# Audio, Video Systems for Telemedicine

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## Introduction

A Telemedicine system (Patient End) normally consists of a Personal Computer (PC) with Telemedicine software, a videoconferencing system and diagnostic instruments. The super-specialty end is also similar except that it will not have diagnostic instruments. In all normal Telemedicine applications the diagnostic picture (X-ray, pathology slide or any other image) is displayed on a PC monitor and the related sounds (Doppler echo cardiogram or ultrasound) are heard using sound system (Sound blaster etc.) supplied with the PC. For videoconferencing application either a separate PC with monitor and sound system is used or a TV is used, (in case of a stand alone type of videoconferencing system). In this article audio, video and multimedia systems, as applied to a Telemedicine system, are discussed.

In normal Telemedicine consultation between a consultant (super-specialty) doctor and the referring doctor, Telemedicine PC monitor displays the diagnostic images and the patient data, and the related sound, if any, can be heard on the same PC's sound system. The videoconferencing picture is normally displayed on a PC monitor or a separate PC or on a TV, depending on the type of videoconferencing system used.

To connect various devices properly it is required to understand different types of audio and video interfaces available. Some brief description about different audio and video interfaces are given in this article.

## Audio

The sounds which can be heard by human aural system or ear, is called audio. The audio which is heard by our ears is in acoustical form of energy and is converted to electrical form using a microphone. Similarly audio signal in electrical form is converted to acoustical form by a speaker.

### Audio Inputs

Most of the equipments have two types of audio inputs namely; microphone input and line input. The microphone input is for connecting a microphone and is for low level audio input with high gain. The line input is for higher level of audio inputs i.e. from the line output of an amplifier. The line input can also be connected to audio outputs from

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most of the diagnostic devices like; electronic stethoscope, 3D-Doppler echocardiogram machine, ultrasound, etc.

### Audio Outputs

Most of the equipments have two types of audio outputs namely; line output and speaker output. The line output gives high level voltage output, which can be connected to line input of any device for further amplification to drive speakers, as in audio power amplifiers or for recording, as in audio tape/CD recorder or PC. This output can not drive the speaker directly. The speaker output can be directly connected to matching speaker for listening. The speaker outputs normally define the speaker impedance and the most popular impedances are; 4 and 8 ohms but impedances lower than these i.e. up to 1.2 ohms or higher up to 32 ohms are also used. Care shall be taken in not connecting speakers with low power handling capabilities to high power amplifiers as this may result into burnt speakers. Similarly low impedance speakers shall not be connected to high impedance speaker output as it may result into burnt amplifier.

### Video

The popular types of electrical interfaces (analogue) for video are:

- Composite video
- Y/C or S-video
- Component video
- Computer video

### Composite Video or CVBS

Composite signals are the most commonly used analog video interface. Composite video is also referred to as CVBS, which stands for Color, Video, Blanking, and Sync, or Composite Video Baseband Signal. It combines the brightness information (luma), the color information (chroma), and the synchronizing signals on just one cable. The connector is typically an RCA jack for non-professional equipments and a BNC connector for professional equipments.

### Y/C or S-Video

Y/C is often incorrectly referred to as "S-video." S-video actually refers to a VCR tape recording format and not a signal interface. Y which is the brightness (luma) signal, and C the color (chroma) signal, are carried on two separate sets of wires. The picture quality obtained using this type of interface is better than what is obtained using the composite signal.

### Component Video

Component signal interfaces are the highest performance, because they have the least encoding. The signals exist in a nearly native format. They always utilize three pairs of wires that are typically in either a red, green, blue (RGB) format or a luma (Y) and two-color-difference-signals format. RGB and color-difference formats are generally used in professional television applications. In RGB format the synchronizing information is either carried by all the three signals or is