Technical Description of TANDBERG 550 with software version E3

TANDBERG

D12840 Rev.05

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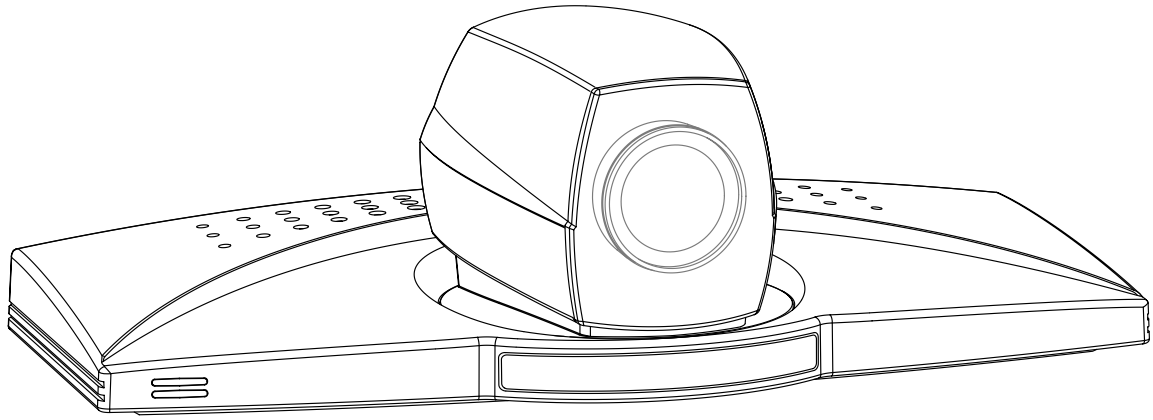
1. Introduction

The TANDBERG 550 is a small, high quality set-top videoconferencing system. The system is designed for use with data rates up to 768 kbps when connected to a LAN, using the ITU-T H.323 standard. The system may also support calls from 56 kbps up to 384 kbps[1], using ITU-T standard H.320 for video compression and a combination of H.221 and BONDING for communication up to 6 ISDN B-channels. All features of the TANDBERG 550 are based on standards set by the ITU-T.

- When directly connected to a Local Area Network, TANDBERG's network manager enables automatic detection of speeds up to 768 kbps.
- When directly connected to BRI ISDN network, TANDBERG's SoftMux enables BONDING calls up to 384 kbps.

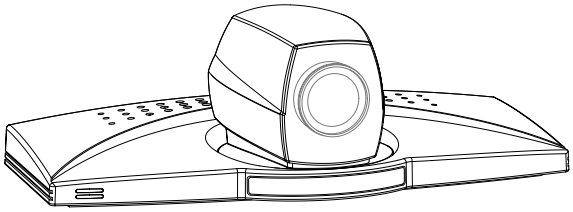
The TANDBERG 550 videoconferencing system consists of a Codec (COding / DECoding unit) with a built-in remotely controllable TANDBERG 550 camera (PAL or NTSC), a hand held remote control unit and a tabletop microphone. The TANDBERG 550 is a single monitor system and may be connected to a normal TV monitor (PAL/NTSC) or an XGA monitor.



[1] ISDN is optional with 128 kbps or 384 kbps

2. Product Description

2.1 Codec



The Codec is the "brain" of the system and handles all incoming and outgoing video, audio and data towards the Local Area Networks (LAN) or switched public telephone networks.
The Codec receives pictures from a video source e.g. the TANDBERG Camera, encodes and compresses the live video and audio at rates of up to 30 frames per second. The coded image and audio is transmitted to a remote unit at rates up to 768 kbps (IP network) or 384 kbps[1] (ISDN).

The Codec also receives incoming video and audio at rates up to 768 kbps, decodes the live video and audio and passes the video signal to the monitor for display. Audio is decoded and passed to the amplifier/speaker of the TV-/XGA-monitor.

Extensive use of industry standard interfaces and connectors ensure seamless integration of external equipment with this set-top system. The interfaces can easily be controlled via the intuitive user interface.

There are two green LEDs in front of the codec; the upper one indicates power while the lower will blink when the remote control is in use.

2.1.1 Software Versions

There are three software versions for TANDBERG 550, differentiated by available ISDN (H.320) bandwidth in a call (all available in either PAL or NTSC):

Software	H.323 (max. bandwidth)	H.320 (max. bandwidth)
IP only	768 kbps	N. A
768 IP / 128 ISDN	768 kbps	128 kbps
768 IP / 384 ISDN	768 kbps	384 kbps

For each software version, there are two software options with special features included:

Software Option	**Features**
Standard	• Receive Digital Clarity (4xCIF/4xSIF/VGA/SVGA/XGA)
Presenter Package (PP)	• Transmit (using *PC Soft Presenter*) & Receive Digital Clarity (4xCIF/4xSIF/VGA/SVGA/XGA)

2.2 TANDBERG 550 Camera

The TANDBERG 550 is equipped with a camera, which is controllable by the remote control. This allows the user to zoom, pan and tilt the camera. The camera is either PAL or NTSC depending on the country of use.

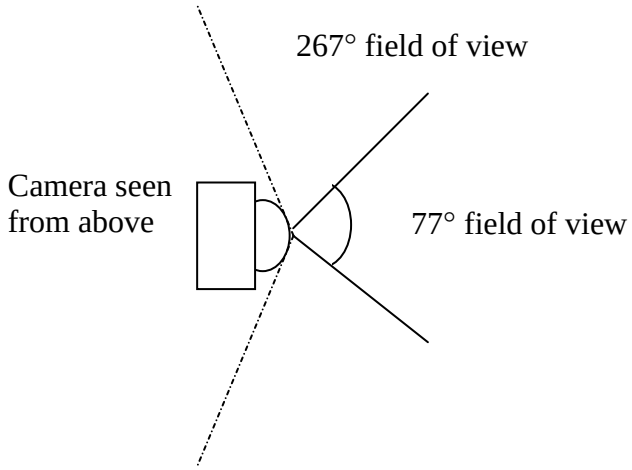
2.2.1 Camera Features

Camera Specifications

1/3" CCD Colour Camera (single chip)	**PAL or NTSC**
190° Pan +77° Horizontal Field of View	**10 x Zoom (optical)**
35° Tilt +61° Vertical Field of View	**15 Camera Pre-sets**
Auto/Manual Focus/Brightness/White Balance	**Min. illumination 2.0 Lux (F1.8 wide)**
Focal length f=4.2 to 42 mm	**Aperture F=1,8 to 2,9 (wide to tele)**
Max. focus response time 0.5sec (∞ to near)	**Zoom speed wide to tele 1,8sec**

- The system is able to store up to 15 pre-set camera positions, making it easier for the user to change the selected view rapidly during a presentation or a meeting. If the main camera is selected, pan, tilt, zoom will also be stored with the preset. The first 10 presets may be accessed via the remote control, while the 5 remaining presets are accessed by data port commands or IR-codes (e.g. by using the TANDBERG Tracker[2]).

- The camera is equipped with a wide angle lens and covers a wide area as shown below: The camera covers a horizontal field of view of 77°, while panning takes the range up close to 270° [3].



- Minimum horizontal field of view (maximum zoom in) is 7.7°.
- The camera covers a vertical field of view of 61°, while tilting takes the range up to 96°.
- Tilting the camera max. 15° upward and max. 20° downward.
- Automatic or manual brightness, focus and white balance ensure that the user obtains the best possible picture.
- Horizontal resolution: 450 TV lines for PAL and 460 TV lines for NTSC.
- Number of picture elements: 752 (h) x 582 (v) for PAL and 768 (h) x 494 (v) for NTSC.
- Shortest Subject Distance: 10 mm (wide end) and 1000 mm (tele end)

[2] Information of the TANDBERG Tracker is found in the User Manual.

[3] Maximum wide angle for all camera measurements.

2.3 Remote Control

2.3.1 Transmission Protocol

The Infra Red (IR) sensor for the remote control is located in front of the codec, behind the glass shield.

The TANDBERG handheld remote control transmits IR- signals using the following parameters:

Protocol	Siemens SDA2208
Reference Freq.	485 kHz
Address	4 & 7
IR wavelength	940 nm
IR carrier Freq.	30 kHz

2.3.2 Key Pad Layout and Codes

The hand held remote control transmits 46 different codes. The keypad will not transmit additional codes if more than one key is pressed simultaneously.

The following table shows relationship between the remote's buttons and their respective codes.

BUTTON CODES			REMOTE
Address	Decimal	Hex	BUTTON NAME
4	1	01	NUMBER 1
4	2	02	NUMBER 2
4	3	03	NUMBER 3
4	4	04	NUMBER 4
4	5	05	NUMBER 5
4	6	06	NUMBER 6
4	7	07	NUMBER 7
4	8	08	NUMBER 8
4	9	09	NUMBER 9
4	10	0A	NUMBER 0
4	11	0B	*
4	12	0C	#
4	13	0D	MAIN CAM
4	14	0E	AUX
4	15	0F	DOC
4	16	10	VCR
4	17	11	PC
4	18	12	SELFVIEW
4	19	13	SNAPSHOT
4	20	14	FAR END
4	21	15	PIP MOVE
4	22	16	ZOOM OUT
4	23	17	ZOOM IN
4	24	18	
4	25	19	VOLUME DOWN
4	26	1A	VOLUME UP
4	27	1B	MIC OFF
4	28	1C	
4	29	1D	UP
4	30	1E	DOWN
4	31	1F	LEFT
4	32	20	RIGHT

BUTTON CODES			REMOTE
Address	Decimal	Hex	BUTTON NAME
4	33	21	OK
4	34	22	CONNECT (GREEN)
4	35	23	DISCONNECT (RED)
4	36	24	DIRECTORY
4	37	25	MENU
4	38	26	DELETE
4	39	27	STORE
4	40	28	PRESET
4	41	29	
4	42	2A	
4	43	2B	SCREEN MENU A (LEFT)
4	44	2C	SCREEN MENU B (MIDDLE)
4	45	2D	SCREEN MENU C (RIGHT)
4	46	2E	
4	47	2F	
4	48	30	P1
4	49	31	P2
4	50	32	P3
4	51	33	
4	52	34	
4	53	35	
4	54	36	
4	55	37	
4	56	38	
4	57	39	
4	58	3A	
4	59	3B	
4	60	3C	
4	61	3D	
4	62	3E	
4	63	3F	TOUCH DETECT
7	25	19	LOW BATT

2.4 Monitor (Optional)

TANDBERG 550 is not supplied with a monitor. Monitor is available upon request. Any standard TV monitor (PAL or NTSC) monitor may be connected.

The system may also be supplied with an XGA monitor (optional). In this case an *Intelligent VGA <-> S-Video switching cable* will be supplied. It must be connected to the dataport and will switch to the VGA cable (thus XGA resolution) when PC is selected and S-Video cable (xCIF resolution) when e.g. Main Camera is selected.

2.5 Cart & Monitor package (Optional)

It is possible to purchase a complete cart & monitor package including: TANDBERG 550 system, normal TV (29") or High Quality (XGA) monitor and a monitor cart.

3. Operation and User Interface

The TANDBERG 550 is normally operated via a hand-held, infrared remote control. TANDBERG 550's simple and concise multi-coloured on-screen menu ensures that the user will be guided directly to the option or the feature required. The menu system is cursor driven and easy to use.

With the intelligent on-screen user feedback the system always ensures the relevant information is given to the user. (E.g. if a channel is lost, the user will see on-screen text message 'please wait, re-establishing the call').

The Quick Keys (located on the top of the remote) relate to the three blocks at the bottom of the screen. The text on these blocks will change depending on which menu is selected.

The user will hear a key tone when entering letters and digits via the remote control. The key tones may be turned off via the system's data port if desired.

The TANDBERG 550 can also be controlled via the data port of the Codec by using a comprehensive set of data port commands[4]. This enables the Codec to be controlled by a different user interface, such as an AMX or Crestron system.

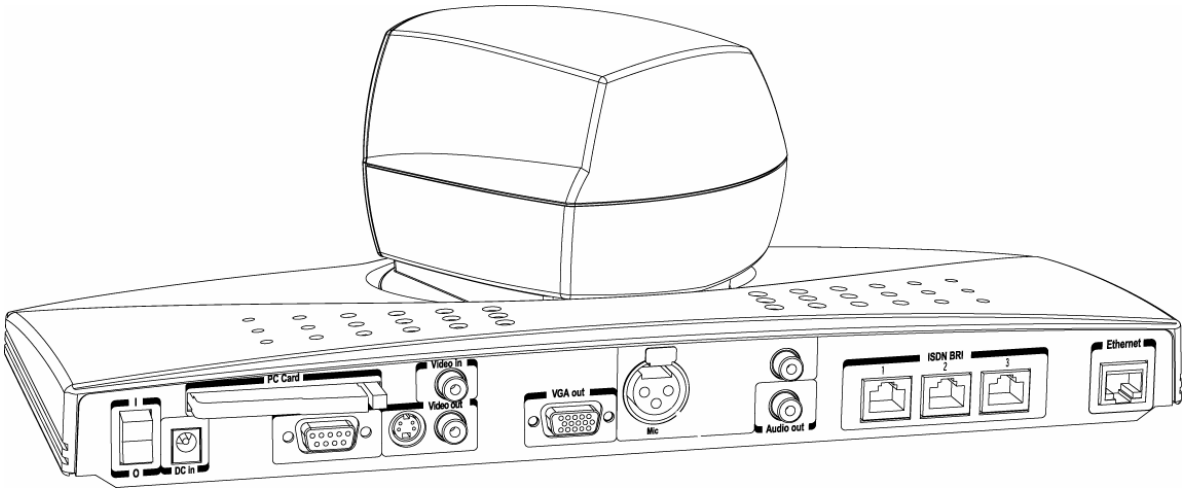
The codec's web browser can be used as another interface to the TANDBERG 550. By connecting the codec to a LAN, the codec may be accessed from a PC located on the same LAN / WAN; allowing the codec's features to be remotely controlled via the web interface.

For information on how to operate the system, please see the 'TANDBERG 550 User Manual' supplied with the system.

[4] Please, refer to 'TANDBERG API – (Dataport User Guide)' (D11943)

4. Codec Interfaces

Extensive use of industry standard interfaces and connectors ensure effortless integration of external equipment with the TANDBERG 550. These interfaces can easily be controlled via one of the intuitive user interfaces.



4.1 Network Interfaces and Features

Network Interfaces	**3 x ISDN I.420 (RJ-45 Jack) Basic Rate Interface S/T (2B+D) up to 384 kbps** **1 x Ethernet (RJ-45 Jack) LAN interface (10/100 Mb) up to 768 kbps** **1 x Wireless LAN interface (PC card slot)**

When the TANDBERG 550 is connected to both an H.323 and H.320 network, the system will automatically respond to incoming calls on either network. One may also dial out on any of the connected networks by inserting the E.164 alias or IP address (H.323) or ISDN number (H.320).

The supported networks are:

- 1 x Ethernet (RJ-45 jack) Local Area Network interface (10/100 Mb) for transmission speeds up to 768 kbps.
- 1 x Wireless Local Area Network interface (PC card slot).
- 3 x BRI ISDN I.420 (RJ-45 jack) Basic rate interface S/T (2B+D) for up to 384 kbps

4.1.1 BRI ISDN Interface

TANDBERG 550 is supplied with the following BRI ISDN Protocols[5]:

- Euro-ISDN (ETSI)
- National ISDN
- AT&T custom
- Fetex ISDN
- Japan/Taiwan ISDN
- Australia ISDN
- 1-TR6
- Italy ISDN

Pin out of S/T Interface:[6]

3	TX +
4	RX +
5	RX -
6	TX -

4.1.1.1 ISDN Subaddress & MSN

Subaddress:

It is possible to set a subaddress on the TANDBERG system when more than one system share ISDN lines (must be ordered from ISDN provider). From a TANDBERG system dialling with subaddress it is achieved by adding a star plus the subaddress at the end of the ISDN number.

E.g. if the ISDN number is 67117777 and the subaddress is 123, the number to dial into this system will be: 67117777*123

Incoming calls without subaddress will be handled by all units on that ISDN line (i.e. all systems would ring). For incoming calls with subaddress, only the unit with matching subaddress will accept the call.

MSN:

Multiple Subscriber Number is also implemented in the TANDBERG system. If MSN is set to ON, the system will only accept incoming calls to the ISDN numbers programmed in the ISDN settings menu.

[5] Available networks correct at time of printing- additional networks may become available.

[6] The cable of use should be a straight through configuration.

4.1.2 Ethernet / LAN Interface (H.323)[7]

Both the RJ-45 jack for the Ethernet interface (manual or automatic detection of 10/100Mb) the wireless PC Card interface (11 Mbps) supports bit rates from 64 kbps up to 768 kbps. The ITU-T standard H.323 v4 protocol is implemented in the TANDBERG 550.

The following features are specifically relevant for this network interface[8]:

4.1.2.1 Default IP Password

New systems or systems that have loaded factory defaults will have a default password "TANDBERG" all caps and the *strict password* enabled.

Strict password: IP password that is at least 8 characters long and contains both letter and Numbers (alphanumeric). When off all IP password are accepted including blank ones.

Command is: "strictpassword <on/off>" Default is on. The strict password needs to be disabled, via Data Port or Telnet to set a blank or simple password.

4.1.2.2 Quality of Service features (QoS)

4.1.2.2.1 IP precedence

IP precedence is a classification of packets from 0 (low priority) to 7 (high priority). The values 6 and 7 are typically reserved for congestion control. IP precedence helps a router select what kind of traffic to prioritise. By means of queue mechanisms, it can select which packets to send first and which to throw away. Some information/traffic is time critical while other is not, and classification is used to differentiate this traffic.

One may set separate IP precedence for Signaling, Audio, Video and Data (values 1 – 7) as well as turn IP precedence off.

The *auto* setting uses the following values for IP precedence:

Signalling=6

Audio/Video=4

Data=3 (e.g. FECC commands)

This means that in *auto*, IP precedence has the value 6 (i.e. signaling value) while both audio and video value is 4; data value is 3. Setting the IP precedence value in system's menu is actually setting the signaling value. The audio/video and data values are changed accordingly in respect to the signaling value (i.e. audio/video value = - 2; data value = - 3).

4.1.2.2.2 Diffserv

Diffserv is an extension of IP precedence, where one can set values from 0 to 63 (63=Highest priority).

4.1.2.2.3 IP type of service (TOS)

TOS helps a router select a routing path when multiple paths are available.

[7] For further info on H.323, please refer to documents 'TANDBERG and IP' (D12434) and 'What is H.323?' (D11964)

[8] NOTE: E3 software does not support T.120 when running H.323 calls

Delay- tells router to minimize delay

Throughput- tells router to maximize throughput

Reliability- tells router to maximize reliability

Cost- tells router to minimize cost

Off- Turns TOS off

4.1.2.2.4 Resource-Reservation Protocol (RSVP)

RSVP is a protocol that allows the TANDBERG system to request the network to reserve the bandwidth needed for the IP call.

4.1.2.3 Automatic selection of H.323 or H.320 outgoing calls

- IP address or E.164 number dialling.
- Automatic selection based on network address type or predefined prefixes.

4.1.2.4 IP adaptive bandwidth management

- The codec never produces more traffic than needed, for better utilization of network resources. Most of the data sent in a videoconference is video data. Thus, by incorporating smart video algorithms, the codec sends no more video data than necessary. Little movement in the picture gives low bit rate; while a lot of movement gives higher bit rate.
- The codec regulates outgoing and incoming media bit rates by means of flow control signalling.

4.1.2.5 Gatekeeper authentication

When set to auto, this feature automatically locates a gatekeeper on the same subnet and registers the system using the E.164 alias.

If the gatekeeper supports alternate gatekeepers, the TANDBERG system will receive a primary and secondary gatekeeper address. If the primary gatekeeper fails, the system will register to the secondary gatekeeper that was declared by the primary gatekeeper.[9]

Re-registration at the gatekeeper will occur regularly and automatically.

4.1.2.6 Registration to Call Manager

The TANDBERG systems support registration to a CallManager. It is only possible to register the TANDBERG system to a CallManager when the gatekeeper registration is disabled, and the CallManager is configured with a H.323 client that matches the IP address and the E.164/phone number of the TANDBERG system.
When the “Use Gatekeeper” is set to off, enable “Use CallManager” by setting it to On, and set the IP address of the CallManager in the ”CallManager IP” field. The endpoint will now register to the CallManger

The registration of a H.323 client in CallManager is supported on the CallManager (CCM) 4.0 software and forward.

[9] alternate gatekeeper supported in the Cisco MCM Sw 12.2 gatekeeper

Note: CallManager does not support features like Duo Video, H.264 and encryption. A TANDBERG endpoint registered to CallManager will loose these capabilities.
There is no confirmation on the TANDBERG system that it is registered to a CallManager.

4.1.2.7 Configuring an H.323 client on the CallManager 4.0

To configure the CallManager with an H.323 client, log on to the administration web interface and go to the phone configuration page. The Phone configuration page is located on: device (top menu) -> Add a New device -> Phone -> H.323 Client.
In the phone configuration page type the IP address of the TANDBERG system in the Device name field, select device pool and push the insert button. A pop-up box will now appear on the screen and ask you if you would like to configure the directory number. Push the ok button. You should now see the Directory Number Configuration WEB page. Enter the E.164/phone number of your TANDBERG system in the Directory number field, and in the "Forward and Pickup Settings" enter the time of "No Answer Ring Duration". The time selected has to have a value from 1 to 300 seconds. Push the Add button to update the CallManager with the directory number settings.
You have now configured the CallManager with a H.323 client and should be able to register the TANDBERG system to it.

When the TANDBERG system is registered to a CallManager, it will be possible to place and receive calls from this system to any other video and voice systems that are registered on the same CallManager.

4.1.2.8 H.323 ID

H.323 ID is a feature allowing text names instead of E.164 numbers to be dialled. The TANDBERG system will use the System Name as its H.323 ID. Even though one cannot dial out with an H.323 ID via the remote control one can use the web interface or the dataport. Other systems can also dial in using the H.323 ID.

4.1.2.9 Dynamic playout buffering

Shapes the incoming data for better playout and re-sequencing of packets delivered out of order. This ensures better lip sync.

4.1.2.10 Asymmetrical media capabilities

Audio and video protocols can be fully asymmetrical.
E.g., the TANDBERG system can send H.263 and receive H.261 at the same time.

4.1.2.11 Diagnostic tools for IP

Q.931 — To show Q.931 trace during a call you need to issue the command *syslog on*. One can get traces for RAS, Q.931 and H.245 with this command. It is a complex trace and requires an extensive knowledge in H.323 signalling to be understood.

Ping — Ping is used to see if the codec is able to reach a specific IP-address, using a mechanism in IP called ICMP. If a codec is unable to register to its gatekeeper, or if it is unable to dial a specific endpoint, one can use ping to see if there is at least an IP-route to the gatekeeper or to the endpoint. In case you have problems, one would first ping the default gateway, then the gatekeeper, and then the other endpoint.

Traceroute — Traceroute does exactly that; it traces the route an IP-packet takes to reach its destination and displays all router hops. Traceroute is very useful for seeing exactly where there is a routing-problem in the IP-network, and for checking where transport-delay is introduced.

4.1.2.12 NAT support

Network Address Translation is implemented to support small/home office applications requiring a single endpoint behind a NAT router. NAT also supports the use of a gatekeeper outside the NAT router.

4.1.2.13 Latency & Jitter

Latency is defined as the time between a node sending a message and receipt of the message by another node. The TANDBERG systems can handle any value of latency-however, the higher the latency, the longer the delay in video and audio. This may lead to conferences with undesirable delays causing participants to interrupt and speak over each other.

Jitter is defined as the difference in latency. Where constant latency simply produces delays in audio and video, jitter can have a more adverse effect (e.g. the video may be 'blocky'). Jitter causes packets to arrive out of order or at the wrong times, which again leads to packet loss. TANDBERG can manage packets with jitter up to 100ms. If excessive packet loss is detected, the TANDBERG systems will downspeed the connection until acceptable packet loss is achieved.

4.1.2.14 Layer 4 Ports used in H.323 calls

The layer 4 ports used by the system in a H.323 call can be defined as follows:

- Dynamic: The ports are allocated at random from 2048 to 65535.
- Static: Will use the predefined layer 4 ports listed in the tables below.

Point-to-point

Function	**Port**	**Type**
Gatekeeper Discovery (RAS)	1719	UDP
Q.931 Call Setup	1720	TCP
H.245	Range 5555—5556	TCP
Video	Range 2326—2333	UDP
Audio	Range 2326—2333	UDP
Data/FECC	Range 2326—2333	UDP

4.1.2.15 IP packet sizes

Audio

The system automatically selects the most favourable IP packet size for audio. Depending on the network conditions, the system will send 20 ms or 40 ms of audio in each packet, thus:

- G.711 – 160/320 bytes per packet
- G.728 – 40/80 bytes per packet
- G.722 – 160/320 bytes per packet

Video

The system is sending maximum 1450 bytes of video per packet.

Note:

In addition, the system needs to add the following header information for each of the audio and video packets above:

20 bytes IP-header, 8 bytes UDP-header and 12 bytes RTP-header (i.e. 40 bytes in total).

Packet loss: *Packet loss* is displayed in percentage (%) in the Call Status menu of the system. The number shown is the average of audio- and video- packets that are lost during the last 2 seconds.

4.1.2.16 Intelligent Packet Loss Recovery (IPLR)

IPLR is an ITU standard based packet loss compensation for H.323 that improves received and transmitted video to/from the TANDBERG system. IPLR supports all video protocols and resolutions that TANDBERG systems already have implemented and is compatible with all terminals, Gateways and MCUs.

IPLR is a special algorithm developed at TANDBERG that will make efforts to reconstruct the lost packets and reduce the visual effects caused by packet losses.

In addition, IPLR will make transmitted data more resilient to lossy networks. IPLR transmission functionality can be disabled and re-enabled by a dataport command.[10] It is enabled by default.

IPLR will automatically start when packet loss is detected on the H.323 network. (See also chapter on 'IP downspeeding').

4.1.2.17 IP Conflict Warning

The TANDBERG system automatically checks whether its IP address has been assigned to another system on the same IP network.

In case of double address assignment, the TANDBERG system will display an IP address conflict warning to the user.

Once a detected IP address conflict has been resolved, the TANDBERG system can be operated without reboot.

4.1.3 Streaming[11]

The TANDBERG 550 supports streaming of H.261 video and G.711 (μ-law) audio when the system is not in a call.

The streaming video may be displayed on the codec's web page. The streamed video/audio can also be viewed on most free viewers, but TANDBERG recommends that Apple Quick Time is used.

- Streaming video rates available are: 16, 32, 64, 128, 192, 256 or 320 kbps.
- Streaming audio rate is fixed to 64 kbps.

[10] refer also to 'TANDBERG API – (Dataport User Guide)' (D11943)

[11] For further info on Streaming, please refer to the User Manual and the documents 'TANDBERG on Streaming' (D12408 and D11934)

The streaming format RTP (over UDP) is supported on the TANDBERG system.

For security purposes, streaming is *disabled* by default and may only be enabled from the main menu or the data port. However, *start/stop* and *configurations* can be set via web or telnet.

A ***Streaming password*** may be set in order to prevent unwanted users streaming from the system.

Streaming Chat:
When streaming is viewed from the systems web page, it is possible to send messages to the system. The messages are displayed on the system's monitor.

4.1.3.1 Automatic announcement of Streaming

The TANDBERG 550 can be used in a Cisco IP/TV environment. The system periodically transmits a Session Announcement Protocol (SAP) message to inform clients where the streaming can be found.

4.1.4 Wireless LAN interface

The TANDBERG 550 can run on wireless LAN compatible with the IEEE 802.11b standard. In order for the TANDBERG 550 to operate in a wireless LAN environment, one requires a Wireless PC Card that can be fitted into the PC-Card slot on top of the unit.

a) Wireless PC Cards recommended[12]:

- Compaq WL110 11 Mbps Wireless LAN
- Lucent Orinoco PC24E-H- (ET/FC/FR/JP) Silver/Gold 11 Mbps
- Cisco Aironet 350 Wireless LAN adapter (AIR-PCM 352)
- Enterasys Networks RoamAbout 802.11 DS High Rate (P/N: CSIBD-AA-128)
- Melco Buffalo WLI-PCM-L11 (G/GP)

These can be purchased from a PC equipment provider. The card interacts with wireless LAN access points that may essentially be mounted anywhere as long as the desired coverage is obtained.

b) An access point (or base station) is also required to be able to use the TANDBERG 550 on a wireless LAN. Access points are available from various manufacturers, but TANDBERG recommends the Cisco Aironet 350 Series Access Point (AIR-AP350 Series) or the Compaq WL410.

All H.323 features described in ch. 4.1.2 are also applicable when running the TANDBERG 550 on a wireless network.

It is only possible to use either the wireless LAN interface or the fixed LAN interface at one time (not both interfaces at the same time).

[12] The PC Card used must comply with the relevant regulations for such cards in the country of use.

Please, see the User Manual for details on how to set up this interface.

4.1.4.1 LEDs on the wireless LAN card

There are two LEDs on top of the wireless LAN cards indicating the card status:

Left LED	**Right LED**	**Status**
ON	Blinking	Left LED indicates normal operation while right LED indicates traffic on network.
Blinking	Blinking	Most possibly a SSID fault
ON	-	SSID is probably correct, but the key(s) are wrong or the access point has blocked this particular card.

4.1.5 Intelligent Call Management (ICM)

By using TANDBERG's Intelligent Call Management (ICM), calls can be made from data rates of 56 kbps up to 384 kbps via ISDN networks.

ICM is a highly sophisticated feature provided by the TANDBERG 550 that makes the connection between two sites more reliable and safe. If the ISDN network drops channels during a call, the conference will not shut down but adjust to the remaining number of available channels[13]. This ability is called 'Downspeeding' and is in accordance to the BONDING Mode 1 standard.

ISDN Downspeeding will be started when one of the following actions occurs:

1. Fallback to 2xH221 call when no BONDING framing is found
2. Non-matching number of channels (N) during BONDING setup (e.g. N=4 on site A, N=6 on site B)
3. Downspeeding during call setup caused by a channel that won't connect
4. Disconnect and downspeed if a channel won't sync
5. Downspeeding when detecting B-channels that are looped
6. Downspeeding if a channel drops during the call

The TANDBERG system will also start the BONDING synchronization procedure if there is a long fatal failure situation:

7. Extended loss of H221 framing
8. Continuous BCH framing error in the video stream. If then a channel fails to sync, it will be disconnected (as mentioned in 4.)

'Downspeeding' on IP:

The TANDBERG system has a similar way of 'downspeeding' on IP, described as follows:

a) If system gets more than 10% packet loss during the last 2 seconds, it will go down 64 kbps. (Ex. Call set up on 768 kbps and the above packet loss occurs, the new call rate will be 768 kbps – 64 kbps = 704 kbps).
b) If after the next 2 seconds, there is still more than 10% packet loss, system will 'downspeed' 64 kbps again.
c) The above will happen until call rate of 192 kbps is reached.
d) If still same packet loss at 192 kbps the system will 'upspeed' back to original call rate (since when in this situation, one may assume that the packet loss is due to other reasons and not the H.323 call itself).

Different from the ISDN downspeeding, the system will not change Audio and Video algorithms during the 'downspeeding' of an IP call. (See also chapter on IPLR).

4.1.6 Network Profiles

The TANDBERG 550 has 3 fixed and 3 programmable Name, Prefix and Protocol settings that may be used when dialling.
The system will automatically make an H.320 call if the dialled number is an ISDN number or an H.323 call if an IP address is dialled. H.323 will also be selected if number prefix is matching the H.323 prefix and the system is registered to a gatekeeper.

[13] Depending on the capability of the remote system to support downspeeding.

4.1.7 Encryption

The TANDBERG system has built-in encryption of audio, video and data for both H.323 (based on ITU standard H.235) and H.320 (based on ITU standard H.233 and H.234) calls. This feature supports point-to-point calls up to *total* 768 kbps (including the features FECC and T.120[14]).

The encryption algorithms used in the TANDBERG system are:
- The Data Encryption Standard (DES) with a 56 bit session key
- The Advanced Encryption Standard (AES) with a 128 bit session key

Although there are small differences between H.323 and H.320, a typical set-up of a secure call can be defined as follows:
1. Establishment of a common shared secret and selection of an encryption algorithm.
2. Exchange of the keys according to the common shared secret and the selected encryption algorithm.
3. Start the encryption.

The establishment of the common shared secret is done through the computation of the Diffie-Hellman (DH) algorithm. The DH method uses prime numbers of 512 bits length for DES and 1024 bits for AES. The shared secret is then used as a key for the selected encryption algorithm, which encrypts "the session keys". When the session keys are collected by the remote end, encryption of the audio, video and data channels can start.

[14] T.120 not supported on H.323 point to point calls nor in MultiSite calls

4.2 Aggregation Standards

ISDN Aggregation	**H.221**	**Frame Structure from 64(56*) kbps to 128 kbps**
	ISO 13871	**BONDING, Mode 1 from 64(56*) kbps to 384 kbps**

4.2.1 BONDING

- ISO 13871, BONDING Mode 1 for bit rates from 56 kbps up to 384 kbps (1 to 6 channels).
- The TANDBERG system can handle relative delay difference between B-channels of up to 0.5 second (i.e. to compensate for different routing of channels).
  Example: Channel 1 is delayed 250 ms, channel 2 is delayed 500 ms and channel 3 is delayed 330 ms. The *relative delay difference* is then (*max. – min.)*, thus in this case it would be 500 ms – 250 ms = 250 ms (0.250 sec).

  If delay difference is more than 0.5 seconds in a call, the TANDBERG system will display 'Corrupted data received' and try to resynchronize the call.

  Note: *Delay difference* will vary depending on the different service providers involved in the call.

The following are the standard bandwidths on H.320:
6ch – 5 – 4 – 3 – 2 – 1

4.2.2 H.221

- For bit rates from 56 kbps up to 128 kbps (1 or 2 channels).
- The maximum relative delay difference between the 2 B-channels is 0.6 second.
- The system will only select H.221 if the far end does not support BONDING or when two ISDN numbers are dialled.

4.2.3 Encoding delay

H.320: The latency in a point-to-point call using TANDBERG systems on H.320 (ISDN) varies between 160-250ms depending on the network performance.

H.323: The latency in a point-to-point call using TANDBERG systems on H.323 (IP) varies between 120-160ms. (An additional 100ms have to be added for playout buffering).

NOTE, the total delay of a call will be as follows:
Encoding delay + Max. network delay + Decoding delay

Network delay (and Delay difference) will vary depending on the different service providers involved in the call.

Decoding delay is typically 1/3 of the encoding delay.

4.3 Data Interface/Application Programmable Interface (API)

Data Standards	**T.120**	**Data Communication Protocol**
	Data	**TANDBERG Dynamic Data Channel (DDC)**
	Modem	**Standard modem commands**
Data Interfaces	**1 x Data port, RS-232 (9-pin D-sub), Up to 38400 Baud for Data & Control**	

The dataport on TANDBERG 550 is implemented as Digital Circuit Terminating Equipment (DCE).

The connector used is a female 9-pin D-sub and the pin out is shown below.

Signal Name	Direction	Pin number
Carrier detect, CD	From DCE	1
Receive data, RXD	From DCE	2
Transmit data, TXD	To DCE	3
Data terminal ready, DTR	From DCE	4
Signal ground, GND		5
Data set ready, DSR	From DCE	6
Ready to send, RTS	To DCE	7
Clear to send, CTS	From DCE	8
Ring indicator, RI	From DCE	9

4.3.1 Data Protocols

Please refer to 'TANDBERG API – (Dataport User Guide)' (D11943) for details.
There are several different modes for the data port as described below.

- **Data, Dynamic Data Channel mode**
  When communicating between two TANDBERG products, this protocol enables the use of a multitude of applications such as:
  - File transfer
  - Diagnostics
  - Application sharing
  - Remote control

  The Codec operates as a modem according to Hayes' commands.

- **Control mode**
  In this mode, the Codec can be controlled by an external user interface.

- **Modem mode**
  When in a call - DDC mode is activated.
  When not in a call - Control mode activated.

- **T.120 mode**
  The T.120 data protocol enables systems from different manufacturers to do data conferencing- implemented by TANDBERG in the form of the T.120 data communication protocol (MLP).
  - Enables the provision of data conferencing capabilities within an MCU call[15].
  - Covers many different aspects of data conferencing such as application sharing and white boarding.

[15] Depending on the MCU's capability to support T.120

- Makes use of MLP and hence requires a suitable application matching your data communications requirements. TANDBERG recommends Microsoft NetMeeting version 2.0/2.1 or Intel's IBVC (Intel Proshare) for data conferencing.
- Maximum bandwidth for data in this mode is 32 kbps.

4.4 Video Interfaces and Video Features

Video Inputs	**1 x Composite, RCA Connector**
	Ethernet connector (used by PC Soft Presenter)
Video Outputs	**1 x S-Video, Mini-DIN Connector**
	1 x Composite, RCA connector
	1 x XGA, 15 pins
Video Formats	**PAL or NTSC**
	VGA, SVGA and XGA (Native Resolutions)

The TANDBERG 550 Codec has the following video connectors:

4.4.1 Video Inputs

- One Video input supporting composite signals through an RCA connector.
- Composite level:

  1 V_{pp}, 75 ohm

4.4.2 PC Soft Presenter (Optional)

The system has implemented a feature that allows PC images to be shown to the codec. A software from 'Virtual Network Computing' (VNC) needs to be installed on the PC to make use of this feature (free download from http://www.realvnc.com).

When correctly set up[16], the PC image will be used as video input by the system whenever the PC button is pressed on the remote control[17].

Note: The VNC Server's *Display Number* and *Password* need to be set on the codec[18].

Please, see the User Manual for guidelines of setting up the PC Soft Presenter.

Note: PC Soft Presenter supports the resolutions VGA, SVGA and XGA. In addition, the VNC server will scale any SXGA input down to XGA.

4.4.3 Video Outputs

Both Video Output 1 and 2 provides main video (incoming/Self view (and PIP), Still Image and menu).

- Video Output 1 supporting S-Video through a Mini-DIN connector.
- Video Output 2 supporting composite signals through an RCA connector.
- Levels:

  - S-Video (Y/C); Y: 1 V_{pp}, 75 ohm load
    C (PAL): 0.3 V_{pp}, 75 ohm load
    C (NTSC): 0.28 V_{pp}, 75 ohm load

  - Composite; 1 V_{pp}, 75 ohm load

[16] If problems getting VNC to work, one may have to update the driver(s) for the PC graphical card and/or the PC network card

[17] The VNC program must be installed as a Server on the PC in use (the codec being the client) and supports Windows, Unix and Macintosh.

[18] Password is encrypted

4.4.4 XGA Output[19]

TANDBERG 550 is provided with an XGA output port that scales the images- when required- to fit an XGA monitor.

The following VGA, SVGA and XGA outputs are supported and may be received as Native Resolutions from a remote system:

VGA	*SVGA*	*XGA*
640X480_60Hz	800X600_60Hz	1024X768_60Hz

Note: By pressing the following buttons on the remote control it is possible to toggle between the settings **VGA out *off*** and **VGA out main**:

Snapshot – Far End – Snapshot – 1

4.4.5 Optimized Video Compression

The ITU standard H.263 provides:

- Optimized compression and decompression of video at lower bandwidths.
- A sharper picture than provided by H.261.
- Improved contrast and enhanced clarity of the finer details within an image.
- Improved motion handling that removes the characteristic blocking that tends to occur during normal H.261 movement.
- 4xCIF/4xSIF live video

The ITU standard H.264 provides considerably better video quality at lower bandwidths. It has been developed with strong TANDBERG participation in joint workgroups of ITU-T and ISO. H.264 is based on the ISO standard MPEG-4.

The TANDBERG 550 system supports H.264 video compression in both CIF and SIF resolutions. An encoding and decoding rate of 15fps is achieved. H.264 may be used on the TANDBERG 550 system for bandwidths of up to 384 kbps.

Under the preconditions named above and depending on the far end's H.264 support, the TANDBERG system will select H.264 as video compression standard if H.264 has been activated in the menu.

In case H.264 is unavailable at the far end or if the above preconditions are not fulfilled, the TANDBERG system will preferably select H.263.

The TANDBERG system will select H.261 in case video is set to "Normal" in the call quality menu before the call is made.

[19] NOTE: When VGA out is set to ON, the system sends out video signal on both the VGA- and the analogue- output. However, it is intended to be used as either an *VGA video* system or an *analogue video* system (not both at the same time).

4.4.6 Digital Clarity (Optional[20])

TANDBERG 550 has the ability to transmit and receive live images using the Native Resolutions VGA, SVGA, XGA or 4xCIF/4xSIF. This feature is called Digital Clarity. When the PC is selected, Digital Clarity is automatically selected by the system- the live picture quality will then be crystal clear and the frame rate lower compared to using CIF/SIF[21].

The Selfview picture will always be shown in PAL/NTSC video quality.

4.4.7 Native Resolutions

The following live video resolutions are supported on the system:

Native NTSC[22]:

4xSIF	(704 x 480 pixels), *Digital Clarity*
SIF	(352 x 240 pixels)

Native PAL:

4xCIF	(704 x 576 pixels), *Digital Clarity*
CIF	(352 x 288 pixels)
QCIF	(176 x 144 pixels)
SQCIF	(128 x 96 pixels)

Native PC Resolutions:

XGA	(1024 x 768 pixels), *Digital Clarity*
SVGA	(800 x 600 pixels), *Digital Clarity*
VGA	(640 x 480 pixels), *Digital Clarity*

4.4.8 One-touch Snapshot

The TANDBERG 550's intelligent One-touch Snapshot button makes it easy to send and receive an image of the highest possible resolution.

- If the far end supports H.263+ custom formats, snapshot can be sent in VGA, SVGA, XGA or 4xSIF.
- If the far end does not support H.263+ custom formats, snapshot will be sent in 4xCIF.

Snapshot is implemented according to the ITU standard H.261 Annex D.

By using the Selfview button one may toggle between the last sent/received snapshot and the self-view picture.

[20] Receive Digital Clarity is implemented on all TANDBERG systems (Transmit Digital Clarity is part of the PP software packet)

[21] Only possible if the remote site can transmit/receive video in 4xCIF/4xSIF, VGA, SVGA, XGA.

[22] Source Input Format SIF (4xSIF) is an NTSC based video format (Defined in MPEG-1 standard).

4.4.9 Screen Saver

If the system is not in a call, a text string will be shown on the monitor screen after 9 minutes. The user is prompted to select *screen saver delay* of 30 minutes, 60 minutes or 3 hours. If the user does not respond within 1 minute, the screen saver is activated and both monitors will go black (i.e. the codec sends out a black image).

Once the remote control is touched (or any other activation of the system; such as an incoming call), the screen saver will be switched off.

If the system is used for local presentation (i.e. not in a call) it is possible to delay the screensaver prompt via the Quick Keys on the remote control (for 1 or 3 hours).

4.5 Audio Interfaces and Audio Features

Audio Inputs	**1 x Microphone, 11V Phantom Powered, XLR Connector**
	1 x Audio, RCA Connector (Line Level)
Audio Outputs	**1 x Audio, RCA Connector (Line Level)**

The TANDBERG 550 Codec has the following audio connectors:

4.5.1 Audio Inputs

The TANDBERG 550 Codec has two audio inputs- one Microphone Input and one Line Level Input.

General:

- The input gains on both inputs are fixed.
- Both audio input signals are mixed together.
- The default settings are correct for Audio Technica AT871-R microphone (Mic input) and for most consumer electronics, e.g. CD-players, cassette recorders, VCRs- (Line level input).

4.5.1.1 Specification Microphone Input

This input is intended for electret type microphones. The input is balanced. This input is to be used for Audio Technica AT871-R microphone only.

Connector label	**MIC input**
Signal type	Balanced
Connector (Codec)	XLR-F, pin 1-gnd, pin 2-hot, pin 3-cold/neutral
Phantom power voltage	11 V +/- 5%
Phantom power resistor, pin 2	1200 ohms
Phantom power resistor, pin 3	1200 ohms
Input impedance between pin 2 and 3	2400 ohms
Max. Input level	59 mVpp

4.5.1.2 Specification Audio Line level Input

This input is intended for connection to external playback devices (VCR, CD-player etc.).

Using the Line Level input with a microphone requires an external microphone amplifier/mixer.

Connector label	**AUDIO Line Level input**
Signal type	Unbalanced
Connector (Codec)	Female RCA/Phono, sleeve-ground, centre-signal
Input impedance	10K ohms
Max. Input level	5.6 Vpp

Features of the line level input:

Line Level input features	***Mode***
Acoustic Echo Canceller / Noise Reduction	OFF
VCR ducking	ON
Automix of Audio inputs	Fixed
Input AGC	ON
Local playback of Line Level input	ON
Line input when Microphone is set to OFF	ON

4.5.1.3 Specification standard microphone (AT871R)

Mic. Audio-technica AT871R	**Specification**
Type	Fixed-charge back plate permanently polarized condenser
Connector (Codec)	XLR, pin 1-gnd, pin 2-hot, pin 3-cold/neutral
Polar pattern	Half-cardioid (cardioid in hemisphere above mounting surface)
Phantom power	9 - 52 V DC, 2 mA typical
Sensitivity	-32 dBm (0dB=1 mW/1Pa)
Impedance	200 ohm
Maximum Input sound level	130 dB, 1 kHz at 1% T.H.D.
Signal to Noise ratio	Greater than 67 dB at 1 kHz/1 Pa
Weight	415 gram
Dimensions, microphone	Width 120 mm/4.72” Length 145 mm/5.71” Height 17 mm/0.67”

4.5.2 Audio Output

TANDBERG 550 has one Audio Output, normally used for connection to the amplifier/speakers of the monitor[23].

4.5.2.1 Specification Audio line Output

- Intended for connection to televisions or audio amplifiers with loudspeakers. Alert tones and DTMF tones will also be present on this output.

The remote volume control will control the level of the Audio Output (i.e. local speaker).

Connector label	**Audio Output**
Signal type	Unbalanced
Connector (Codec)	Female RCA/Phono, sleeve-ground, centre-signal
Output impedance	680 ohms
Max. Output level	5.6 Vpp
Volume control attenuation	0 to 21 dB + mute (steps of 1.5 dB)

4.5.3 Flexible Audio Features

- The TANDBERG 550 has **lip synchronization** for audio.

[23] The Codec has an internal alerting speaker where only alerting signals are present.

4.5.4 Acoustic Echo Canceller

Acoustic echo cancelling is provided on the Microphone Input.

- Max acoustic echo cancellation 70 dB.
- Echo cancelling tail length lowest frequency sub band 340 ms.
- Echo cancelling tail length highest frequency sub band 250 ms.

4.5.4.1 Adjusting the Acoustic Echo Canceller

The TANDBERG 550 has the ability to manually adjust the echo canceller in two ways to obtain the best performance for rooms with special acoustic environments; room size and movement, each controlled by a 0-15 slidebar placed under the echo control menu.

When adjusting these settings, please remember that in a video conference between system A and system B, any echo problem on system A will be experienced by the users of system B and vice versa.

Room size:
For optimum performance, this setting should be adjusted when the system is installed in a new room.

This setting allows optimization of the echo canceller to the acoustic size of the room where the system is placed. The setting should reflect the acoustic size of the room; two physically equal sized rooms may require different settings, depending on the materials in walls, floor etc. If the materials are hard (windows/metal etc.), the appropriate setting is higher; if the materials are soft (carpets/curtains etc.), the appropriate setting is lower.

Correct setting of the room size parameter will lead to significantly increased echo canceller performance. Adjust the setting if one of two symptoms occurs:

1) There is still some residual echo after a long period of training (audio from the loudspeaker, but no talking in the room where the system reside); Increase the room size setting.
2) The system adapts slowly to acoustic changes in the room (door opens, persons moving etc.); Decrease the room size setting.

Please note that the system will have to readapt each time the room size setting is changed.

Movement:
If the system suffers from echo caused by heavy movements in the room, for example people moving close to the loudspeaker and/or microphone; increasing this setting (i.e. number next to slidebar) may reduce the problem.

By increasing this setting, limited voice switching is introduced in addition to the echo cancellation; the higher the setting, the more voice switching is introduced. Therefore, a too high setting may result in clipped words etc. during double talk situations.

This setting is without memory (i.e. the system does not have to readapt when the movement setting is changed).

4.5.5 Noise Reduction (NR)

Two sorts of noise can be removed when using the TANDBERG 550, namely low frequency noise and constant noise. The noise reduction algorithms are both enabled on the TANDBERG 550.

The constant noise reduction algorithm available on the TANDBERG 550 is able to reduce noise with a slowly varying level and frequency response, i.e. the reduction is based on an assumption that the noise is constant over time. Therefore, it will reduce noise from fans, air-conditioning and PCs, but it will not remove conversation and noise caused by slamming doors, coughing etc.

4.5.6 Audio levelling/ Automatic Gain Control (AGC)

The TANDBERG 550's built-in automatic audio levelling feature (AGC) will ensure that the transmitted audio will always be at the same level.

- The audio leveller tries to keep the signal from the corresponding input at a constant, fixed level, by attenuating very strong signals and amplifying weak to medium signals. Very weak signals, i.e. normal background noise alone, will not be amplified.
- The main purpose of the leveller is to automatically adjust the signals to ensure that each sub signal in a mix of different sub signals has comparable levels.
- The leveller will also compensate for different speaker levels and different distances from the person speaking to the microphone.

4.5.7 VCR Audio Features

The TANDBERG 550 can be used for playback of a VCR; when connected to Video In and Audio Line Level input.

- When a VCR is connected to the Audio Line level input and is playing, the audio from the VCR is transmitted to the other side. The audio will also be heard in the local loudspeaker.
- Some VCRs (and some other recording equipment) connect the signal on their input directly to the output when in idle or record mode. This feedback loop will cause echo, both locally and on the remote side. The Codec has a facility that automatically detects and removes this feedback loop. This feature is provided on the Audio Line level input only.
- **VCR Ducking** automatically reduces the audio level during a VCR transmission when one or several persons speak (from either site). I.e. when audio is detected by Microphone input or the incoming audio, VCR Ducking will decrease the audio from Audio Input 2 (VCR). VCR Ducking will automatically adjust the level of the VCR input back to normal if no other audio (than that of the VCR) is detected. This allows for easy voice-over commentary during a VCR broadcast.

4.5.8 Telephony

The system supports point-to-point voice only calls both on the ISDN and IP interfaces, by using the audio compression algorithms described in ch. 4.5.10.

4.5.9 Microphone Off

Pressing the Mic off key on the remote control will mute audio from the Microphone Input. It will not mute the audio from the Line Level Input. When the microphone is turned off any and any of the microphones detects audio, the *mic off* symbol will flash to warn the user.

4.5.10 Audio compression algorithms

The following audio algorithms are supported on the TANDBERG 550:

- G.711 48/56/64 kbps, 3.1 kHz bandwidth.
- G.728 16 kbps, 3.1 kHz bandwidth.
- G.722 48/56/64 kbps, 7 kHz bandwidth.
- G.722.1 24 kbps or 32 kbps, 7 kHz bandwidth[24].

When system set to Auto, the following are the preferred *audio quality priorities* on call rates above 192 kbps:

1. G.722 (64 H.323)
2. G.722 (56 H.320)
3. G.722 (48 H.320)
4. G.722.1 (32 H.320, H.323)
5. G.722.1 (24 H.320, H.323)
6. G.728
7. G.711 (64,56,48)*

When system set to Auto, the following are the preferred *audio quality priorities* on call rates below or equal to 192 kbps:

1. G.722.1 (24 H.320, H.323)
2. G.722.1 (32 H.320, H.323)
3. G.728
4. G.722 (56 H.320)
5. G.722 (64 H.323)
6. G.722 (48 H.320)
7. G.711 (64,56,48)*

(*) H.323 and H.320 will always choose μ-Law before a-Law (for G.711). Telephony will choose algorithm according to the network used.

[24] 24 kbps is used on call rates ≤192 kpbs, 32 kbps >192 kbps.

4.6 System Management

TANDBERG provides a comprehensive set of management tools, and is committed to the use of standards-based tools.

The TANDBERG 550 can be managed in many ways:

- Locally by remote control
- Locally by a computer connected directly to the videoconferencing system (e.g. via RS232, a standard asynchronous serial port or via the codec's Ethernet port using a crossover cable)
- Remotely, by a computer connected to the videoconferencing system via LAN/WAN/Internet
- Remotely, via an external router/modem one can dial into the modem which needs to be connected to the codec's Ethernet port
- TANDBERG Management Suite (Optional, purchased separately)

4.6.1 LAN Interface Set-up

The LAN interface supported on the TANDBERG 550 is 10base-T and 100base-T compatible.

The system supports the following settings of this interface:

- Auto The codec will auto-detect the speed/duplex on the LAN
- 10/Half The codec will connect to the LAN using 10Mbps speed/Half Duplex
- 10/Full 10 Mbps speed/Full Duplex
- 100/Half 100 Mbps speed/Half Duplex
- 100/Full 100 Mbps speed/Full Duplex

In auto negotiate mode, the codec will try to dynamically change to different ethernet speed settings. However, when a forced setting has been made, it will be done during start-up, so a reboot is necessary on the Codec.

If problems with codec set to *Auto* (usually due to switch/hub incompatibilities), please check the following:

a) If switch/hub uses *Auto negotiation*
   Set codec to 100 or 10 half duplex (do not use full duplex)
b) If switch/hub uses *Fixed setting*
   Set codec to the same setting as the switch/hub, ensuring that both speed- and duplex-settings match

'DHCP' (Dynamic Host Configuration Protocol) can be selected when a DHCP server is present. When using DHCP, IP-address and IP-subnet mask are not used since the DHCP server assigns these parameters. When using DHCP the address given is displayed in the boot-up text and in 'Test Network' in the menu.

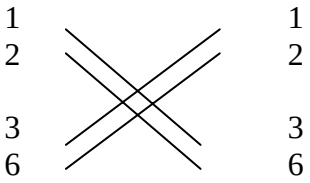
If 'Static' is selected, the codec's IP-address and IP-subnet mask must be specified in the TCP/IP settings menu.

To connect to a LAN use a standard Ethernet cable (or order TANDBERG part number 110879). The cable specification is:

```
1 ------------ 1
2 ------------ 2

3 ------------ 3
6 ------------ 6
```

If no LAN is available and the codec is connected directly to a computer, use a crossover cable. The cable specification is:



If such a connection is needed the codec and PC must use 'static' TCP/IP settings because no DHCP server is controlling the small "LAN" which has been created between the computer and the codec. When configuring a back-to-back connection between the PC and the codec, make sure both static IP addresses exist on the same subnet.

4.6.2 Platform Requirements

The management tools are based on standard protocols, obviating the need for special programs running on the management computer.

The management computer may be any computer running a standard operating system. I.e., the management computer may be a Personal Computer running the Windows 95/98/2000/NT/XP operating system, which includes the necessary programs such as:

- An FTP client (please see 'Upgrading software in TANDBERG Videoconferencing units'- document D10238- for details)
- A web-browser (please see 'TANDBERG 550 User Manual'- for details)
- A Telnet client (please see 'Data port User Guide'- document D11943- for details)
- A terminal emulator for the RS232 port (please see 'Data port User Guide' for details)

4.6.3 Protocols Supported

TCP/IP - *Transport Control Protocol/Internet Protocol*, providing connectivity over LAN/WAN to any networked computer.

HTTP - *HyperText Transport Protocol*, providing a Web-browser interface to the management computer. (Max. number of simultaneous connections= unlimited, although only one is processed at a time)

FTP - *File Transfer Protocol*, providing a standard method for remote software upgrades. (Max. number of simultaneous connections= 1)

TELNET - providing a standard command-line interface to management functions. (Max. number of simultaneous connections= 3)

SNMP[25] - *Simple Network Management Protocol*, standard for network management and surveillance. (RFC1157 SNMPv1, RFC 1213 MIB-II).

DHCP - *Dynamic Host Configuration Protocol*, enabling the system to automatically be given IP address and Subnet Mask when connected to a network with a DHCP server.

[25] For further info on SNMP refer to document 'TANDBERG SNMP' (D12190)

In addition to the above TCP/IP based protocols allowing management to be performed remotely; local management, control and software upgrade facilities are also available through a standard RS232 interface (see chapter 4.3).

4.6.4 System Management Functionality

4.6.4.1 Remote software upgrades using FTP:

This service is provided by the standard TCP/IP based FTP protocol. Any networked PC may perform software upgrades either locally or over the Internet depending on the LAN connectivity on the customer premises (firewalls etc.). Using any FTP-client software (such as the FTP-client bundled with the Windows operating system), it is possible to upload the new software release to the videoconferencing system. The software file is in binary format in order to decrease upload time. It is possible to keep the directory list and all other special settings after the new software is uploaded.

4.6.4.2 Remote software upgrades during a call[26]

The TANDBERG 550 has the ability to upgrade another TANDBERG system when inside a call (ISDN or IP) by using the built-in file system. The management PC needs to be connected to the calling codec via the Ethernet port to upgrade a called system through H.320/H.323 link. While in a call to the upgrading system, the codec software file should be put into the file system of the local codec;
e.g. ftp://*LocalCodecIPaddress*/remote/s08301e30.pkg. Please, see document D10238 'How to upgrade a TANDBERG Videoconferencing system' or User Manual for further info.

It is also possible to do this type of software upgrade via the codec's web-page.

4.6.4.3 Management using a standard Web-browser:

Using a standard Web-browser (Netscape, MS Internet Explorer 3.0 or later), the user may perform basic set-up, diagnostics and troubleshooting. This includes placing calls, disconnecting calls, using the directory as well as remote software upgrading.

4.6.4.4 Management using a standard Telnet-client:

(such as the Telnet program bundled with the Windows operating system)

This gives the user the same functionality as from the remote control and the data port. It provides advanced debug capabilities such as ISDN layer 3 (D-channel) traces on Basic Rate and Primary Rate interfaces, low-level H.320 protocol diagnostics (e.g. H.221 traces), etc. This interface is a command-line type interface, not a graphical interface like the Web-browser interface. The codec supports multiple simultaneous Telnet sessions.

4.6.4.5 Management using a terminal connected to the RS232 port:

(such as using the HyperTerminal program bundled with the Windows operating system). Provides many of the same services and features as the Telnet-interface does in addition to the possibility to do software upgrades. See chapter 4.3 and TANDBERG Data port User Guide (D11943) for details.

4.6.4.6 Remote Management using SNMP:

The TANDBERG system may be managed from a remote Management System such as the

[26] Both systems needs software B3 or later for this type of remote upgrade to function

TANDBERG Management Suite (TMS) using the Simple Network Management Protocol (SNMP). For further info on SNMP refer to document 'TANDBERG SNMP' (D12190).

4.6.5 Security

4.6.5.1 Disable Services

There is no router inside the system that can route between the ISDN side and the IP side of the TANDBERG system. This means it is not possible to get access to the Ethernet port via an ISDN call. However, if wanted the following services may be disabled/enabled (with dataport commands):

- TELNET
- HTTP
- FTP
- H323
- *rinfo* command
- Remote software upgrade
- SNMP (may also be set to *read only*)
- MD5 challenge for TMS

4.6.5.2 Security Alert

The system will notify any management application when someone tries remote access over IP with illegal password (via SNMP traps). Information about the *intruder's* IP-address and the service used (Web, Telnet and FTP) will be given.
When the (optional) TANDBERG Management Suite (TMS) is used, an email notification may also be sent to the administrator of the network.

4.6.6 System Protection

4.6.6.1 System Access (/Account) codes:

A System Access Code is an optional verification code before placing a call and is implemented to protect access to the TANDBERG system. Access codes can also be used for accounting purposes in collaboration with the *TANDBERG Management Suite (TMS).*

Hint:
The use of access codes is turned on/off in the Call Settings menu. Therefore, for full protection, use the dataport command *protect on <optional password>* to ensure that the user cannot turn this protection feature *off*. (User will then only get read access inside the Terminal Settings menu).

The user enters the access code in the input field and presses OK. The system will verify if the entered code is valid by checking the code with the allowed codes listed in the *access.txt* file stored on the codec's ftp-server. (This file must be made and stored on system by the administrator).

If no 'access.txt' file is uploaded to the codec, registration of the code will be done without validation. E.g. you can enter whatever code you want and have access to the system.

If the entered code is invalid, the menu is held on screen and an error message 'Invalid account code!' is displayed on the status line and user will not be able to dial from the system.

Any combination of the characters entered via the remote control may be used as access codes.

Note:
It is only in conjunction with the TANDBERG Management Suite that these codes may be used (and referred to) as Account Codes.

4.6.6.2 Menu Password:

A menu password is implemented to protect from users entering the menu of the system via the remote control. This is a dataport command and the system may still be accessed via the Ethernet port even when this password is set on the system. Ref. 'Dataport User Guide' (D11943) for details.

4.6.6.3 Authentication of Remote Management System

In order to increase network security, the TANDBERG system can force remote management systems such as the TANDBERG Management Suite (TMS) to authenticate. Authentication is performed via an MD5 challenge using a configurable TELNET port (port 57 by default).

In the course of authentication, the TANDBERG system provides a "challenge" such as a text string to the management system. The management system must then compute a response using the MD5 hash algorithm from this string and a secret password. The response is used as the management password. It changes every time because the challenge is different every time.

4.6.7 Layer 4 ports used by the system

The following TCP and UDP ports are relevant for the TANDBERG 550 system.

Port Number	Service	Protocol
21	Ftp/control	*TCP
23	Telnet	*TCP
57	Telnet[27]	TCP
80	Http	*TCP
123	NTP	*UDP
161	Snmp/queries	*UDP
962	Snmp/traps	UDP
963	Netlog	TCP
970	Streaming/RTP	UDP
971	Streaming/RTP	UDP
972	Streaming/RTP	UDP
973	Streaming/RTP	UDP
1026	Ftp/data	TCP
1027	VNC	TCP
1719	H323/RAS	UDP
1720	H323/Q931	*TCP
2326-2373	H323/RTP	UDP

[27] Default port for MD5 challenge authentication mechanism, configurable

5555-55xx H323/H.245/Q.931 TCP

Outgoing H.323 call:
First call uses 5555 for outgoing Q.931 and 5556 for H.245, next uses 5557 for Q.931 and 5558 for H.245, etc.

Incoming H.323 call:
First uses call uses 5555 for H.245, second 5556 etc. Disconnecting a site in a call will not free up available 55XX ports until the whole conference is down.

(*) Listening sockets

4.7 Web Snapshots

For monitoring purposes, the TANDBERG system's web interface shows a snapshot of the incoming video if the system is in a call. Outside of a call, the web snapshot will reflect the local main camera view or another selectable video source on the system. The snapshot image is updated every five seconds.

The snapshot picture information is protected by the following security mechanisms:

- The web snapshots are not stored on the TANDBERG system.
- The web snapshots are protected by the TANDBERG system's IP password.
- The web snapshots are not visible for encrypted calls.
- The web snapshot functionality is disabled by default. It may be turned on only via the local codec interfaces (on-screen menu or RS-232 dataport connection).

5. Miscellaneous features

5.1 Multi-language Options

The TANDBERG 550 supports multiple languages for its on screen menus. The user can select between the following languages[28]:

- Chinese
- Chinese (simplified)
- English
- French
- German
- Italian
- Japanese
- Norwegian
- Portuguese
- Russian
- Spanish
- Swedish

Note: By pressing the following buttons on the remote control the menu is set to English: *Snapshot – Far End – Snapshot – 0*

5.2 Directory

The TANDBERG 550 can store up to 500 numbers in the directory.

- 100 in the local directory
- 400 in the global directory (stored in codec's file system)
  The global directory can only be edited through the file system (by using ftp). Once the global directory file is stored on the codec (ftp://*codecIPaddress*/user/globdir.prm), these numbers will appear on the normal directory menu.

  Note: The Global Directory numbers may not be edited via the menu.

5.3 Boot up logo

It is possible to customize the boot up logo on the TANDBERG 550 through the codec's file system. The logo file must be in jpg-format and the file size cannot be larger than 704 x 480 pixels[29]. The colour format of the file should be RGB and the file must be stored under ftp://*codecIPaddress*/user/startup.jpg. The boot up logo will be shown on screen during boot up, and may also be displayed when system is not in use (selection in menu).

5.4 Startup scripts

When certain settings- other than default settings- are required on the TANDBERG 550 system, one can run two customized start-up scripts. The scripts can contain a series of Dataport commands starting with *P (Ref. Dataport Userguide). 20 seconds after reboot of the codec, these files will be executed in the following order: startup1, startup2.

The files should be stored under ftp://*codecIPaddress*/user/startup1.prm (…/startup2.prm).

Note! Do not put the command **P boot* into these files as this will cause the codec to continuously reboot. (If this is done, ftp into the codec after bootup and delete the file within 10 seconds before it's being executed).

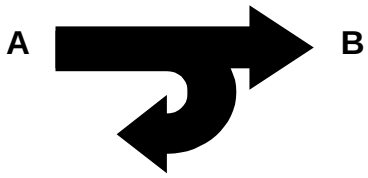
[28] Available languages correct at time of printing- additional languages may become available.

[29] By opening the jpg-file in a web-browser one may see the number of pixels of the file (*properties*)

5.5 Loopback Testing for Remote Diagnostics[30]

There are two ways of testing network loop back on the TANDBERG 550.

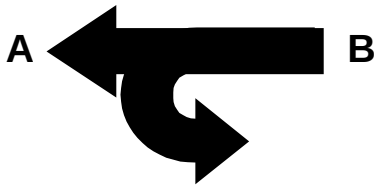
Request remote loop



A request is sent to remote side to switch on its loop.

- The local site (A) will see its own video and hear its own audio
- Remote site (B) will see and hear site (A)

Set in local loop



The local system will loop incoming audio and video.

- The local site (A) will see and hear site (B)
- Remote site (B) will see its own video and hear its own audio

5.6 Maximum call length

Normally a call will stay up until it is disconnected by the user. The system has the ability to automatically disconnect the call (incoming or outgoing) after a certain time.

Once a value (1-999 minutes; i.e. up to approximately 17 hours) is inserted in the menu this will apply for all calls made. Default value is set to zero (i.e. max. call length *off*).

When the time has expired, the user will be prompted a 'need for delay?' message.

5.7 Closed Captioning/Text Chat

The TANDBERG system has the ability to display text on local and far end screens via the system's web page. Text chat is supported on both H.320 and H.323 and only in point-to-point calls. The feature is implemented according to the ITU standard T.140.

T.140 defines a universal presentation-level protocol for text conversation which will work with all multimedia protocols and with the existing standard for text telephony; V.18. This is expected to greatly improve the lives of those users reliant on text-based conversation systems, such as the hearing and speech impaired.

Please, see the User Manual for more information about the usage of this feature.

[30] For more diagnostic features on the system, please refer to 'dataport user guide' (D11943)

5.8 Other Standards supported

5.8.1 H.320

This ITU standard is a generic name applied to all standards based videoconferencing equipment. By its nature, it calls up a number of other standards that are designed to perform a set process to enable the transmission of video, audio and data (i.e. multimedia) across any synchronous network.

5.8.2 H.323

H.323 is an ITU standard that specifies the operation of real-time audio, video and data communications over packet based networks. These networks are collectively termed IP networks and are by nature asynchronous.

5.8.3 H.231/H.243 (MCU control)

When connected to an external MCU (Multi Conference Unit) on ISDN or IP networks, the TANDBERG system uses the ITU standard H.231 *'Multipoint control units for audiovisual systems…'* for MCU controlling features, such as Chair Control and View Site. These features are easily available by using the coloured Quick Keys on the remote control.
The standard H.243 *'Procedure for establishing communications between three or more audio-visual terminals..'* is also implemented in the system for MCU connections for both ISDN and IP with the following functionality:

- Floor request and release
- Site naming and view indication
- MultiSite cascading
- Microphone off indication
- TCS-1 password.

5.8.4 H.243 Password

H.243 password is supported by the system. This feature allows you to have a meeting password set in the external H.320 or H.323 MCU and the endpoints must then put this password in to join the meeting. The password must be numerical.

There are two ways of entering this external MCU password:
1) Password entered together with the MCU number
E.g. with MCU number=207987654 and password=*1234*, the number to dial will be 207987654**1234*.
2) Password prompted on screen after the MCU is called
In this case the MCU sends a TCS-1 message to the terminal immediately after the terminal has called the MCU. When the TANDBERG system receives this message, it will prompt the user for the password. If password is correct, the MCU will join the system to the conference; if not correct the system will not be connected.

5.8.5 H.281 (FECC)

The ITU standard H.281 is implemented to control the remote site camera and video sources. The TANDBERG system uses H.281 on both H.320 (Synchronous networks) and H.323 (Asynchronous networks).

6. Environmental Issues

6.1 TANDBERG's Environmental Policy

- TANDBERG's Research and Development is continuously improving TANDBERG's products towards less use of environmentally hazardous components and substances as well as making the products easier to recycle.
- TANDBERG's products are Video Conferencing Solutions. The idea of Video Conferencing is to reduce the need for expensive, time demanding and polluting transport of people. Through people's use of TANDBERG's products, the environment will benefit from less use of polluting transport.
- TANDBERG's wide use of the concepts of outsourcing makes the company itself a company with a low rate of emissions and effects on the environment.
- TANDBERG's policy is to make sure our partners produce our products with minimal influence on the environment and to demand and audit their compatibility according to applicable agreements and laws (national and international).

6.2 Environmental Considerations

Like other electronic equipment, the TANDBERG 550 contains components that may have a detrimental effect on the environment.

- Printed-wiring boards made of plastic, with flame-retardants like Chloride or Bromide.
- Component soldering that contains lead.
- Smaller components containing substances with possible environmental effect.

After the product's end of life cycle, it should be returned to authorized waste handling and should be treated according to National and International Regulations for waste of electronic equipment.

7. Product Approvals

The product has been approved by various international approval agencies, among others: UL, BABT and NEMKO. According to their Follow-Up Inspection Scheme, these agencies also perform production inspections at a regular basis, for all production of TANDBERG's equipment.

The test reports and certificates issued by the approval agencies show that the TANDBERG 550 complies with the following standards.

7.1 Connection of Tele-Terminal Equipment

- CTR 3 w/Amd.1, as specified in Commission Decision 98/515/EC. (Product complies with EU's Commission Decision 1999/5/EC).

7.2 EMC Emission - Radiated Electromagnetic Interference

- EN55022:1994 + A1:1995 + A2:1997 (CISPR 22:1993 + Corr. and Am.1 and Am.2) Class B. (Product complies with EU's Commission Decision 89/336/EEC).
- FCC15 B, Class B

7.3 EMC Immunity

- EN 55024:1998
- EN 61000-3-2:1995 + A12:1995
- EN 61000-3-3:1995 (product complies with EU's Commission Decision 89/336/EEC).

7.4 Electrical Safety

- IEC 60950:1999
- EN 60950:2000 (product complies with EU's Commission Decision 73/23/EEC).
- UL 1950 3. Edition
- CSA C22.2 No. 950-M95

8. Product Reliability

The predicted reliability of the TANDBERG 550 is expressed in the expected random Mean Time Between Failures (MTBF) for the electronic components based on the Power On Hours (POH).

- The POH for the TANDBERG 550 Codec is > 69 000 hours.

The MTBF value is dependent on correct handling (e.g.: ESD protective measures are used), installation and use of the TANDBERG 550.

- The Useful Life Cycle for the TANDBERG 550 is in excess of 6 years.
- TANDBERG is in a position to identify batches of products with possibly less reliability than stated above ('product tracking') and will in such an event inform their customers.
- ISO 9001 certificate is available upon request from the manufacturer.

9. Technical specification of TANDBERG 550

9.1 Mechanical information[31]

	TANDBERG 550		Remote Control		Cart (optional)	
Height	13.0 cm	5.1 in	24.5 cm	9.6 in	76.2 cm	30.0 in
Width	38.0 cm	14.9 in	4.5 cm	1.8 in	82.0 cm	32.3 in
Depth	20.0 cm	7.9 in	2.1 cm	0.8 in	69.4 cm	27.3 in
Weight	2.3 kg	5.0 lbs	0.2 kg[32]	0.5 lbs[29]	31.0 kg	68.2 lbs

Note: Monitor and monitor chart is optional for the TANDBERG 550 and needs to be ordered as a complete package.

	29" TV (PAL)[33] (Optional)		27" TV (NTSC)[30] (Optional)		29" TV XGA[30] (Optional)	
Height	58.8 cm	23.0 in	60.0 cm	23.5 in	61.5 cm	24.2 in
Width	73.6 cm	28.7 in	66.0 cm	26.0 in	68.0 cm	26.8 in
Depth	49.3 cm	19.5 in	50.5 cm	20.0 in	50.0 cm	19.7 in
Weight	36.5 kg	80.5 lbs	42.2 kg	93.5 lbs	40.0 kg	88.0 lbs

Standard cables for TANDBERG 550	**Part no.**	**Length**	
Microphone cable	111021[34]	7.5 m	24.6 ft
Video cable (Phono-Phono)[35]	112084	1.5 m	5.0 ft
S-Video cable (MiniDin-MiniDin)[32]	111816	2.0 m	6.6 ft
Audio cable (Phono-2x phono)	111016	1.5 m	5.0 ft
BRI cables (ISDN 1-3)	111890M1,M2,M3	4.0 m	13.1 ft
Ethernet cable	112083	3.0 m	9.8 ft
Power supply w/cable[36]	112052	4.1 m (EU)	13.4 ft (US)
Scart adapter (S-VHS) *if applicable*	112306	-	-
RS232 Monitor Control Cable XGA (PAL)[37]	112742	2.0 m	6.6 ft
RS232 Monitor Control Cable XGA (NTSC)[34]	112743	2.0 m	6.6 ft

31 All figures are subject to change without any further notice.

32 4 x AAA 1.5V batteries included

33 TV model is subject to change without further notice.

34 Part no. includes microphone

35 Either S-Video or Phono cable used at the same time, not both.

36 Measured lengths: Power supply (0.1 m) + connected cable (1.5 m) + Wall socket cable (2.5 m EU/2.0 m US)

37 Intelligent XGA<->S-Video switching cable for High Quality monitor **(Optional)**

9.2 Packaging

The following table shows the approximate measurements on the cardboard packaging of the TANDBERG 550 system- as shipped from production.

	TANDBERG 550 box
Width	49 cm
Depth	29 cm
Height	26 cm
Weight	6.5 kg

9.3 Operating Temperature and Humidity

- 0° C to 35° C (32° F to 95° F) ambient temperature.
- 10% to 90 % Relative Humidity (RH)

9.4 Storage and Transport Temperature

- -20° C to 60° C (-4° F to 140° F) at RH 10-90 % (non-condensing)

9.5 System Power Consumption

- Maximum power consumption for codec is 45 W.
- External power supply, input 100-240 V AC, 50-60 Hz, 1.6 A
  DC out: 12 V, 4.3 A

10. Technical specification sheet

Unit delivered complete with:
Wireless remote control, camera, microphone, integrated cabling

Bandwidth
H.323 up to 768kbps
H.320 up to 384kbps

Video Standards
H.261, H.263, H.263+, H.264

Video Features
Picture in Picture (PIP)
Intelligent Video Management[TF]

Video Inputs (1 input)
Built-in main camera
1 x RCA/Phono, composite: document camera/aux/VCR playback
XGA, PC using VNC (PC softpresenter[TF])

Video Outputs (3 outputs)
1 x MiniDin, S-video: main monitor
1 x RCA/phono, composite: main monitor
1 x XGA: main monitor

Video Format
NTSC or PAL

Live Video Resolution
Native NTSC:
4SIF (704 x 480 pixels), Digital Clarity[TF]
SIF (352 x 240 pixels)
Native PAL:
4CIF (704 x 576 pixels), Digital Clarity[TF]
CIF (352 x 288 pixels)
QCIF (176 x 144 pixels)
SQCIF (128 x 96 pixels)
Native PC Resolutions:
XGA (1024 x 768 pixels)
SVGA (800 x 600 pixels)
VGA (640 x 480 pixels)

Still Image Transfer
CIF, 4CIF, H.261 Annex D

Audio Standards
G.711, G.722, G.722.1, G.728

Audio Features
Automatic noise reduction
Acoustic echo canceller
Audio mixer
Automatic gain control
VCR ducking

Audio Inputs (2 inputs)
1 x microphone, 11V phantom powered, XLR connector
1 x RCA/Phono, Line Level: auxiliary/VCR playback

Audio Outputs (1 output)
1 x RCA/Phono, Line Level: main audio

XGA Input / Output
Input: : 640 x 480 – 1024 x 768, via PC SoftPresenter (VNC)
Output: 640 x 480 – 1024 x 768, 60 Hz

Frame Rates – Point to Point
15 frames per second @ 56 - 128kbps
30 frames per second @ 168 - 768kbps

Network Features
Auto H.320/H.323 dialing
Downspeeding[TF]
Programmable network profiles
Password protection
Intelligent Call Management[TF]
Maximum call length
Automatic SPID and line number configuration (National ISDN, GR-2941-CORE)
SoftMuxTF

Embedded Encryption
H.320 and H.323 point-to-point calls (128 bit key AES or 56 bit key DES)
Standards-based: H.233, H.234, H.235, DES, AES
Automatic key generation and exchange

H.323 Network Features
Resource Reservation Protocol (RSVP)
IP precedence (QoS)
DiffServ (QoS)
IP type of service (TOS)
Network Address Translation (NAT) Support
IP adaptive bandwidth management (including flow control)
Auto gatekeeper discovery
Dynamic playout and lipsync buffering
Intelligent Packet Loss Recovery [TF] (IPLR)

Security Features
IP Administration password
Access code
Menu Password
Streaming password
H.243 MCU password
VNC password
Authentication of remote management system via MD5

Wireless LAN support
Compliant with IEEE 802.11b, up to 11Mbit
Support for 64/128bit encryption (WEP)
Infrastructure or ad-hoc mode

Network Interfaces
3 x ISDN BRI (RJ-45), S-interface
1 x LAN/Ethernet (RJ-45) 10/100 Mbit (LAN/DSL/cable modem)
1 x PC card slot for wireless LAN

Ethernet / Internet / Intranet Connectivity
TCP/IP, DHCP, ARP, FTP, Telnet, HTTP
SNMP Enterprise Management
Internal web server
Internal streaming server
Wired 10/100Mbit full/half duplex (manual or auto detect selection)
Wireless up to 11 Mbps (auto detect selection)
IP conflict warning

Other Supported ITU Standards
H.320, H.323, H.281, BONDING (ISO 13871), H.231, H.243

W.A.V.E. II (Wide Angle View) camera

10 x zoom
1/3" CCD
35° Tilt +61°
190° PAN +77°
76° vertical field of view
270° horizontal field of view
450 (PAL) / 460 (NTSC) horizontal TV lines
Min. illumination 7 Lux (F1.8)
Auto or manual focus, brightness and white balance
Far end camera control
15 near and far-end camera pre-sets
Voice-activated camera positioning

Presentations and Collaboration

Presenter Package including:
PC SoftPresenterTF
Digital ClarityTF

T.120 Microsoft NetMeeting support via RS-232 (9-pin D-sub)
Streaming (compatible with Cisco IP/TV, Apple QuickTime and RealPlayer v8 etc.)

Closed Captioning/Text Chat

T.140 standards-based

System Management

Total management via embedded web browser, SNMP, Telnet and FTP
Remote software upload: during a call over all networks, via webserver, and via FTP server
1 x RS-232 for local software upgrades, local control and diagnostics
Remote control and menu system
Support for the TANDBERG Management Suite
Authentication of remote management system via MD5

Directory Services

400 number global directory
100 number local directory including:

11 selectable menu languages:

Chinese, English, French, German, Italian, Japanese, Norwegian, Portuguese, Russian, Spanish and Swedish

Customized boot up logo (jpeg)

Power

Auto-sensing power supply
100 - 250V AC, 50 - 60 Hz
45 watts max.