

APPENDIX 11/2

TEST RESULTS FOR LGExecutive

Manufacturer: LifeSize
Model: LGExecutive
Software Version: 4.8.0
Optional Features and Modifications: None
Date of Test: 8th – 12th August 2011



LGExecutive System



Remote Control

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A: INTRODUCTION

The LGExecutive is a high definition (HD) desktop videoconferencing system with a picture resolution of 1280 x 720 pixels (720p) at 30 fps (frames per second). The CODEC, camera with integral microphones and loudspeakers are combined with a 24" LG monitor to form a compact desktop unit. Compatibility with other H.323 and SIP CODECS is achieved across a range of resolutions from CIF (352 x 288 pixels) up to 720p (1280 x 720) depending on the capability of the remote CODEC and the connection bandwidth.

LifeSize also produce the Passport, a stand-alone CODEC which shares much of the architecture of the LGExecutive but has the advantage that it also supports Skype. Skype is not supported on the LGExecutive.

Feature Summary:

- An integrated high definition videoconferencing system which supports a range of resolutions up to 720p (1280 x 720 pixels) at 30 fps.
- A single unit comprising: 24" picture monitor, CODEC, camera with integral microphones and dual loudspeakers.
- A CODEC operating at connection speeds up to 2 Mbit/s over H.323 and SIP.
- H.261, H.263 and H.264 video coding.
- G.711, G.722, G.722.1, G.722.1C, G.728, G.729, MPEG4 AAC-LC audio coding.
- Fixed focus HD camera with a native resolution of 1280x720 @ 30 frames per second with integrated twin microphone array.
- External headset input and output
- Supports AES encryption.
- Far end camera control.
- H.239 dual video is supported, but as no PC input is provided, LifeSize Virtual Link software has to be installed on a PC or Laptop to provide the H.239 Content connectivity over a network connection.
- Supports live streaming and recording (when not in a call) via the LifeSize Video Center.
- LDAP global directory support

B: SETUP PROCEDURE

Setting up the LGExecutive system was very straightforward and was achieved in ten minutes. Assembly just involves fitting the base of the stand to the monitor. An infrared remote control completes the package.

The only connections required for basic operation were:

- Establishing an Ethernet IP network connection through the single RJ45-RJ45 cable.
- Connecting power to the unit.

System set up was conveniently configured through the "on-screen" menus via the hand held remote control. IP address, IP Gateway, Subnet mask and Gatekeeper

address were all entered through these menus.

Approximate set-up time: 10 minutes

Documentation quality: No documentation was supplied with the evaluation systems. A combined Passport/LGExecutive User and Administrator guide was available from the Lifesize web site but a guide dedicated to the LGExecutive would have been less confusing. The documentation was concise and easy to follow but lacked any information on the LG monitor menus or controls.

C: HARDWARE DESCRIPTION

General

This compact system is self contained and requires no additional equipment for basic conferencing.. The CODEC will establish connections up to a maximum bandwidth of 2 Mbit/s and delivers a peak image resolution of 720p at 30 frames per second. The system has a single auto switching 10/100 Mbit Ethernet interface with a loop-through connector for a local computer.

Where data sharing is required a PC or laptop computer may be linked to the system using the LifeSize Virtual link software via an IP network connection. Connections for an external microphone/earphone headset are provided.

The 24 inch LG monitor has three inputs:

- An external digital HDMI input for connecting a PC
- An external analogue VGA input for connecting a PC
- An internal (not accessible) input for videoconferencing

With a native resolution of 1080p, PC images from either the HDMI or VGA inputs were excellent. Neither of these images could however be transmitted during a conference - they can only be used for monitoring. If a PC image is being viewed and a conference call is received the system automatically switches to the videoconferencing signal.

The Perspex screen across the front of the monitor was highly reflective and degraded the image quality for the viewer.

The LGExecutive system supports a number of video resolutions from the basic CIF format resolution of 352x288 pixels up to high definition (HD) w720p (1280x720) at 30 fps

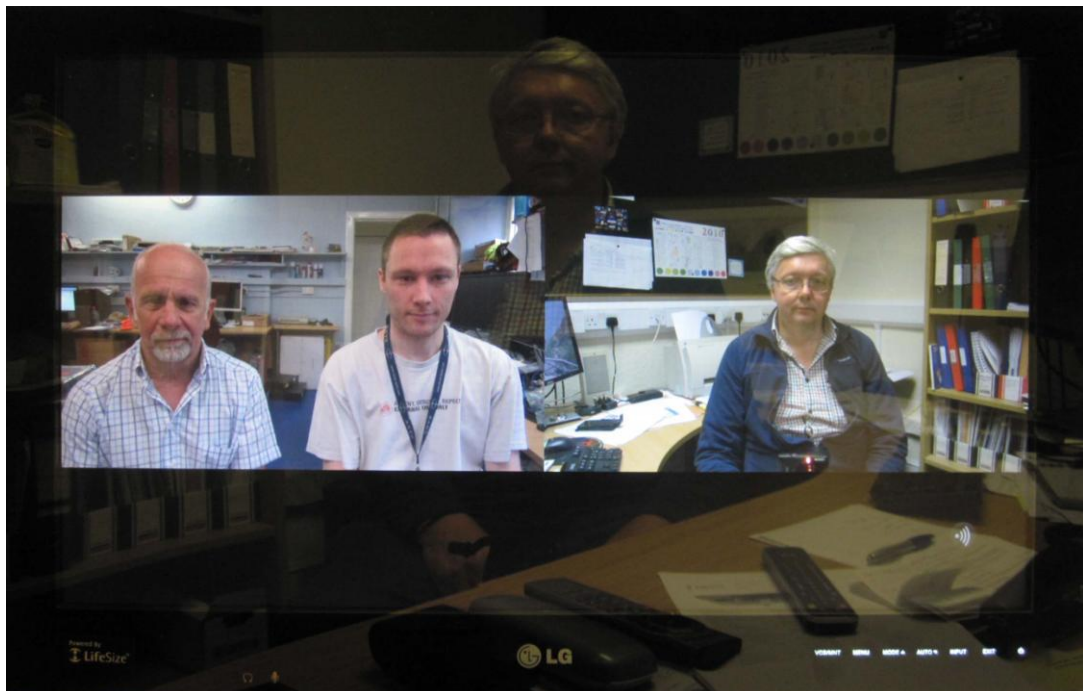
The call connection bandwidth determines the upper image resolution and frame rate. In calls between two LGExecutive systems the negotiated resolution and frame rate is indicated in the table below.

Connection Bandwidth	Resolution	Frame Rate
128 Kbit/s	452 x 240	15
384 Kbit/s	720 x 400	30
768 Kbit/s	1024 x 576	30
1 Mbit/s	1232 x 688	30
1.5 Mbit/s	1280 x 720	30
2 Mbit/s	1280 x 720	30

As there are no external video outputs, the CODEC only supports Picture in Picture (PIP) and Picture outside Picture (POP) options on the LG monitor. The PIP may be set to ON, OFF or Auto, in Auto mode the PIP is displayed for 10 seconds following any button press on the remote control.

The Image button on the remote control enables the user to cycle through a number of different screen layouts including:

- Full screen display of the local image, with or without remote image PIP
- Full screen display of the remote image, with or without local image PIP
- Side by side local and remote images POP.



Picture outside Picture (POP) no Presentation Material

This image clearly shows the screen reflections

When presentation material from a PC is incorporated six layouts are available.

- Full screen display of the presentation image, with or without local video image PIP

- Full screen display of the local video image, with or without presentation image PIP
- Side by side presentation image and local video image POP
- Full screen display of the remote video image, with or without local video image PIP
- Full screen display of the local video image, with or without remote video image PIP
- Side by side remote video image and local video image POP

It is not possible to view the remote presenter and the transmitted or received presentation material simultaneously.



Picture in Picture (PIP) with Presentation Material

The 720p High Definition camera has a native resolution of 1280 x 720 pixels at 30 frames per second. The fixed (zoom and focus) lens provides an acceptable image for up to two conference participants. The camera has a manual tilt facility and together with the picture monitors pan and tilt adjustment permits a reasonable viewing position to be obtained, the monitor does not however adjust vertically. To reduce interference caused by fluorescent lighting the camera includes an anti-flicker mode. The image quality from the camera appeared to be a little grainy across all areas of the image whether in shadow or highlight.

The camera also includes two omni-directional, beam-forming microphones. Dual video H.239 coding provides a second unidirectional (Content) video channel for presentation material during H.323 calls, but without a second audio channel. Bandwidth is shared between this Content channel and the main camera (People) signal. Bandwidth allocation between channels is user adjustable. Thus the main camera output and material from a PC or laptop can be transmitted simultaneously and displayed at a remote site.

SIP dual video is also supported both as a proprietary LifeSize to LifeSize implementation and BFCP supported by Tandberg(Cisco) and Polycom.

As no PC input is provided on the CODEC, H.239 can only be achieved by using the downloadable software application LifeSize Virtual Link. This application enables an IP connection between the PC or Laptop and the CODEC. This arrangement supports image resolution up to XGA but only at low frame rates so that it is only suitable for still or slow moving material. Thus snapshots of the computer screen at user adjustable frame rates of 1 to 5 frames per second may be transmitted from the PC via the CODEC to remote sites.

When presentation material is being shared via LifeSize Virtual Link, unlike hard wired PC systems the software fully refreshes the images every 9-10 seconds even for static images, this effect is seen at both the local and remote CODECS. This image rebuilding effectively reduces the overall image quality seen by the viewer.

The minimum PC or Laptop specification for effective use of Virtual Link is:

Supported Operating Systems:

- Windows Vista - 32 bit & 64 bit
- Windows 7 - 32 bit & 64 bit
- Mac OS X 10.5 & 10.6
- Windows XP

CPU:

- Dual Core AMD processors 2.1 GHz or higher
- Pentium Core Duo or Core 2 Duo 2.1 GHz or higher

Storage:

- 50 MB minimum available hard disk space

Memory:

- 2 GB minimum

Software:

- Adobe AIR 2 runtime

Live streaming and recording a conference are possible when an LGExecutive is connected to a LifeSize Video Centre. As a LifeSize Video Centre was not accessible during the evaluation we were unable to test this feature.

Several audio formats are supported by the CODEC. LifeSize has implemented the ITU standard MPEG-4 AAC-LC, giving 16 KHz analogue audio bandwidth.

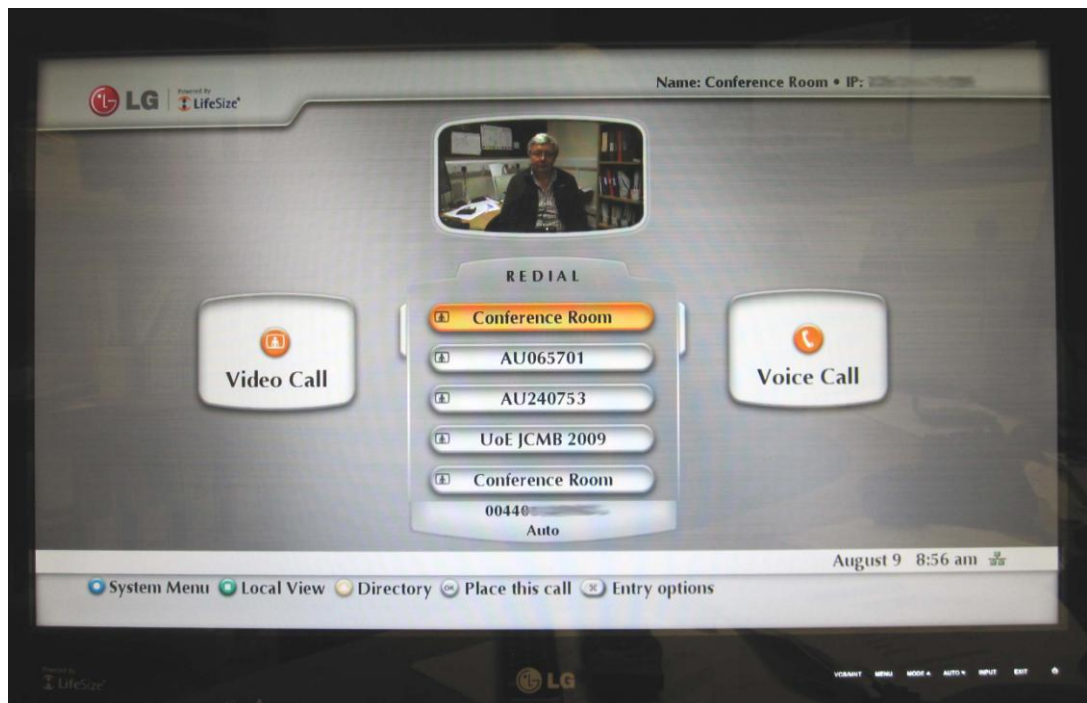
When “Auto Microphone” mode is selected the system defaults to the integrated loudspeakers and microphones. If a personal conference is preferred then “Headset Microphone” is selected and an external microphone/headphone headset may be plugged in, which mutes the integrated loudspeakers/microphones.

Using external loudspeakers in place of the internal monitor loudspeakers significantly improved the sound quality

Encryption is available at all connection speeds through Advanced Encryption Standard (AES) with a 128 bit session key.

D: SYSTEM OPERATION

The system is controlled via the infra red remote control which includes four context sensitive colour coded buttons: yellow (triangle), green (square), blue (circle) and orange (return), the function of each button is indicated by the on-screen menus. This indication is vital as the function of each button changes depending on which mode the system is in at any given time.



Main Menu

There are dedicated buttons for Call, Hang up, Microphone mute, Near/Far camera, Display layout and Volume. Zoom and Input select only operate on remote system control.



LifeSize Remote Control

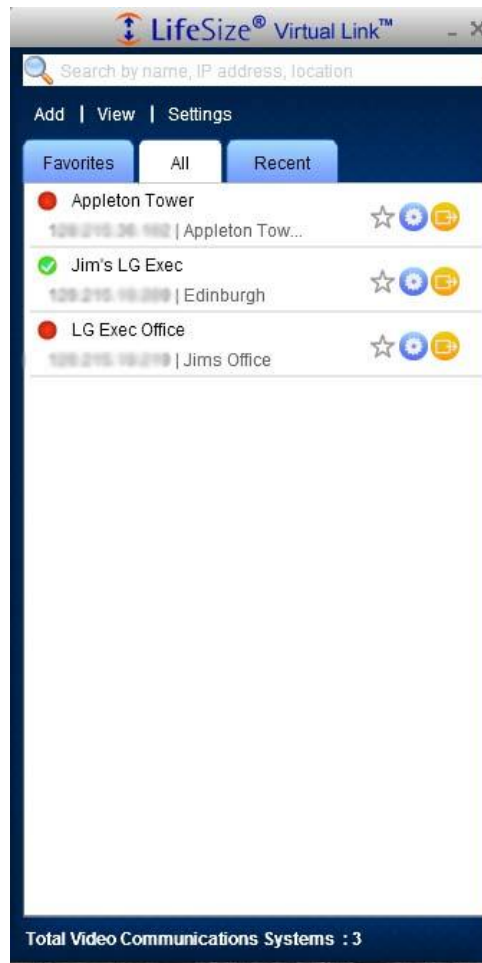
The system takes just over two minutes to boot up from cold. When not in a call the system automatically reverts to screensaver mode which may be selected to 1, 10, 20, 30 minutes or never. Sleep mode may also be activated after 1, 10, 20 or 30 minutes, and 1, 2, 3 or 4 hours of inactivity. An incoming call or pressing a remote control button will then return the system to active mode.

The Statistics menu displays call status data including resolution, connection speed, compression protocols, packet loss, jitter and frame rate for the main video channel. Frame rate information is not available for the second H.239 channel.

In wide screen mode, a 4x3 aspect ratio Content image transmitted from a computer is displayed on the widescreen monitor with the familiar black bars on each side of the image, thus maintaining the aspect ratio of the image. When a 16x9 Content image is transmitted it is compressed horizontally into 4x3 thus distorting the aspect ratio.

Using the LifeSize Virtual Link software to share PC or laptop material

When the software application is started on the PC a list of available endpoints is displayed. Selection of the “Start” presentation button causes an “Accept/Reject” caption to appear on the local CODEC output, the conference presenter must then accept this presentation start using the LGExecutive remote control.



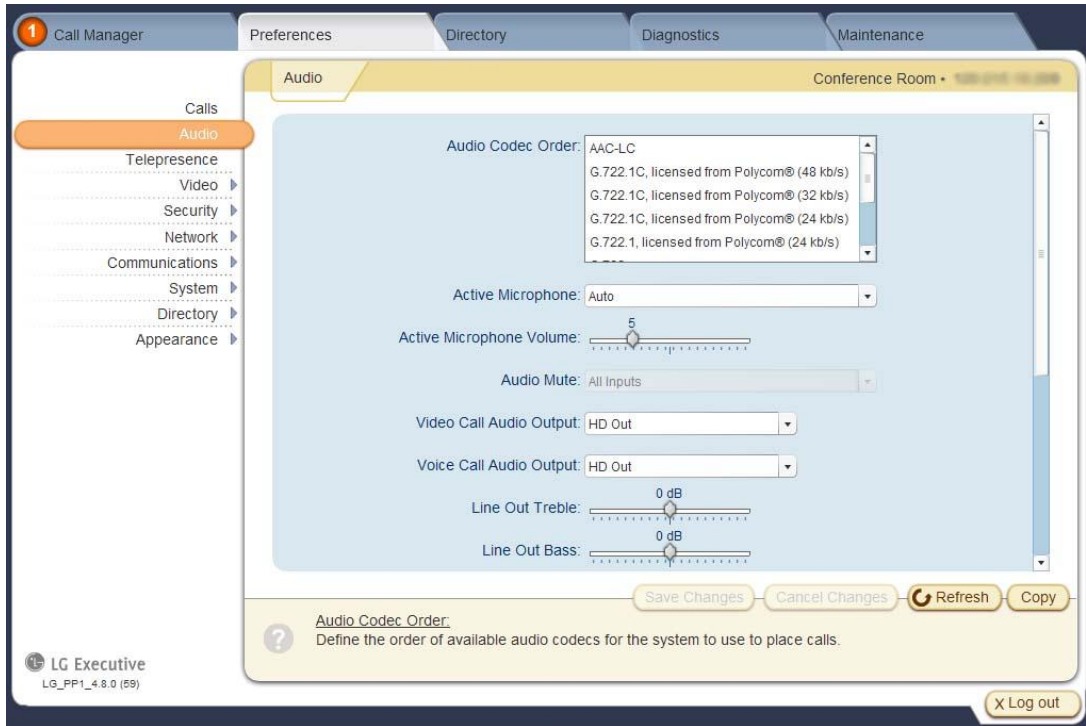
Virtual Link Application

Screenshot reproduced by permission of LifeSize

The presentation transmission is also terminated from the Virtual Link application.

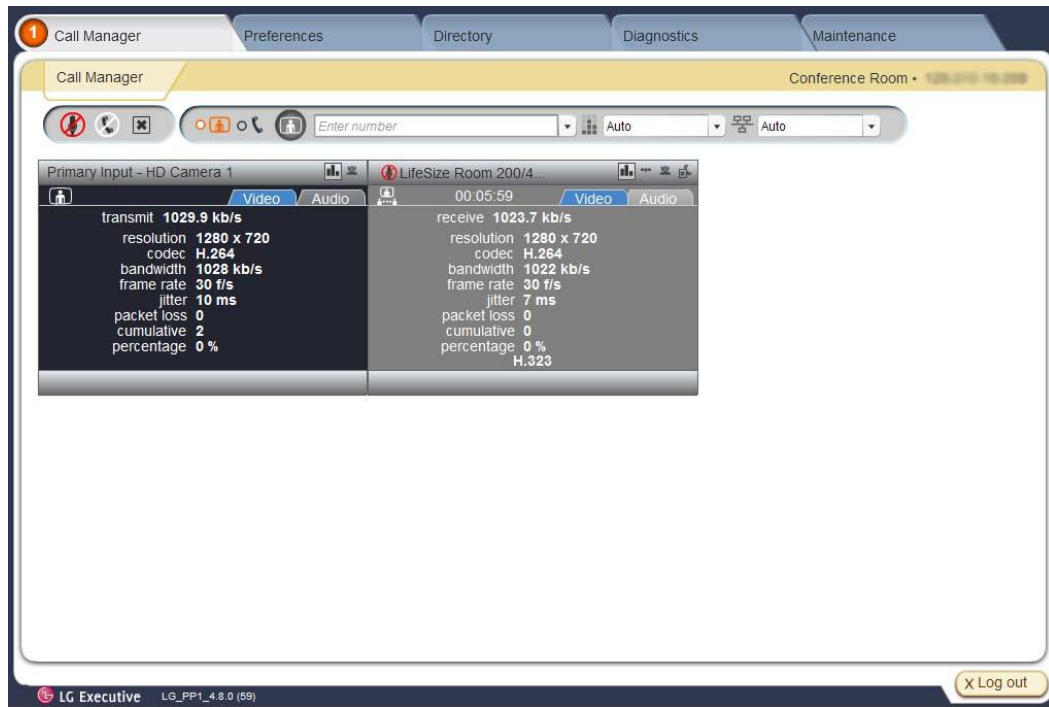
The H.239 Virtual Link PC connection is restricted to a maximum frame rate of 5 frames per second which limits the type of material able to be transmitted to slow moving sequences or still frames. The resolution of the transmitted images depends upon the type of video coding selected. When H.264 was negotiated the transmitted H.239 channel was displayed at XGA resolution but for H.263 the PC image was downgraded to 4CIF. The system may however receive content up to 720p resolution in widescreen.

Audio from the PC or Laptop may not be transmitted with the presentation. Remote configuration and control is available via a web browser interface, with password protection, a useful tool for configuring the system and remotely monitoring calls. Call status, diagnostic information, together with the ability to initiate and terminate calls are available through this web interface. Web snapshots of transmit and receive images are however not available.



Remote Configuration Screen Shot

Screenshot reproduced by permission of LifeSize



Remote Web Monitoring with Statistics

Screenshot reproduced by permission of LifeSize

E: VIDEO TESTS SUMMARY

The LGExecutive systems were capable of producing high quality images. At bandwidths of 1.5Mbit/s and above, the 720p 30 frames per second images from the HD camera were very good.

H.239 Presentation material (Content) was compromised however due to three restrictions:

- A maximum frame rate of 5 frames per second meant that only slow moving or static images could be transmitted.
- The type of video coding determines the resolution. During calls where H.264 was negotiated the H.239 channel resolution was transmitted at XGA, however for H.263 it reduced to 4CIF.
- Received images took time to construct and refreshed every 9-10 seconds. The image received at the far end took several seconds to construct, even for static images. The image also fully refreshes every 9-10 seconds effectively degrading the viewed image. This effect is seen on both local and remote CODECS.

To summarise, while the H.239 channel may be considered adequate for a PowerPoint presentation, a web page with embedded video, an animation or small characters on a spreadsheet may be difficult to read as the movement and fine detail will be lost.

F: AUDIO TESTS SUMMARY

The evaluation was carried out using the camera microphones. The audio quality was good when the conference participant was positioned close to the camera. However when the participant moved further away, although the audio level was adequate, the overall audio quality decreased. Using external speakers significantly improved the received audio quality.

Setup The echo canceller is 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 running the LifeSizeVirtual Link software may be connected to the CODEC via an IP connection

H: CONNECTIVITY

H.323

There were no problems connecting between the LifeSize LGExecutive systems during the evaluation.

Time to Connect with encryption On

H.323

All speeds 8 seconds

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

5 Seconds	Picture froze - successful reconnection, call does not terminate
15 Seconds	Picture froze - successful reconnection, call does not terminate
30 Seconds	Picture froze – picture goes to black - call terminates

Connectivity with Other Machines (models listed with comments)

H.323

Successful connections were made in each direction with the following CODECs, where the system supported H.239, presentation material was also shared.

CODEC	Call Bandwidth	Resolution Transmitted by the LGExecutive	Resolution Received by the LGExecutive
Polycom® VSX7000 Ver.: 9.0.5.1	2 Mbit/s	CIF	CIF
Polycom® PVX Ver.: 8.0	2 Mbit/s	704 x 480	QVGA
Polycom HDX 9002 Ver.: 2.6.0	2 Mbit/s	w720p	w720p
Tandberg Edge 95 Ver.: F9.0.2 PAL	2 Mbit/s	720 x 400	w720p
Tandberg 6000 MXP Ver.: F9.0 PAL	2 Mbit/s	720 x 400	w720p
Tandberg C40 Ver.: TC4.0.1	2 Mbit/s	w720p	w720p
Tandberg C60 Ver.: TC3.1.1	2 Mbit/s	w720p	w720p
Tandberg C90 Ver.: TC4.1.2	2 Mbit/s	w720p	w720p
Lifesize Team Ver.: 4.7.10	2 Mbit/s	w720p	w720p
Lifesize Room 200 Ver.: 4.7.10	2 Mbit/s	w720p	w720p

Resolution in pixels and their common designation:

- 1280 x 720 720p
- 704 x 576 4CIF
- 352 x 288 CIF
- 320 x 240 QVGA
- 176 x 144 QCIF

H.239 was successfully shared in all connections with the following exceptions:

1. Polycom VSX 7000
2. Polycom PVX
3. Tandberg Edge 95
4. Tandberg 6000 MXP

During connections with the above systems the LGExecutive received content at 4CIF and transmitted content at QCIF.

Connectivity with JANET Videoconferencing Switching Service (JVCS)

H.323

The CODEC connected successfully to the JVCS Codian MSE 8510 HD MCU negotiating H.264 Video, 720p resolution and AAC-LC audio with video and audio in both directions.

When an LGExecutive was connected to the MCU any Content transmitted by other CODECS was negotiated down to CIF resolution 352x288. When Content was transmitted from the LGExecutive although the MCU indicated “Content received” a blank image was displayed within the MCU monitoring and at the remote CODECS.

The received audio level was measured as peaking to -4dBm.

MCU Software Version 4.1 (1.51) and Build 6.16 (1.51)

Procedure for making a call

- Press Call button on the remote control
- Select connection speed/quality (the system defaults to auto)
- Input E.164 number, IP or SIP address
- Press the OK button

Or use the Local Contacts directory available from the user interface. A recent call redial list is also available which can be set to display between 0 and 15 numbers.

Appendix 1 Detailed Physical Information

Dimensions: (w x h x d) 59.4 x 51.5 x 7.1 cm

Video Inputs	Signal Type	Connector
Main camera	Digital	Internal connection
PC monitor input	Analogue RGB	15 pin D type
PC monitor Input	Digital	HDMI

Video Outputs	Signal Type	Connector
Main monitor	Digital	Internal connection

Audio Inputs	Level	Connector
Camera microphones	Microphone	Internal connection
Headset	Microphone	Mini jack

Audio Outputs	Level	Connector
Main output	Line	Internal connection
Main output to headset or external speakers	Line	Mini jack

Data

1. 1 off LAN 10/100 Mbits/s Ethernet connection (RJ45)
2. 1 off LAN 10/100 Mbits/s loop through Ethernet connection (RJ45)

Cables Supplied

1. 1 off 3 metre RJ45 – RJ45 network cable
2. 1 off – 1.5 metres 15pin D-type - 15pin D-type
3. IEC mains cables for international markets

Mobility

The LifeSize LGExecutive can be moved easily. To establish a connection, each new location will need the local IP information to be re-entered into the configuration menu or its DHCP registration amended.

Appendix 2 Detailed Video Tests

The LifeSize LGExecutive does not include any external video inputs hence the normal suite of detailed video quality tests could not be undertaken.

Appendix 3 Detailed Audio Tests

The CODEC only includes a fixed microphone level audio input with echo cancellation fixed to ON, so only a limited range of subjective audio tests could be undertaken.

Test 4: Echo Cancellation

Setup The echo canceller is 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