TEST RESULTS FOR STARLEAF GT MINI AND PT MINI

Manufacturer:	**StarLeaf**
Models:	**GT Mini and PT Mini**
Software Version:	**1.2.22b9**
Optional Features and Modifications:	**GT Mini - Dual Monitor**
Date of Test:	**7th – 11th July 2014**

GT Mini Front view

GT Mini Rear view

StarLeaf Touch Control (GT Mini)

Sony PTZ Camera (GT Mini)

Desk Microphone (GT Mini)

PT Mini Front view

PT Mini Front view

StarLeaf Phone, Control and Audio (PT Mini)

Logitech USB Webcam (PT Mini)

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A: EXECUTIVE SUMMARY

The StarLeaf portfolio of endpoints provides a range of HD video hardware and software endpoints managed from the cloud. StarLeaf provides central network infrastructure within the cloud, including MCU facilities.

The StarLeaf business model includes hardware endpoint purchase, a monthly connection charge for all StarLeaf hardware endpoints, StarLeaf Breeze software endpoints at no charge for hardware endpoint owners together with MCU videoconferencing packages available at an additional monthly charge.

This evaluation focuses on the GT Mini designed for small to medium rooms and the PT Mini a personal system.

GT Mini

The GT Mini system supplied for evaluation included: CODEC, Sony PTZ Camera, desk microphone and StarLeaf Touch control system. It supports 720p@60fps transmit and receive on the main channel and 1080p on the presentation channel; dual monitor is also supported. Two external power supplies for the CODEC and Sony Camera complete the package.

PT Mini

The PT Mini system supplied for evaluation included: CODEC, Logitec USB webcam and StarLeaf Phone control system. It supports 720p@30fps transmit and 720p@60fps receive on the main channel and 1080p on the presentation channel; only single monitor is supported. Two external power supplies for the CODEC and StarLeaf Phone complete the package.

The maximum point to point connection speed is 1.5 Mbit/s, compatibility with other CODECS is achieved across a range of resolutions from SIF (352x240) to 1280x720 pixels. The quality of the conference is dependent upon the capability of the remote CODEC and the connection speed.

Pros:
- Range of Hardware and Software Endpoints sharing the same User Interface.
- Feature rich: Presence, Call Forward, Hold and Transfer, Video Voicemail, Ad Hoc and Scheduled MCU conferences.
- Mixed Purchase/Monthly Fee funding model reduces initial outlay.

Cons:
- Restricted image quality when sharing presentation material due to the 1.5Mbit/s max call speed
- System does not support Picture outside Picture (POP) layouts; only Picture in Picture (PIP) is supported
- Non-standard funding model.

GT Mini

Video standards	H.263, H.263+, H.264, SVC
Supported video resolutions	Up to 1280 x 720@60 frames per second (HD720p)
Communications	H.323 and SIP up to 1.5Mbps
Audio standards	AAC-LD, G.711 µ -law / A-law, G.722, G.722.1, G.722.1 Annex C, iLBC
Camera	HDMI 12x optical zoom camera, PTZ function, 1080p native resolution. 70° Horizontal field of view.
Video inputs	One HDMI, One DVI-I
Video outputs	Two HDMI
Audio inputs	Two XLR microphone, 3.5mm mini-jack connection for PC/DVD audio
Audio outputs	HDMI, 3.5mm mini-jack,
Auxiliary features	H.239 second video channel up to 1080p resolution. Far End Camera Control Scheduled and Adhoc Multisite Conferences Email Invites With other StarLeaf Systems: - Presence - Call Forward, Hold and Transfer - Video Voicemail Messages Serial API Control
Encryption	AES Encryption

PT Mini

Video standards	H.263, H.263+, H.264, SVC
Supported video resolutions	Up to 1280 x 720@30 frames per second (HD720p) transmit Up to 1280 x 720@60 frames per second (HD720p) receive
Communications	H.323 and SIP up to 1.5Mbps
Audio standards	AAC-LD, G.711 µ -law / A-law, G.722, G.722.1, G.722.1 Annex C, iLBC
Camera	USB Webcam 1080p native resolution.
Video inputs	One USB Webcam, One HDMI
Video outputs	One HDMI
Audio inputs	3.5mm mini-jack connection for PC/DVD audio
Audio outputs	HDMI
Auxiliary features	H.239 second video channel up to 1080p resolution. Far End Camera Control Scheduled and Adhoc Multisite Conferences Email Invites With other StarLeaf Systems: • Presence • Call Forward, Hold and Transfer • Video Voicemail Messages
Encryption	AES Encryption

B: SETUP PROCEDURE

GT Mini

Setting up the GT Mini system was straightforward. The camera (positioned adjacent to a picture monitor) and the CODEC have their own power supplies and together with the StarLeaf Touch and the desk microphone complete the package. Cabling the system was easy and involved:

- Connecting the HDMI-HDMI leads between the CODEC and the high definition monitors.
- Connecting the DVI-I to DVI-I and Visca control cable between the CODEC and the camera.

- Connecting the desk microphone to the CODEC XLR input.
- Conecting the CODEC to the StarLeaf Touch controller via a single RJ45-RJ45 cable.
- Establishing an Ethernet IP network connection to the CODEC through the single RJ45-RJ45 cable.
- Connecting power to the CODEC and camera from their external power supplies.

PT Mini

Setting up the PT Mini system was straightforward. The CODEC with its own power supply is connected between a PC and the PC monitor with the webcam positioned adjacent to the monitor, together with the StarLeaf Phone supporting headset or handset audio complete the package. Cabling the system was easy and involved:

- Connecting the HDMI-HDMI lead between the CODEC and the high definition monitors.
- Connecting the HDMI PC output to the CODEC
- Connecting USB Webcam to the CODEC
- Conecting the CODEC to the StarLeaf Phone controller via a single RJ45-RJ45 cable.
- Establishing an Ethernet IP network connection to the CODEC through the single RJ45-RJ45 cable.
- Connecting power to the CODEC and StarLeaf Phone from their external power supplies.

System set up was conveniently configured through the StarLeaf Touch or Phone interface and mainly involved inserting the network settings for the CODEC; very limited system setup menus are available via the StarLeaf Touch or Phone. Configuration is primarily carried out via the StarLeaf Portal

Approximate set-up time: 15 minutes

Documentation quality: The concise User and Installation Guides were all easy to follow.

C: HARDWARE DESCRIPTION

General

The GT and PT Mini systems operate in a similar methodology; the key differences between the systems are the input and output configuration and transmit frame rate:

GT Mini

- PTZ Camera
- Up to two Desk Microphone inputs
- Dual Monitor
- StarLeaf Touch Control
- 720p@60fps Transmit

The GT Mini includes vari-speed cooling fans which at their slowest speed produce some background noise, so care is required in positioning the CODEC.

PT Mini

- USB Webcam
- Audio from StarLeaf Phone Handset or Headset
- Single Monitor
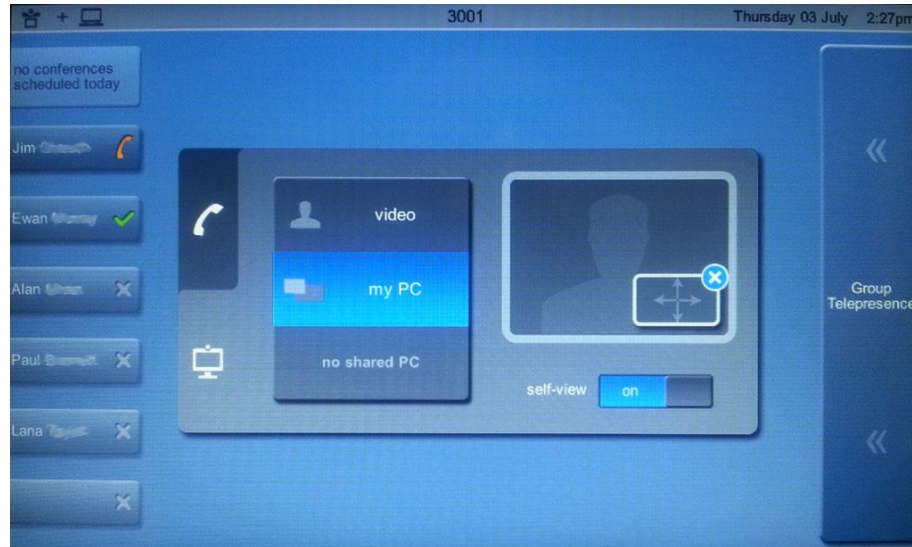- StarLeaf Phone Control
- 720p@30fps Transmit

The main HDMI connection carries the digital audio output, Analogue audio input (GT and PT) and output connections (GT Only) are also provided. Many HDMI monitors crop the image also known as "Monitor Overscan" this effect will particularly impact on the Presentation Image; the extremities of the image, for example, the task bar will appear cropped and not visible to the user. There is no adjustment within the GT or PT systems to compensate for this cropping. Using our monitors, DVI input resolved this issue.

The GT and PT Mini systems support a number of video resolutions up to 720p on the main channel and 1080p on the H.239 second channel.

The systems support traditional Picture in Picture (PIP) display format; the position of the self view PIP may be moved around the four quadrants of the screen and switched off via the touchscreen graphic interface on the StarLeaf Touch/Phone control panel. The local PC input may also be previewed full screen. There are no on-screen menus, all graphic user menus are displayed on the StarLeaf Touch/Phone control panel. The system does not support Picture outside Picture (POP).
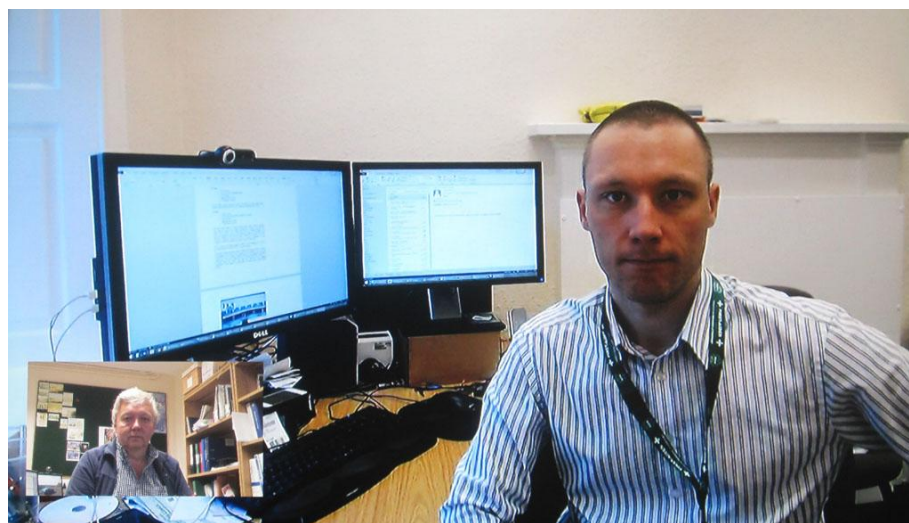
Full screen of the Far Image with Near Image Picture in Picture (PIP)

StarLeaf Touch/Phone Display Layout Control

When H.329 dual images are either transmitted or received in single monitor display mode, the default layout is Presentation image full screen with Near and Far camera images Picture in Picture (PIP). The Far camera image may be selected full screen with the Presentation image displayed as a PIP. Inn addition, the local PC input may be previewed full screen when receiving presentation material. The PIP images may be cycled around the four quadrants of the screen and either or both PIP images switched off via the touchscreen interface.

Presentation Image Full Screen, Near and Far Images PIP

In Dual monitor mode (GT Mini Only) without Presentation material the monitors display:

	Not in a Call	In a Call
Main monitor	StarLeaf Logo	Far Image + Near Image PIP
Second monitor	PC I/P	Local PC I/P

When presentation material is transmitted or received the second monitor displays the presentation material and the main monitor displays Full Screen of the far end image with near image PIP. The local PC input may also be previewed full screen when receiving presentation material The position of the self view PIP may be moved around the four quadrants of the screen and switched off via the touchscreen graphic interface on the StarLeaf Touch/Phone control panel

The Sony PTZ (Pan Tilt and Zoom) 1080p HD camera supplied with the GT Mini has a native resolution of 1920 x 1080 pixels and horizontal viewing angles of 70 degrees. The system control does not support Preset Camera Positions.

The Logitech HD Pro USB Webcam supplied with the PT Mini has a native resolution of 1920 x 1080 pixels.

While the native resolution of both cameras is 1920 x 1080 the resolution transmitted is 1280 x 720

Dual video coding H.239 is supported providing a second unidirectional video channel. Thus presentation material from a camera and material from a PC could be transmitted simultaneously and displayed on two monitors at the remote site. When the GT and PT Mini systems conferenced together at its maximum 1.5 Mbit/s connection speed the following resolution and frame rate was noted:

Transmit from StarLeaf GT Mini to PT Mini	No Presentation Material	Presentation Material Transmitted
Transmit Main Channel	720p@30fps	1024*576@30fps
Transmit H.239 Channel	N/A	1080p@12fps
Receive Main Channel	720p@30fps	720p@30fps

It was noted that when Presentation material was being shared the resolution of the main channel was reduced while maintaining 30fps, the presentation channel delivered 1080p resolution at 12fps.

The data sheet states that the GT Mini can transmit and receive 720p@60 and the PT Mini can receive 720p@60 therefore it would have been expected that 720p@60 would have been experienced in connection from the GT to the PT system. At no point in the evaluation was 720p@60 experienced.

Several audio formats are supported by the GT and PT CODECs; in point to point calls AAC-LD was negotiated by default.

The GT Mini includes one desk microphone with an inbuilt mute button. A second desk microphone may also be added for larger rooms.

StarLeaf Desk Microphone

The PT Mini operates with the StarLeaf Phone providing audio facilities via the Phone handset or alternatively a headset.

PC audio input (GT and PT) and stereo audio outputs (GT Only) are both available via industry standard 3.5mm mini jack connectors. The main HDMI output also carries the digital stereo audio signals.

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

StarLeaf Breeze

Owners of StarLeaf hardware endpoints have access to StarLeaf Breeze software clients and can allocate these to members of their organisation or use them to invite guests to join conferences. The desktop client menus are nearly identical to the hardware endpoint control.

It was noted that when sharing presentation material with moving images from the Breeze client that the frame rate was restricted to 5 frames per second or under.

Breeze Menu (not in a call)
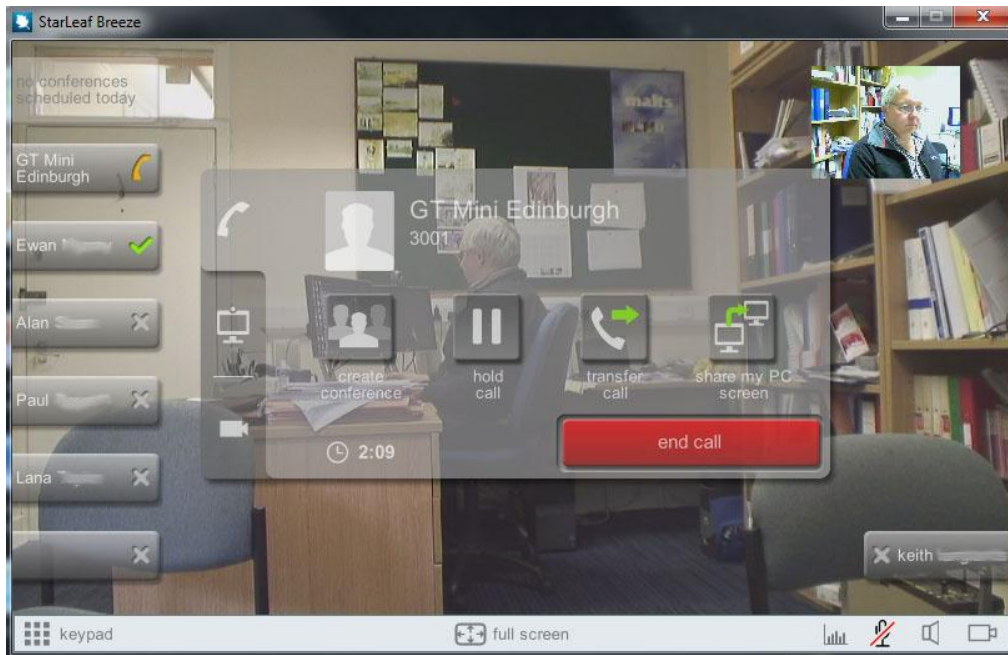
Breeze Menu (in a call)

D: SYSTEM OPERATION

The system may be operated locally from the touch screen on the StarLeaf Touch or Phone units. The on-screen menus are logical and easy to follow. The system may also be configured via a web portal interface from a network connected PC. For security this remote portal connection is password protected. The GT Mini may also be interfaced to a room control system via a serial API connection.

StarLeaf Touch   **StarLeaf Phone**

Main Menu (not in a call)

In addition to the touch screen control single operation control buttons are provided including: Home, Volume, Mic. Mute, Camera Mute, Loudspeaker On/Off, Headset, Key Pad.

The Touch screen interface also provides "Presence" indicating whether other StarLeaf systems are available, in a call or set to do not disturb. The 14 Direct Dial Favourites, Personal Contacts and Company Directory lists, together with a recent calls list, is also accessed via the touch screen to assist in making connections. When a StarLeaf system is called and is busy or unanswered a video voicemail message may be left for that endpoint.

Voicemail Replay

Email invites to join a StarLeaf conference may be sent via the touch screen, the email will provide connectivity details from standard H.323 and SIP endpoints, together with a download link for the StarLeaf Breeze software client if the email recipient does not have access to VC equipment.

Scheduled StarLeaf multisite conferences are also joined from the touchscreen; in addition ad-hoc conferences may be initiated and calls forwarded or transferred to another endpoint.
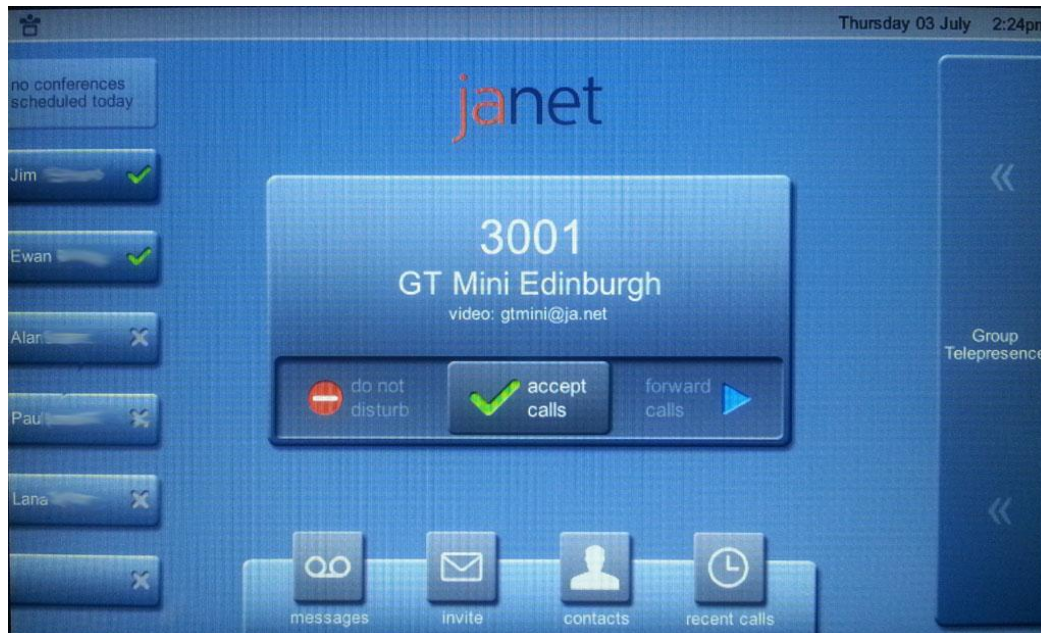
Main Menu (in a call)

The touch screen control includes a "Share my PC Screen" button:

- Pressing this button selects the PC presentation source and opens an H.239 connection
- Pressing the button again closes the H.239 connection

The main camera occupies one channel and the source connected to the DVI-I (GT) or HDMI (PT) input the second channel, normally a PC. At the remote site these two images may either be viewed on two separate monitors or using PIP displayed on a single screen.

During a call to a system that includes a PTZ (Pan Tilt and Zoom) camera an addition camera tab appears on the main menu which provided access to the PTZ controls for the remote camera.
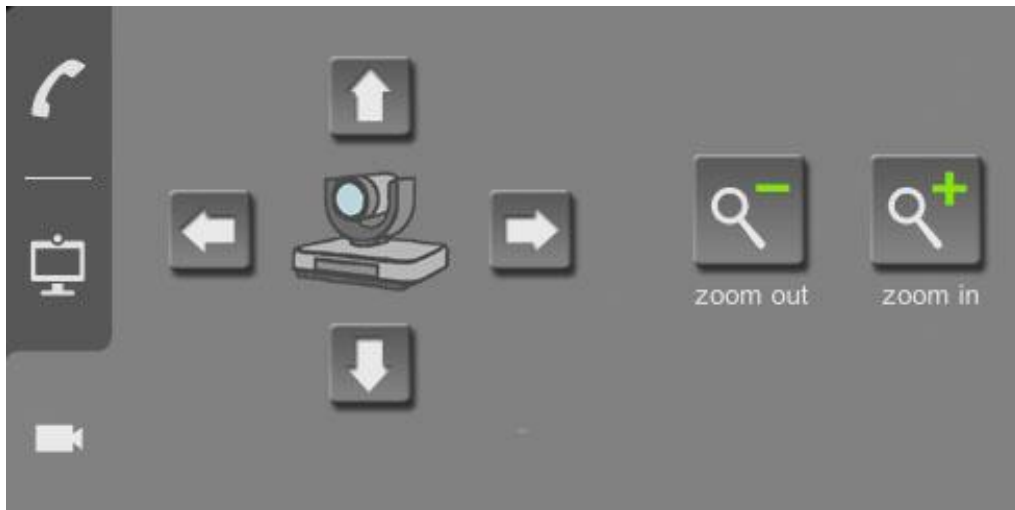
StarLeaf MCU

StarLeaf MCU packages may be purchased for an additional monthly fee; this provides access to Continuous Presence MCU functionality with up to five sites (organiser plus four additional sites), the four remote sites being displayed in a quad split image. During an MCU conference the maximum resolution of the Presentation image was 1080p; when some legacy endpoints were connected to the StarLeaf conference this was reduced to 1152 x 656.

MCU conferences may be scheduled via the web portal or immediately initiated from the endpoint graphic interface. Setting up a conference by either method was simple and straightforward.

When an endpoint is scheduled into a conference this booking is reflected on the system interface; at the conference start time the user is invited to join the conference via a message on the system interface and in the case of hardware systems, on the monitor output.

Scheduled Conference Indication

Invitation to Join Scheduled Conference

The hardware systems take a significant period to boot up from cold (~60 seconds), on screen graphics on the monitor output and touchscreen provide useful user feedback that the system is booting up. When not in a call, the system does not go into sleep mode and while the monitor output changes from the StarLeaf Logo to black, the Touchscreen and Monitors remain on at all times.

The Status menu, available in a call via the Home button, displays calls' status data including connection speed, compression protocols and packet loss.

The system may also be configured via a password protected web portal from a network connected PC. This facility provided user and endpoint configuration and monitoring facilities including the ability to schedule StarLeaf multisite conferences.

Configuration Portal - Users and Meeting Rooms

Configuration Portal GT Mini Endpoint Setup

Connection Call Statistics

E: VIDEO TESTS SUMMARY

The video quality experienced between StarLeaf systems, both hardware and software, at 720p was very good. When presentation material was transmitted and the limited 1.5Mbit/s maximum connection bandwidth was shared between the main and H.239 presentation channels, the quality was very good on static presentation images. However the maximum 12fps frame rate and the available bandwidth of ~700Kbit/s limited the performance of the presentation channel. When significant motion was displayed within the presentation channel, for example full screen motion video, the restricted frame rate and, at times blockiness of the image, was noticeable.

The data sheet states that the GT Mini can transmit and receive 720p@60 and the PT Mini can receive 720p@60, therefore it would have been expected that 720p@60 would have been experienced in connections from the GT to the PT system. At no point in the evaluation was 720p@60 experienced.

F: AUDIO TESTS SUMMARY

Setup   The echo canceller is fully automatic in operation.

	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	Very Good

At times the Lip Sync appeared further in advance that would be expected, this was inconsistent and on many occasions the Lip Sync was acceptable.

G: INTEROPERABILITY

H.323

There were no problems connecting between the StarLeaf GT and PT Mini units.

Time to Connect with encryption On
H.323

All speeds   3 seconds

Connectivity with Other Machines (models listed with comments)

H.323

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

CODEC	Call Bandwidth	Resolution Transmitted by The GT Mini	Resolution Received by The GT Mini
Tandberg 6000 MXP S/W F9.0 PAL	1.5 Mbit/s	624x352@30	768x448@25
Cisco SX20 (JCMB) S/W TC7.0.2	1.5 Mbit/s	1280x720@30	1280x720@30
Cisco C40 S/W TC7.0.2 (No Premium Res)	1.5 Mbit/s	1280x720@30	1280x720@30
Cisco C60 (Prem Res) S/W TC4.2.1	1.5 Mbit/s	1280x720@30	1280x720@30
Cisco C90 (Prem Res) S/W TC7.02	1.5 Mbit/s	1280x720@30	1280x720@25
Lifesize Express 220 S/W 4.9.00	1.5 Mbit/s	1280x720@30	1280x720@30
Lifesize Room 200 S/W 4.7.22	1.5 Mbit/s	1280x720@30	1280x720@30

Note: In connections with Lifesize systems the resolution of the presentation channel received by the StarLeaf systems was 704 x 480.

In connections with a Tandberg 6000MXP presentation material could not be shared in either direction.

Connectivity with JANET Videoconferencing Switching Service (JVCS)

H.323

The StarLeaf PT system connected successfully to the JVCS Codian MCU negotiating H.264 video at 720p resolution with corresponding audio coding of AAC-LD, H.239 content was also successfully shared via the MCU. The received audio level was measured as peaking to -4dBm.

Procedure for making a call

1.   Select Contacts
2.   Select Dial Tab
3.   Input IP address
4.   Press the "Call" button

Or use the Favourites Buttons, Personal Contacts, Company Directory, or the Recent Calls list.