WAINHOUSE
Research

Evaluation of the Yamaha CS-700

Hands-on testing of an all-in-one USB mic, speaker, and camera solution for small to medium spaces

This evaluation sponsored by ...

⊛ YAMAHA

Background

Yamaha Corporation has over 130 years of expertise in musical instruments, professional and consumer audio systems, and electronic capture, processing and reconstruction of audio signals.

In 2006, Yamaha released its first USB telephone for business communications. Since then, the company has expanded its product reach into the enterprise market.

In 2014, Yamaha acquired Revolabs, and as a result added wireless professional microphone systems and conference phones for telephony and unified communications to its product line.

In March 2017, Yamaha officially announced the Yamaha CS-700 - an all-in-one USB audio / video solution (a.k.a. group add-on solution) including an integrated microphone, speaker, and camera designed for use in small to medium spaces.

In December 2017, Yamaha commissioned the WR test team to perform a third-party assessment of the Yamaha CS-700. This document contains the results of our hands-on testing.

What is a Group Conferencing Add-On Solution?

Group conferencing add-on solutions (a.k.a. group add-ons) are designed and intended to enhance the functionality of personal devices (e.g. notebook PCs, tablets, and smartphones) or meeting room PCs to support a group environment.

Group conferencing add-on solutions typically include microphone(s), speaker(s), and audio processing systems (echo cancelling and/or noise reduction algorithms, etc.) and are intended for use in small to medium-sized meeting rooms. In some cases, group add-on solutions also include an integrated video camera or inputs for external cameras (e.g., a USB webcam).

Group conferencing add-on solutions address two specific challenges:

1) The fact that meeting room PCs (meaning PCs of various forms permanently installed in meeting rooms) do not typically include "meeting-room-ready" microphones, speakers, or a camera.

2) The fact that personal devices (e.g., notebook PCs, mobile devices, etc.) were designed to support the audio and video needs of a single person and NOT a group. In this use case, the group add-on solution's audio system (and possibly camera) is used in place of the personal device's integrated mics, speakers, and webcam.

Understanding the Yamaha CS-700

The Yamaha CS-700 is a family of video-capable group add-on solutions designed for use with USB-capable devices such as notebook and meeting room PCs.

A complete CS-700 package includes:

- The CS-700 Video Sound Bar™ / device (see image below) which includes:

    o A high definition camera offering a 1080p image with a 120-degree field of view, manual (mechanical) tilt, and 2.25x digital zoom

    o An integrated four (4) element beamforming mic array with noise and echo cancellation (an optional extension microphone with a 7.5-meter cable will be available soon)

    o An array of four (4) integrated speakers supporting a maximum total output of 90 dB SPL

    o Front-panel buttons for volume up/down, mic mute, camera mute, Bluetooth® pairing, and NFC pairing. Many of these buttons also act as status indicators.

- 1 x USB 3.0 cable (3-meter length)
- 1 x Ethernet cable
- External power supply
- Wall mounting bracket

Figure 1: The CS-700 Video Sound Bar

The CS-700 is intended to be installed in a small to medium-sized meeting room and supports the following two use cases:

1) USB Audio / Video Add-On – the CS-700 connects to the USB 3.0 / 2.0 port of a notebook PC or a meeting room PC, and acts as the external mic, speaker, and camera for that device. The CS-700 is UVC (plug-and-play) compliant which allows it to work with Windows, Mac, and many other operating systems without the need for proprietary audio and video drivers, plug-ins, or apps.

2) Bluetooth / NFC Speakerphone – the CS-700 uses Bluetooth pairing to connect to the user's smartphone, tablet, or notebook PC, and acts as the external mic and speaker for that device.

The CS-700 family is expected to include the following models:

Model	Audio / Video (Mic, Camera, Speaker)	SIP	IP Device Management	DisplayLink (Content over USB)
CS-700AV	Yes	No	Yes	No
CS-700SP	Yes	Yes	Yes	No
CS-700DL	Yes	No	Yes	Yes
CS-700DS	Yes	Yes	Yes	Yes

As shown above, all CS-700 models include integrated audio and video (mics, speakers, and camera).

In addition, all versions of the CS-700 can be configured, monitored, and managed over IP. The system also offers a web user interface, and can provide SNMP traps to external monitoring systems. These are power features of great interest to enterprise clients that are not offered by many competing solutions.

All versions of the CS-700 can be configured, monitored, and managed over IP.

The CS-700SP and CS-700DS models also support SIP audio including a robust set of call handing features (make a call, answer a call, place call on hold, resume call, transfer call, forwarding, do not disturb, redial, caller ID, speed-dial, and more), support for two SIP calls, the ability to bridge SIP and USB calls, and server-based central provisioning. Integrated SIP support, controlled via API commands, is another power feature not found on many competing group add-on solutions.

Finally, the CS-700DL and CS-700DS models support DisplayLink, a technology that transports audio, video, and content signals over a single USB connection. The DisplayLink implementation supports dual displays via HDMI from the CS-700 to the display, eliminating the need for a separate HDMI connection between the host PC and the CS-700 or the display. This is yet another CS-700 power feature.

The most basic version, the CS-700AV, is currently available for purchase from Revolabs / Yamaha channel partners for US $1,299 (MSRP). The other CS-700 versions are expected to ship during the first half of 2018.

For this assessment, Revolabs provided a pre-shipping version of the CS-700AV. Therefore, we were unable to test the SIP and DisplayLink capabilities expected to be offered on the other CS-700 variants.

Installing the Yamaha CS-700

The installation of the CS-700 was both quick and easy, requiring only the physical installation of the device, and the connection of three cables – power, Ethernet, and USB.

We were pleased that all connections are made at the back of the unit, and that the connectors are positioned and angled sideways to allow for an easy and tidy installation. We also appreciate that the system includes a long USB 3.0 cable which allows the video sound bar to be placed quite a distance from the host PC. Cable management nuances like these are often ignored by hardware manufacturers.
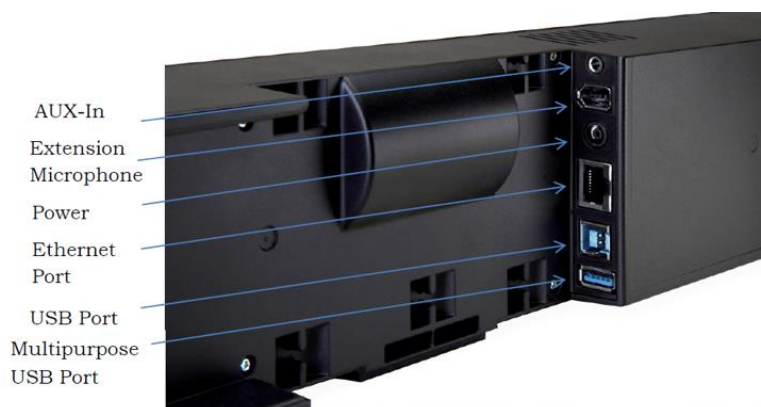
As a part of our testing, we used the CS-700 in two places:

- In our conference room (see image at right of the unit mounted above our main display)

- In one of our offices (with the unit sitting on the table at the foot of the display) [1]
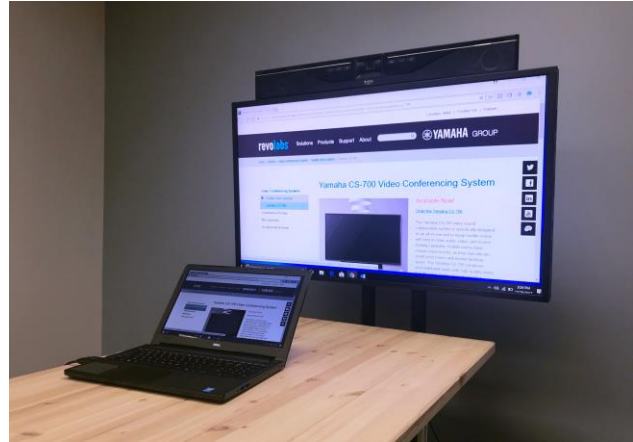
After powering up the CS-700 device, we connected the other end of the USB cable to each of the following host devices (one at a time):

- A Dell Inspiron 15 notebook running Windows 10 Pro

- A MacBook Air notebook running macOS 10.13.2

- A Microsoft Skype Room System (SRS version 2). See image in hands-on testing section below.

As with most group add-on solutions, and thanks to the CS-700s UVC support, no software installation on the host device / PC was required.

Finally, since the CS-700AV we were given doesn't support DisplayLink, we connected an HDMI cable between each host device and our meeting room display.

All in all, it took us less than ten minutes to unpack, connect, and start using the CS-700.

Web Configuration and Management

The CS-700 can be used right out of the box, and we performed our initial test calls successfully using the device's default settings. However, the device also offers a wide range of configuration options and settings accessible via the device's web user interface.

The CS-700 supports both static and dynamic (DHCP) IP addresses. By default, the system uses DHCP, and pressing the Volume-Up and Bluetooth buttons simultaneously for five seconds causes the CS-700 to "say" its IP address. While the voice used is a bit robotic, this process worked extremely well.

With the IP address of the unit in hand, we accessed the system's web UI via a standard browser and entered the default 4-digit password. What we found was a well-designed and intuitive web UI offering easy access to device status information (see screen shot below) and a myriad of system settings.

For brevity's sake, we will not list every web-accessible setting here. However, some of the notable and more powerful settings include:

- the ability to enable / disable the front panel buttons (seems trivial, but is likely to avoid many meeting failures as users play with the buttons on the device).

---

[1] Yamaha recommends mounting the CS-700 below the display, but not higher than 18 inches above the table.

- the ability to enable and configure the CS-700's SNMP (simple network management protocol) support so the device can be remotely monitored by third-party monitoring systems.

- the ability to enable the device to be configured using a centralized deployment server (e.g. a TFTP server). By default, this setting is enabled.

- a configurable high pass filter to adjust the frequency response of the microphones to eliminate in-room background noise from air conditioning, lighting fixtures, and other items.

- an incoming audio equalizer to improve incoming voice quality (options are voice enhance, bass boost, and treble boost).

- the ability to set the camera's "home" PTZ setting (see coverage of this feature below).

- the ability to export and import device configuration files (significantly reduces the time needed to configure additional CS-700 units in the field).
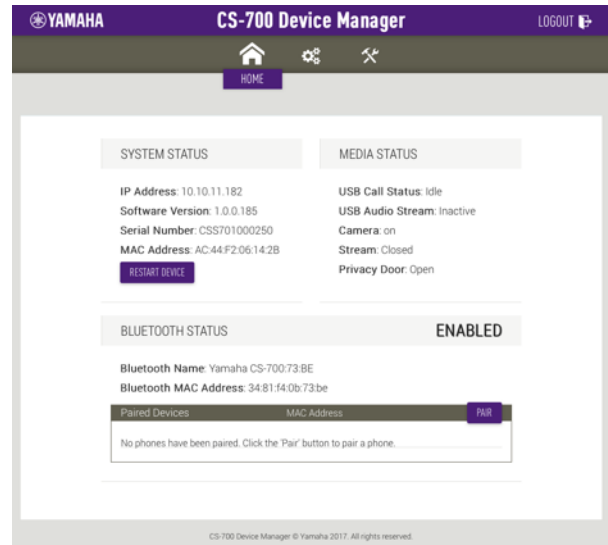
The CS-700 also offers a robust API accessible over IP or USB connections.

After reviewing the web UI, the centralized provisioning capabilities, and the API documentation, it became abundantly clear that the CS-700 is a professional device designed specifically to address the needs of enterprise customers. This is not a consumer device adapted for meeting room use.

Throughout our testing we enabled and disabled the various configuration settings to assess the overall performance of the solution.

Hands-On Testing

USB Audio / Video Add-On Mode

To test the CS-700 in its primary use case (as a USB audio / video add-on device), we placed numerous video calls using a variety of collaboration tools and cloud services including (in alphabetical order):

- BlueJeans Network
- Cisco WebEx
- Polycom RealPresence Desktop
- Skype for Business (with Office 365)
- Zoom

Audio Performance / Experience

Overall, we were <u>extremely</u> pleased by the CS-700's audio performance.

Microphone Pick-Up / Performance – the CS-700's integrated 4-microphone beamforming array performed extremely well throughout our testing. At distances from 3 feet to more than 15 feet from the video sound bar, the CS-700 faithfully captured and sent our speech to the remote participants. The unit even passed our pickup stress test involving a soft-spoken tester standing 16 feet from the device and facing the opposite direction.

*Overall, we were extremely pleased by the CS-700's audio performance.*

Audio Processing (Noise Reduction, Echo Cancellation, etc.) – the CS-700's integrated DSP did an exceptional job in all areas of our testing. In terms of noise reduction, the CS-700's automatic noise cancellation system successfully masked in-room ceiling HVAC noise and almost completely eliminated off-axis noise (in our case the sound of people speaking outside the door of our conference room).

The system also offers a manually activated high pass filter to compensate for low frequency ambient room noise. We tested this capability, and it worked as expected. But in all fairness, the system's automatic noise cancellation provided a more than acceptable experience.

In terms of echo cancellation, the CS-700's DSP performed perfectly throughout all testing – even when the CS-700's speaker was set to full volume.

In addition, the CS-700 passed our full duplex audio test (near and far-end participants speaking and hearing each other at the same time) with flying colors.

Incoming Sound Quality / Speaker Performance – the CS-700's four speakers provided more than ample volume for a small to medium meeting room. Even at maximum levels, the audio was not noticeably distorted.
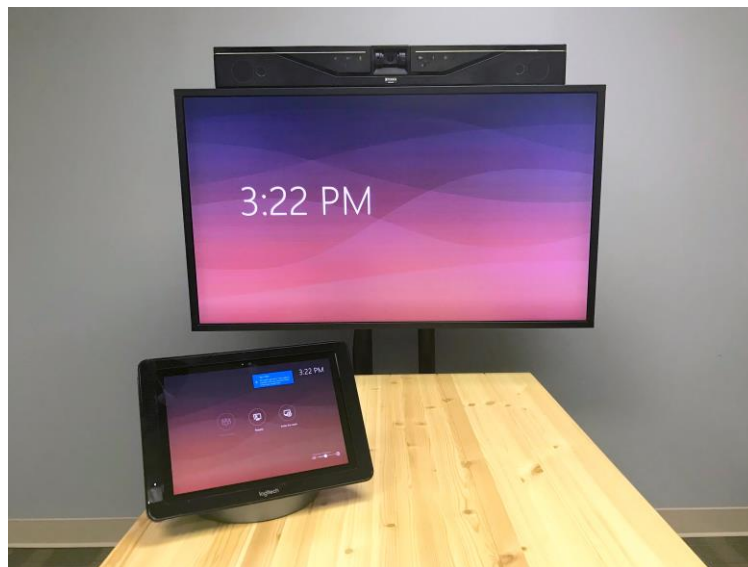

Skype for Business huddle room including a Yamaha CS-700AV connected to Skype Room System
(Surface Pro 4 tablet installed in a Logitech SmartDock)

Video Performance / Experience

Image Quality – the CS-700's integrated HD camera provided the far-end participants with a solid, full-motion video experience during all test calls.

Participant Capture – the CS-700's 120-degree horizontal field-of-view camera successfully captured all local meeting room participants, including those seated only a few feet from the display as would be the case in small / huddle rooms.
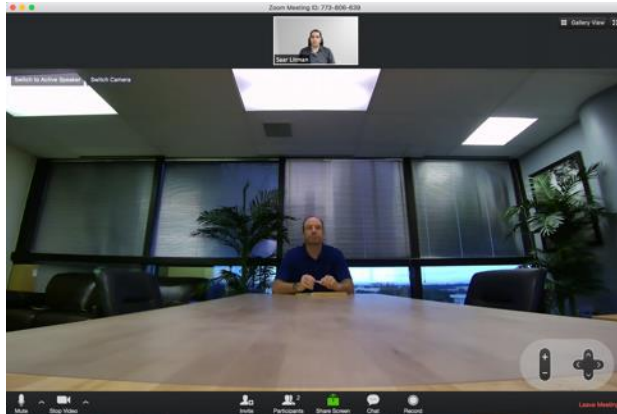

Yamaha CS-700 (No Digital Zoom)

Yamaha CS-700 (2.25x Digital Zoom)

Zoom Performance – the CS-700's digital zoom worked exactly as expected and allowed us to zoom-in on the person at the head of the table without noticeable loss of image quality (see images above taken with the CS-700 placed on the tabletop). That said, we would have preferred a 4x or 5x digital zoom capability over the system's 2.25x digital zoom.

PTZ Home Function – In some situations, a 120-degree horizontal field of view may result in the capture of empty parts of the room (see image above left). To address this issue, Yamaha allows admins to define a "home" position for the CS-700 camera. Once defined, the system will automatically use these PTZ settings whenever a USB signal is detected. This means that all users will enjoy a consistent experience, regardless of the camera settings in place on their laptop.

To use this feature, the admin uses any UVC-capable software with PTZ controls to set the optimal digital zoom, pan, and tilt settings. In our case, we used the Polycom Real Presence Desktop (RPD) software and adjusted the zoom to 1.4x, the tilt to 10, and the pan to 4. This provided the optimal framing for the seats in our meeting room.
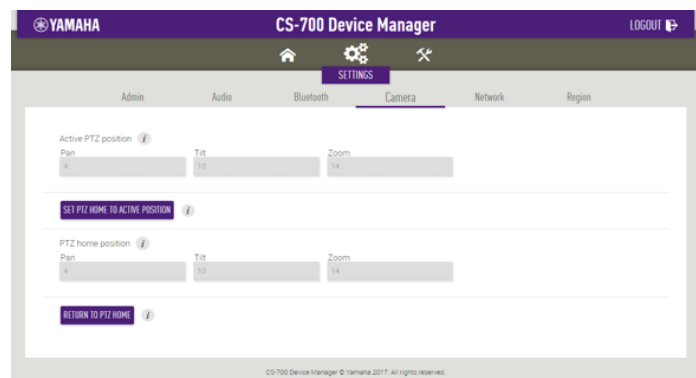
Once done, we clicked the "SET PTZ HOME TO ACTIVE POSITION" button within the web UI (see screenshot below), and stored these settings as the PTZ home position.

Note that the CS-700 does not offer an optical zoom. For this reason, the digital pan and tilt functions are only available when digital zoom is in use.

This PTZ home setting function is a smart solution to a common problem found in huddle rooms today.

Bluetooth Speakerphone Mode

To test using the CS-700 as a Bluetooth speakerphone, we placed the CS-700 in Bluetooth pairing mode by pressing and holding the Bluetooth button on the device. The blinking Bluetooth LED confirmed that the CS-700 was in pairing mode.

We then successfully paired the CS-700 with each of the following smartphones and placed numerous test audio calls:

- A Samsung Galaxy S6 Active
- An Apple iPhone 7

The CS-700 worked very well as a Bluetooth speakerphone, offering solid incoming and outgoing audio quality that would be more than adequate for use in a small to medium room.

Analysis and Opinion

The Yamaha CS-700AV is a well-performing USB group conferencing add-on solution from a longstanding player in the meeting room audio market.

There's a lot to like about the CS-700AV. The system is easy to install, easy to use, and provides a strong audio and video experience - at a compelling street price of ~ US $1,000. In addition, in terms of the system design, the unit is thin and relatively unobtrusive when installed.

But there's more to the CS-700 series than meets the eye. Unlike most of the USB solutions in this category, the CS-700 can be configured, monitored, and managed remotely via IP. In addition, the CS-700 can be provisioned using a centralized provisioning server, monitored using any SNMP-capable monitoring platform, and controlled via the CS-700's robust set of APIs.

Furthermore, the CS-700 offers a wide range of audio, video, network, security, and control options through its web UI. These features range from basic (e.g. disabling the physical buttons on the device) to advanced (e.g. configuring the integrated SIP capabilities available on some versions of the CS-700).

After using the CS-700 for several weeks in our test lab and our production environment, we found only a few minor weaknesses with the device. For example, the system's digital zoom of 2.25x is sub-par compared to competitors, but is adequate for standard huddle rooms. The device also has a dated, somewhat technical look and feel to it. Neither of these items are show stoppers.

The takeaway here is that the CS-700 is a huddle room powerhouse hiding within a somewhat utilitarian package. Given its strong price to performance ratio and remote management capabilities, we expect the CS-700 to be well received by enterprise customers.

Contributing Authors / Research Team

Ira M. Weinstein is a Senior Analyst & Partner at Wainhouse Research and a 25+ year veteran of the conferencing, collaboration and audio-visual industries. Ira has authored and contributed to dozens of articles, white papers, studies, reports, and evaluations on rich media communications, video conferencing, streaming and webcasting, audio-visual design and integration, business strategy, and general business practices. Ira specializes in providing strategic advisory services to vendors, resellers, and end-users within the collaboration space. Ira can be reached at iweinstein@wainhouse.com.

Saar Litman is a Senior Researcher & Consultant at Wainhouse Research and has 17 years of experience in the audio-visual and video conferencing industry. Saar's primary focus is the products, services, and companies within the audio-visual space. In addition, Saar provides AV design services, helps enterprise organizations define and implement global AV standard systems and designs, and manages the WR test lab in Coral Springs, Florida. Saar can be reached at slitman@wainhouse.com.

About Wainhouse Research

Wainhouse Research, www.wainhouse.com, is an independent analyst firm that focuses on critical issues in the UC, conferencing, collaboration and professional AV markets. The company conducts multi-client and custom research studies, evaluates product and service offerings, consults with end users on key implementation issues, advises vendors on go-to-market strategies, publishes white papers and market statistics, and delivers public and private seminars and webinars.

About Yamaha   (Copy provided by Yamaha)

Yamaha entered to the unified communications (UC) market in 2006 with audio communication products and established a firm position with the quality and sound technology from working with our enterprise customers in Japan. Yamaha acquired Massachusetts-based Revolabs in March 2014, a pioneer in the wireless conference phone segment and continues to grow in UC market. Leveraging the expertise of Revolabs, a subsidiary of the company within the development of a dedicated UC department, Yamaha aims to better focus on solutions that enhance communication and will continue to develop products that help organizations reach their business goals.

All trademarks within this document are the property of their respective owners.