H.323 High Definition

The Polycom® HDX 6004 connected using H.264 Video and G.722.1 audio in both directions. The negotiated resolution was 720p. Dual video H.239 was shared in both directions.

Received audio level was measured as peaking to -4dBm.

Procedure for making a call

1. Press Call button on the remote control
2. Select connection speed
3. Input IP address or E.164 number
4. Press the OK button or press the call button.

Local Contacts Directory and Recent Call list are also available from the user interface.

Appendix 1 Detailed Physical Information

Dimensions: (w x h x d) 10 x 30 x 26 cm

Video Inputs Composite/YC/High Definition (HD) Connector

Video 1 HD camera 1	**HD** **Composite, Y/C** Component	HDCI

Video 2

PC Input	VGA	DVI-I

Video Outputs	Composite/YC/ Component /VGA	Connector
Video 1	VGA, DVI Component	HDMI

Audio Inputs	Level	Connector
HDX Microphone	**Line**	Proprietary
Audio input PC (stereo)	Line	3.4 mm Mini jack

Audio Outputs	Level	Connector
Audio output 1 Main audio (stereo)	Line	HDMI
Audio output 1 Main audio (stereo)	Line	RCA Phono x 2

Data

1. 1 off LAN 10/100 Mbits/s Ethernet connection (RJ45)
2. 1 off USB connector (future use)

For added security, the CODEC includes a Kensington lock fixing.

Cables Supplied

1 off	3 metre camera cable	HDCI - HDCI
1 off	7 metre microphone cable	
1 off	2 metre monitor output	HDMI – HDMI
1 off	3 metre monitor output	HDMI – DVI
1 off	2 metre audio cable	2 Phono – 2 Phono
1 off	3 metre PC Cable	DVI – DVI
1 off	Network cable.	

Mobility

The Polycom® HDX 6004 system is portable, lightweight and could be moved easily. To establish a connection each new location will need the local IP address re-entered into the LAN configuration menu.

Appendix 2 Detailed Video Tests

Note: The Polycom® HDX 6004 system supported H.261, H.263, H.263+ and H.264. However it was not possible to force the H.261 or H.263 protocols in calls between HDX units. Subsequently, in the video tests below, only the H.264 (default protocol) was negotiated by the CODEC.

For the following tests using the DVI input and playing test video from a PC set to favour motion, video resolution between Polycom® HDX 6004 systems was **CIF** at 384kbit/s and **4CIF** at all other speeds.

For the following tests at 384kbit/s the corresponding audio protocol was **Siren 22, 48Kbit/s** and for all connection speeds > 384kbit/s was **Siren 22, 64 kbit/s.**

Objective Video Tests: Signal measurements

1. 75% EBU bars
2. Grey scale

Subjective Video Impairments Tested:

Lip synchronisation	**LS**
Block distortion (tiling)	**BLK**
Blurring (reduced edge sharpness and spatial detail)	**BLR**
Colour errors	**CLR**
Jerkiness (distortion of smooth motion)	**JRK**
Object persistence (lagging images from previous frames as faded or outline images)	**OP**
Scene cut response (i.e. time to build up the new image)	**SCR**

Scale of impairments:

Imperceptible	**1**
Perceptible	**2**
Slightly annoying	**3**
Annoying	**4**
Very annoying	**5**

MII Test Tape:

Signals recorded	Time on tape
1. EBU colour bars	1min 30secs
2. Grey scale	1.40 - 2.40
3. Blue field	2.50 - 3.50
4. Medium close up female face, still	4.00 - 5.00
5. Medium close up female face, talking	5.10 - 6.10
6. Close up face, nodding	6.20 - 7.20
7. Close up face, shaking head side to side	7.30 - 8.30
8. Zoom out slowly to wide angle three people	8.40 - 9.40
9. Zoom in quickly to close up of centre person	9.50 - 10.50
10. Turntable speeds: 1,2,3 and 4	11.00 - 15.30
11. Football sequence	15.40 - 16.40

12. Zoom in and out of "A to Z" map 16.50 - 17.50
13. Text legibility, font sizes 20 to 12 pt 20.30 - 20.50
14. Cut tests, scenes various with camera movements 21.00 - 22.00
15. Man teaching at whiteboard 22.10 - 23.23

(Insert 75% EBU bars at local site, measure at remote site)

Test 1 (H264): Colour bar test

(Insert 75% EBU bars at local site, measure at remote site)

Subjective Impairments H.323	384kbit/s	768kbit/s	2.0Mbit/s
BLK	1	1	1
BLR	1	1	1
CLR	1	1	1

Test 2 (H.264): Grey scale

(Insert grey scale at local site, measure at remote site)

Subjective Impairments H.323	384kbit/s	768kbit/s	2.0Mbit/s
BLK	1	1	1
BLR	1	1	1
CLR	1	1	1

Test 3 (H.264): Blue screen

(Insert blue screen at local site, measure at remote site)

Subjective Impairments H.323	384kbit/s	768kbit/s	2.0Mbit/s

BLK	1	1	1
CLR	1	1	1

Test 4 (H.264): Medium close up female (still)

Subjective Impairments H.323	384kbit/s	768kbit/s	2.0Mbit/s
BLK	2	1	1
BLR	2	2	1
CLR	1	1	1

Test 5 (H.264): Medium close up female (talking)

Subjective Impairments H.323	384kbit/s	768kbit/s	2.0Mbit/s
LS	2	2	1
BLK	3	2	1
BLR	3	2	1
CLR	1	1	1
JRK	2	1	1

Test 6 (H.264): Close up head (nodding)

Subjective Impairments H.323	384kbit/s	768kbit/s	2.0Mbit/s

BLK	4	2	1
BLR	4	2	1
CLR	1	1	1
JRK	2	2	2

Test 7 (H.264): Close up head (shaking side to side)

Subjective Impairments H.323	384kbit/s	768kbit/s	2.0Mbit/s
BLK	4	2	1
BLR	4	3	1
CLR	1	1	1
JRK	2	2	3

Test 8 (H.264): Medium close up, slow zoom out to three shot

Subjective Impairments H.323	384kbit/s	768kbit/s	2.0Mbit/s
BLK	3	2	1
BLR	3	2	1
CLR	1	1	1

JRK	3	1	1

Test 9 (H.264): Three shot, quick zoom in to medium close up centre person

Subjective Impairments H.323	384kbit/s	768kbit/s	2.0Mbit/s
BLK	3	2	2
BLR	3	2	1
CLR	1	1	1
JRK	2	2	2

Test 10a (H.264): Turntable speed 1

Subjective Impairments H.323	384kbit/s	768kbit/s	2.0Mbit/s
BLK	1	1	1
BLR	1	1	1
CLR	1	1	1
JRK	2	2	2

Test 10b (H.264): Turntable speed 2

Subjective Impairments H.323	384kbit/s	768kbit/s	2.0Mbit/s

BLK	2	2	1
BLR	2	2	1
CLR	2	2	1
JRK	3	2	2

Test 10c (H.264): Turntable speed 3

Subjective Impairments H.323	384kbit/s	768kbit/s	2.0Mbit/s
BLK	3	2	1
BLR	3	2	2
CLR	2	2	2
JRK	3	2	3

Test 10d (H.264): Turntable speed 4

Subjective Impairments H.323	384kbit/s	768kbit/s	2.0Mbit/s
BLK	3	3	1
BLR	4	3	3
CLR	2	2	2

JRK	4	2	3

Test 11 (H.264): Football sequence

Subjective Impairments H.323	384kbit/s	768kbit/s	2.0Mbit/s
BLK	4	4	2
BLR	4	3	2
CLR	2	2	2
JRK	3	1	1

Test 12 (H.264): Zoom in and zoom out of ‘A to Z’ map

Subjective Impairments H.323	384kbit/s	768kbit/s	2.0Mbit/s
BLK	4	2	2
BLR	4	3	2
CLR	1	1	1
JRK	4	3	2

Test 13 (H.264): Text legibility (% of screen height) at viewing distance approx. 5x screen diagonal

Legibility H.323	384kbit/s	768kbit/s	2.0Mbit/s

20 pt (3.5%)	**Yes**	**Yes**	**Yes**
16 pt (3%)	**Yes**	**Yes**	**Yes**
14 pt (2.5%)	**Yes**	**Yes**	**Yes**
12 pt (2.3%)	**No**	**Yes**	**Yes**

Test 14 (H.264): Video with several vision cuts

Subjective Impairments H.323	384kbit/s	768kbit/s	2.0Mbit/s
BLK	4	3	2
BLR	4	3	2
CLR	1	1	1
OP	1	1	1
SCR	3	3	2
JRK	4	3	2

Test 15 (H.264): Man teaching with flip chart

Subjective Impairments H.323	384kbit/s	768kbit/s	2.0Mbit/s
LS	2	2	1

BLK	3	2	1
BLR	3	2	1
CLR	1	1	1
JRK	1	1	1

Test 16 Playback from a domestic VHS videotape player

As there is no analogue video input this test could not be carried out.

Appendix 3 Detailed Audio Tests

Note: In tests between Polycom® HDX 6004 systems it was not possible to force audio protocols so only a limited range of audio protocols could be fully tested.

Test 1: Frequency response (-3 dB)

(Insert -6 dB signal at local site, measure at remote site)

G.722.1 Annex C	Siren 22 48Kbit/s	Siren 22 64Kbit/s
14 KHz	22 KHz	22 KHz

Test 2: Headroom (measured on Siren 22 64Kbit/s connection)

(Insert increasing amplitude 1 KHz tone at local site, monitor for overload distortion at the remote site auxiliary output.)

Overload occurs at: +3 dBm

Test 3: Audio level

(Insert 0dBm 1KHz tone at local site, monitor the received level at the remote site VCR output)

Remote site signal measures: -6 dBm

Test 4: Echo Cancellation

Setup The echo canceller was fully automatic in operation. The quality of echo cancellation and doubletalk from the system was excellent.

	Lecture Theatre	Room
Audio levels adequate? (Yes/No)	Not tested	Yes
Audio quality acceptable? (Yes/No)	Not tested	Yes
Echo cancellation acceptable? (Yes/No)	Not tested	Yes
Quality of double talk	Not tested	Excellent