

WHITE PAPER

ShoreTel Ergonomic Phones

ShoreTel's mission was to create a telephone that was a joy to use. The ShoreTel IP Phone was the result.

Table of Contents

1. Ergonomic Phone Design	3
2. Bringing Ergonomics to Phones	3
3. ShoreTel Embraces a Human-Centered Design	3
4. Designed for Sound	4
5. Designed for Sight	7
6. Designed for Touch	9
7. Designed for Ease of Management	12
8. A Wide Range of Phones	12
9. ShoreTel Compliance with the American Disabilities Act	14
Figure 1: The Bell 500 Desk Phone and Bicycle Handlebars	4
Figure 2: Bandwidth Comparison	5
Figure 3: ShoreTel Speakerphone Microphone	7
Figure 4: ShoreTel Speaker Grill	7
Figure 5: ShoreTel IP Phones	7
Figure 6: IP Phone Audio Controls	8
Figure 7: IP Phone Message Indicator Light	8
Figures 8–11: Handset Ergonomics	9
Figure 12: Handset Ergonomics	10
Figure 13: IP Phone Feature Keys	11
Figure 14: IP Phone Soft Keys	11

1. Ergonomic Phone Design

From the wheel to the MP3 player, the success of any technology depends in large part on the usability of the tool that delivers it. Advances in industrial design have led to everything from ergonomically designed kitchen utensils to lightweight power tools, yet many business professionals spend hours on the phone each day using the equivalent of a \$10 plastic screwdriver when they should be using a commercial-grade cordless drill. Employees are typically the most expensive asset in any company, and giving them the communications tools they need to be more responsive and productive is key to delivering business value.

Although the telephone is indisputably the most essential business communications tool, the importance of great office telephone design has largely been ignored since Bell Labs invented the touchtone phone more than 50 years ago. With today's worker spending hours collaborating with co-workers, vendors and clients, and call center agents constantly talking to customers, a successful phone must sound great, but it also needs to be easy to use and aesthetically pleasing to reflect the organization's business value.

2. Bringing Ergonomics to Phones

Good ergonomic design adapts the device to the user, ensuring the device is comfortable and easy to use. Ergonomics is the science of designing products, machines and systems that maximize the safety, comfort and efficiency of the people who use them. In ergonomics, designers draw on many principles, including industrial engineering, psychology, human measurement, and biomechanics to adapt the design of products and workplaces to people's sizes and shapes, and their physical strengths and limitations.

Armed with a complete picture of how people interact with their environment, ergonomists develop the best possible design for products and systems. One of the primary goals is to prevent workplace illnesses and accidents. Ergonomists also seek to increase worker efficiency and productivity when designing workspaces, and today, the science of ergonomics is used widely—in everything from the creation of consumer products such as toothbrushes and razors, computer products such as displays and keyboards, automobile interiors, and manufacturing assembly lines. Even the design of the PC graphical user interface, with its icons and drop-down menus, did much to make formerly cryptic computers usable by virtually anyone.

3. ShoreTel Embraces a Human-Centered Design

ShoreTel has focused on great design from the very beginning. One of our flagship applications, ShoreTel Call Manager is widely recognized in the industry as easy to use because of its intuitive user interface. The ShoreTel IP Phone family, which can be considered a physical manifestation of ShoreTel Call Manager, delivers the ultimate in ergonomic and aesthetics design, including superior audio quality. ShoreTel IP Phones

clearly demonstrate our leadership as a design and technology innovator.

“ShoreTel IP Phones gave us an opportunity to create a higher quality phone,” said Tom van Overbeek, a major proponent of the IP phones’ ergonomic design during his tenure as ShoreTel CEO. “The design philosophy behind ShoreTel’s IP Phones is simple: Your office phone should be a joy to use.”

When it comes to designing a phone that is a joy to use, three of the five senses should be considered: sight, touch and hearing. But achieving a design for a great sounding phone, one that is a pleasure to use and affordable, means revisiting some vintage ideas and throwing out some preconceived notions.

“We started by looking backward,” said Curt Anderson, Founder of Compass Product Designs, the industrial design firm instrumental in the design of the ShoreTel IP Phones. One inspiration was the Bell “500” desk phone, which was created in 1949, and became the gold standard for easy-to-use phones around the world.

Another inspiration came from professional cycling. The handlebars of a racing bicycle are designed to be held in multiple positions to minimize rider fatigue after long hours on the bike. Business professionals similarly spend grueling hours on the phone.

ShoreTel also looked to the sleek design of the Audi dashboard, which puts all the controls within the easy reach of the driver. Similarly, ShoreTel put all of the controls for the telephone within easy reach and sight.

Figure 1:
The Bell “500” desk phone,
and bicycle handlebars.



4. Designed for Sound

ShoreTel was one of the first in the industry to implement a hi-fidelity, wideband audio codec in its IP phones—the technology behind the first improvement in telephone sound quality in 75 years. “We designed an office phone that has the best possible sound quality,” said Ed Basart, ShoreTel founder and Chief Technology Officer. “At that time, no one had ever tried to do that before.”

ShoreTel worked with MWM Acoustics, a world-renown acoustical engineering firm, to custom design the microphones and speakers used in the speakerphone and handset for exceptional sound quality from a desk phone.

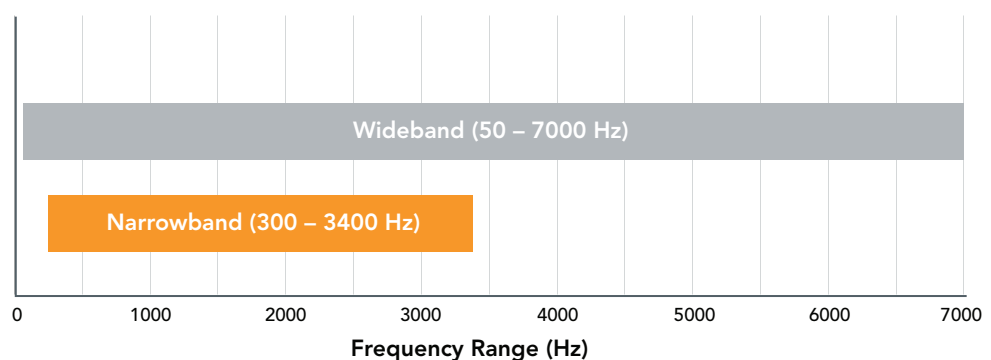
While some other IP telephony solutions have lesser sound quality than traditional TDM PBXs, the packet-based nature of IP telephony is actually an opportunity to deliver better than toll-quality sound. The rich sound of ShoreTel IP Phones results from hi-fidelity audio and innovative design. ShoreTel phones deliver seven octaves of range, whereas most phones deliver only three octaves. Hi-fidelity sound simply sounds better, is easier to understand and is less tiring for the listener. Better sound translates into productivity gains—shorter calls with fewer errors and the potential for higher sales because salespeople sound more professional and are more clearly understood.

Hi-fidelity audio, also known as wideband audio, is possible once IP telephony is freed from the narrowband audio used on the public switched telephone network (PSTN). Wideband audio, which is specified in TIA-920, provides a frequency response from 50 Hz to 7,000 Hz, which more than doubles today's 300 Hz to 3,400 Hz narrowband standard. Wideband codec samples speech at 16 kbps which is twice the rate of conventional PSTN calls, resulting in a sound quality that is more natural.

Narrowband was locked in during the transformation of the PSTN from analog to digital in the 1980s and the adoption of the G.711 codec. The lower frequency limit of narrowband was set at a practical level to avoid noise in the external environment, such as 60 Hz from power lines and other electrical gear. The upper limit comes from the Nyquist Theorem which says that a sine wave can be reconstructed from sampled data at a maximum of half the sample rate. In the case of traditional telephony, the sample rate is 8 KHz, the Nyquist limit is 4 KHz, and because of the limits in the algorithm, errors begin to creep in at 3,400 Hz, which is the set upper limit on most systems.

Figure 2:

Wideband audio technology provides a frequency response from 50 Hz to 7,000 Hz, which more than doubles today's 300 Hz to 3,400 Hz standards. The wideband codec samples the speech at twice the rate of conventional narrowband PSTN calls, which results in superior speech quality.



Overall, two-thirds of the frequencies in which the human ear is most sensitive, and 80 percent of the frequencies in which speech occurs, are beyond the capabilities of the public telephone network. Contrast narrowband telephone performance to FM radio and television, which span 30 Hz to 15 kHz. Interestingly, CD audio covers 20 Hz to 20 kHz, professional and audiophile audio covers a range between 20 Hz to above 22 kHz, and AM radio extends up to 5 kHz.

With wideband audio, the increased range on the low end (50-300 Hz) makes conversations sound less tinny (think of more “bass” on a stereo). The increase on the upper range contributes to the naturalness of the speaker’s voice (think of more “treble” on a stereo).

In musical terms, adding 150–300 Hz gives one additional octave, and 75–150 Hz adds a second octave at the low end. The frequency of speech signals can extend up to 14 kHz, particularly on unvoiced sounds.

Tests throughout the industry consistently show that using wideband for speech communications results in enormous improvements in speech quality. This makes it easier to recognize the caller, reduces the number of ambiguities in the conversation and eases listener fatigue. Practically speaking, callers do not have to spell out words (“S” as in “Sam” and “a” as in “apple”) to be understood, and at the average speaking rate of 120 words per minute, the number of ambiguities is reduced to almost the same number as face-to-face speech. At 3.3 kHz bandwidth, people typically understand about 75 percent of words, which improves to more than 95 percent at 7 kHz bandwidth.

The expansion of global business has increased the importance of accurate telephone communications among workers with different native languages or dialects. Understanding accented speech can be much more difficult than native speech, both because of the presence of an accent, and because grammar, pronunciation and even word selections are not always what the listener expects to hear. The importance of speech clarity rises because listeners cannot always deduce an unclear word from its grammatical context.

ShoreTel’s use of wideband audio in the ShoreTel IP Phone is just one ingredient in delivering great sound. ShoreTel also optimized the speakerphone design to sound better than a typical speakerphone. Users have the convenience of a speakerphone with the sound quality of a handset. A ShoreTel IP Phone can be used in small and midsize conference rooms without worrying about the tinny echo that plagues conventional speakerphones, or both sides speaking at the same time and nobody being heard.

ShoreTel and MWM Acoustics designed the handset and speakerphone microphones, and speakers to meet ShoreTel’s requirements for hi-fidelity sound. The custom high-gain speakerphone microphone delivers outstanding sound pickup, and the speakerphone has full-duplex operation, so the audio flows continuously between both ends. Not all conventional speakerphones do this, and as a result, conversations often sound clipped. The high-volume output on the speakerphone complies with the Americans with Disabilities Act (ADA) requirements for the hearing impaired (see page 14 for full compliance details).

The innovative placement of the microphone in the ShoreTel IP Phone also drives hi-fidelity sound. The speakerphone microphone is located away from the speaker for maximum sound isolation. The microphone points downward and the phone is slightly lifted by the base, so it has a 360-degree pickup range.

The speaker grill has more than twice the standard number of holes, which quite simply lets the sound out. As any audiophile knows, good speakers allow for plenty of air and a large, round enclosed speaker cavity on the underside of the phone helps create this volume.

Figure 3:

The phone includes a high-gain, custom-designed speakerphone microphone for loud, clear sound.



Figure 4:

The speaker grill design represents the large “speaker engine” under the hood.



The ShoreTel handset has a high-gain microphone for exceptional sound quality. The handset also meets ADA compliance for the hearing impaired, as it is a non-magnet speaker that’s compatible with hearing aids and delivers high-output volume.

The ShoreTel IP Phones are standards-based and support G.729, G.711 and BV-16 codecs as well as the G.722 and BV-32 wideband codecs.

5. Designed for Sight

An elegant phone is as much a part of office décor as a mahogany desk or ergonomic executive chair. ShoreTel designed its phones to encourage interaction. The phones are aesthetically pleasing, and created with elegant, sweeping lines.

ShoreTel IP Phones come in black and silver to match office style, whether more traditional or style conscious. The IP 560g gigabit phone is beautiful silver or black aluminum. The IP 265, IP 230 and IP 230g office worker, IP 565g, IP 212 key system, and IP 115 and IP 110 public area phones are black or silver plastic with a special texture that mimics aluminum.

Figure 5:

ShoreTel IP Phones are designed to be aesthetically pleasing. They come in black or silver to match your office style, and are available with color screens for elegance and clarity.



The phone base has a gentle concave sweep, which places the keypad somewhat horizontally for ease of dialing—like a laptop—while the display remains on a vertical angle so it's easier to see. Workplace studies show that people find it easier to read displays when they are placed lower and angled upward toward their faces, just like reading the morning newspaper. The ShoreTel IP Phone resolves the classic conflict of traditional desk phones, which seldom allow users to see the display and use the keypad at the same time. With ShoreTel IP Phones, both are visible, so users don't have to fiddle with a swiveling display while dialing.

The audio controls for the speaker, headset and mute provide clear, quick access to advanced communications features. Users can easily switch between a handset, headset and speaker without inadvertently disconnecting the call. Bright indicators make it easy for visitors walking into an office to see whether the person is on speaker, a headset or muted. This helps eliminate the most frequent office conversation-starter: "Are you on the phone?"

Figure 6:

It's easy to switch between a handset, headset and speaker. Plus, bright indicator lights make it easy to see if a person is on the phone.

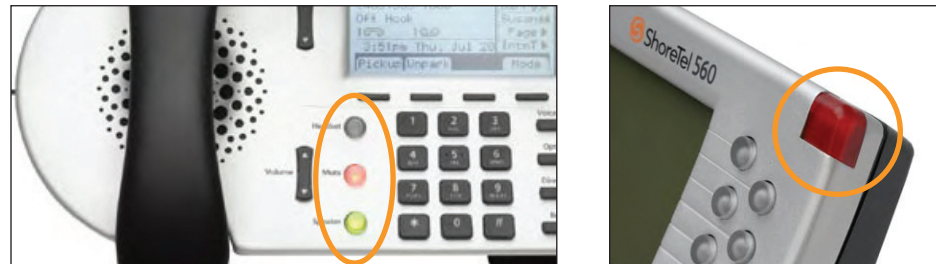


Figure 7:

A large, bright message waiting light makes it easy to see if a message is waiting even if the phone is turned away from the user.

The volume control, headset and speaker buttons are clearly labeled with internationally recognized symbols. Volume for the handset, speaker, and headset and ringer are independently controlled and automatically remembered.

The display on the ShoreTel IP Phone is large and easy to see, which is particularly important as the average age of the workforce increases. In addition, the message-waiting light is large and bright, and visible from 360 degrees because it's located at the top right corner of the phone. A user can see if a message is waiting even if the phone is turned away, and the line buttons are color-lit so they are easy to use.

The IP 565g and IP 265 have bright backlit color displays. Not only are they aesthetically pleasing, but they use color very effectively to present information that is important to recognize at a glance, such as missed calls or voicemail count.

The IP 560g gigabit phone has a bright, backlit display for exceptionally easy reading. The IP 230, IP 230g, IP 212 and IP 110 phones have high-contrast displays, which are easy to see.

"Cell phones typically have bright displays, but ShoreTel pioneered putting a nice, bright display on office phones," said ShoreTel CTO Basart. "We designed the display so you can see it easily and without glare."

6. Designed for Touch

Since office workers work mostly with their hands, a phone should feel comfortable and be easy to use. ShoreTel placed a major focus on designing the handset to maximize productivity while minimizing user fatigue and shoulder and neck pain. ShoreTel tested 35 competitive handsets to understand people's behaviors and preferences when using the phone, and evaluated hundreds of models for its own phone design in its user testing efforts to determine the right shape.

The ShoreTel handset feels balanced in a user's hands. A handset that's too light feels flimsy and cheap. A handset that is too heavy can feel awkward and lead to fatigue. ShoreTel designed the handset with an ideal, balanced weight of 180 grams. The handset is weighted toward the earpiece, so a user can easily pick up the phone and take advantage of its momentum to rotate it to his or her ear in a fluid motion—not unlike swinging a hammer.

The ShoreTel handset has a smooth rubber grip that feels soft and comfortable. The material is similar to the covering used on ergonomic hand tools or kitchen utensils. Many phones are in hard plastic and feel slippery, which makes for sweaty hands on long conference calls. ShoreTel designed the earpiece for comfort when pressed against the ear.

ShoreTel designed the handset to be held in multiple ways. Business professionals spend hours on the phone and how a person holds a handset depends on personal preferences and other tasks he or she performs simultaneously, like typing or using the telephone keypad. The handset has a slim waist, so users can easily grip it around the middle, pick it up in different ways, or hold it by the mouthpiece. Many other handsets on the market are designed with hard angles that feel awkward against the hand's natural curvature.



Figure 8:
The handset can be held across the saddle, with the handset matching the curves of the hand.



Figure 9:
A user may hold the handset with an index finger on the back, so there is a finger notch.



Figure 10:
The mouthpiece has rounded corners so a user may comfortably hold the handset around the mouthpiece.



Figure 11:
A user may hold a handset with a thumb on the back, using the finger notch.

Figure 12:
When you pick up the handset, you'll find the handset conforms to the shape of your hand.



It's easy to pick up a ShoreTel IP Phone because there's plenty of room created by the curvature of the handset which lines up against the inverse curvature of the phone base. Sized appropriately, the handset fits neatly into the hand. Picking up a conventional bar-shaped phone can be clumsy because there isn't enough space between the handset and the base. This can result in hanging up on a caller by knocking the phone while trying to pick it up.

The keypad buttons on a ShoreTel IP Phone have a progressive feel. They provide enough resistance so they feel like they're being used without feeling either clunky or ineffective. Tactile feedback is critical for visually impaired people, and the ShoreTel phones meet the ADA requirements. The buttons have a mild texture so fingers hit and stay on the button, which makes it easier to dial without looking directly at the keypad. Indents on the "5" key also help guide the visually impaired. Audio controls are symbolic and easy to understand at a glance.

ShoreTel IP Phones have fixed-feature keys for consistent, easy access to the most common operations, including transfer, conference, intercom, hold, voicemail, options, directory and redial. Phones that rely too heavily on soft keys can be difficult to use, since common features can be hard to find or change position. The feature keys on the ShoreTel phones are labeled in English, which minimizes training for new users. At the same time, the keys are grouped together so you can easily add an overlay with translations for international use.



Figure 13: ShoreTel has grouped together the most common feature keys for consistent, easy access. This includes transfer, conference, intercom, hold, voicemail, options, directory and redial.



Figure 14: Soft keys provide context-sensitive operations, making the phone easy to use.

- Soft keys on the ShoreTel IP Phones make even complex operations easy.
- The Directory uses the same concepts as the QuickDialer on the ShoreTel Call Manager, with smart filtering to allow a user to just type one digit per letter. After pressing the directory key, users can instantly locate and call another person by entering just the first few characters of a name on the keypad, and the phone automatically displays all of the matches. For example, to reach a user named “Rich,” simply press Directory, then 7 once (R), 4 once (I), 2 once (C), and all of the matches that begin with RIC appear. Users do not have to press keys multiple times to get the right digit, and then cancel if they accidentally press too many. Plus, the directory is always up to date with all the people on the system, because new users are dynamically added.
- The Redial key on the phone is more than just redial. If a user hits the redial key once, a complete call history of inbound, outbound and missed calls appears. Then the user selects the desired number, and hits the key again to automatically redial.
- The Options key allows quick management of user’s personal options, including call handling and ring-tone selection.
- The Voice Mail key provides quick, one touch access to voicemail.
- In Idle Mode the phone screen quickly communicates the name, date, time, extension, DID, number of missed calls, number of voicemails, agent state and call handling mode. During a call, the display indicates the status of call, including caller ID and call timer.

7. Designed for Ease of Management

Not only are ShoreTel IP Phones a joy to use, but systems administrators will find that managing the phones as an integral part of the ShoreTel brilliantly simple UC system is easy and efficient—even when the organization has many locations.

Installing a ShoreTel IP Phone in an existing ShoreTel UC system is plug-and-play. A non-technical person can simply plug in a new phone, and the phone automatically gets an IP address, subnet mask, and gateway, plus the accurate time from a time server and the latest software from the ShoreTel management server. There's no need to manually "flash" the telephone for a software update.

When the ShoreTel IP Phone comes up as "available," the user simply logs in to voicemail, and assigns their extension to that phone. This simple process makes deployment fast, easy and automatic, and there is no need to track telephones by MAC address. The keys are self-labeled, so the buttons are always accurate and eliminate the tedious manual labeling of key caps.

For the system administrator, the ShoreTel Director application makes it quick and easy to deploy software updates to the phones in any office from a central location. As new software releases become available, an administrator can automatically update all of the phones via a network download, further reducing administrative costs.

ShoreTel IP Phones also let administrators clean up the clutter of wires under users' desks. All models of phones—even the IP 110 and IP 115 lobby phones—have an embedded Ethernet switch, so only one wire to the desktop is needed.

8. A Wide Range of Phones

ShoreTel has a wide range of phones to meet organizations' varying requirements for functionality and price.

Essential

IP 110: This cost-effective, single-line IP telephone is ideal for open areas including lobbies, visitor offices, classrooms and dorm rooms. It offers six feature keys for common operations and a one-line display that shows caller ID, date and time. The IP 110 has a speaker that enables one-way intercom communication for increased versatility.

IP 115: A single-line phone that offers all the features of the IP 110, plus a half-duplex speakerphone for hands-free calling.

Professional

IP 212k: This 12-line IP telephone is designed for key-system environments such as shipping departments, supermarket and retail stores, branch offices and small offices. It has eight feature keys and two soft keys for easy access to high performance capabilities.

The IP 212k has an easy-to-read high-contrast display and a full duplex speakerphone that delivers headset-level audio performance. An integrated headset jack enables increased productivity and ease of use, without cluttering the desktop with additional devices.

IP 230: The IP 230 is a three-line phone tailored for knowledge workers, salespeople and general users who rely on telephone communications. It has eight feature keys and four soft keys for easy access to high-performance capabilities. It has an easy-to-read, high-contrast display, a full-duplex speakerphone, and an integrated headset jack.

IP 230g: The IP 230g offers all the features of the IP 230—four soft keys, full-duplex speakerphone and integrated headset jack—as well as a 10/100/1000 Ethernet switch. It is ideal for users with Gigabit speed requirements to the desktop, including design professionals and media creators.

IP 265: The IP 265 is a six-line phone in a compact form factor with a crisp back-lit color display for knowledge workers with advanced requirements. It also has eight feature keys and four soft keys for easy access to the rich ShoreTel UC system feature set. A full-duplex speakerphone and integrated headset jack are also standard.

Executive

IP 560g: This six-line console telephone is ideal for telephony-intensive professionals, executives and executive assistants. A full range of features are available through the IP 560g's four soft keys. A large backlit display instantly conveys call information and other critical information. The IP 560g's full-duplex speakerphone delivers headset-level audio performance, and an integrated headset jack increases productivity while offering the user the choice of speaking into the handset or choosing hands-free headset communications. It also includes a 10/100/1000 Ethernet switch for Gigabit speed.

IP 565g: ShoreTel's most advanced telephone, the IP 565g provides all the features of the IP 560g, as well as a rich backlit color display and a Bluetooth interface that lets users connect with their personal Bluetooth headset for cordless, hands-free calling.

Programmable button box

ShoreTel BB 24: Operators and assistants have at-a-glance presence information and fast, one-button feature access with the only IP-based button device on the market. Buttons can be customized to suit the needs of different users, and self-labeling keys eliminate paper labels. The BB 24 includes an Ethernet switch and provides Power-over-Ethernet (PoE) power forwarding for one downstream device. .

All ShoreTel IP Phones feature an integrated Ethernet switch that allows a network drop to be shared with a desktop PC. They support multiple languages including English (US), French (France), German (Germany) and Spanish (Spain).

Conference Phone

IP 8000: This high-definition audio conference phone delivers exceptional levels of quality audio conferencing and provides complete room coverage. Low distortion and advanced noise reduction allow multiple participants to effectively participate, while reducing distracting background sounds. The IP 8000's elegant, non-intrusive design delivers the highest levels of functionality in an eye-pleasing form.

ShoreTel SoftPhone

A flexible choice for mobile workers, SoftPhone brings desktop telephony capabilities to the PC, even over wireless networks. This offers transparent access to enterprise telephony features while on the road.

As a leader in IP phone systems, ShoreTel continues its innovation in phone design. "We make continuous improvements to our phones," said ShoreTel CTO Basart. "We focus on what people want and have created a full line of phones that are easy to use, look great and provide superior sound."

9. ShoreTel Compliance with the American Disabilities Act

The ShoreTel UC system complies with the 1990 ADA and the associated regulations issued by the federal agencies that define guidelines for accessibility to places of public accommodation and commercial facilities by individuals with disabilities. These guidelines include requirements for telephones and telephone systems.

All models of the ShoreTel IP Phone are ADA compliant, meeting the "ADA Standard for Accessible Design" (Pt.36, Appendix A, Section 4.31, Telephones) and the 508 provision for TDD/TTYs.

The ShoreTel UC system complies with these specific items:

- Volume Control – Telephones should have volume controls that provide a gain adjustable up to a minimum of 20 dB. The telephones should provide at least one intermediate step of 12 dB for incremental volume control.
- Automatic Volume Reset – The telephone should automatically reset the volume to the default level after every use.
- Controls and Keys – Controls and keys shall be tactilely discernible without activating the controls or keys. These controls and keys shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist. The force required to activate controls and keys shall be 5 lbs maximum. If key repeat is supported, the delay before repeat shall be adjustable to at least 2 seconds. The status of all controls or keys should be visually discernible, and discernible either through touch or sound.

- Hearing Aid Compatibility – A means for effective magnetic wireless coupling to hearing technologies shall be provided.
- Minimized Interference – Interference to hearing technologies, including hearing aids, cochlear implants, and assistive listening devices, shall be reduced to the lowest possible level that allows a user of hearing technologies to use the telephone.
- Support for TDD/TTYs – Products that transmit or conduct information or communication, shall pass through cross-manufacturer, non-proprietary, industry-standard codes, translation protocols, formats or other information necessary to provide the information or communication in a usable format. Technologies which use encoding, signal compression, format transformation, or similar techniques shall not remove information needed for access or shall restore it upon delivery. (See ShoreTel Application Notes 106 and 107)
- Cord Length – The cord from the telephone to the handset shall be at least 29 inches (735 mm) long.
- Wall Mount Depth – A wall-mounted object should not protrude into the walkway more than four inches to ensure visually impaired individuals do not run into them. (When wall-mounting phones in walkways, halls or aisles, the ShoreTel phone should be inset into the wall by at least one inch. Otherwise, the phone and the wall mount bracket will protrude by 4 1/2 inches.)

ABOUT SHORETEL

ShoreTel is the provider of brilliantly simple Unified Communication (UC) solutions based on its award-winning IP business phone system. We offer organizations of all sizes integrated, voice, video, data, and mobile communications on an open, distributed IP architecture that helps significantly reduce the complexity and costs typically associated with other solutions. The feature-rich ShoreTel UC system offers the lowest total cost of ownership (TCO) and the highest customer satisfaction in the industry, in part because it is easy to deploy, manage, scale and use. Increasingly, companies around the world are finding a competitive edge by replacing business-as-usual with new thinking, and choosing ShoreTel to handle their integrated business communication. ShoreTel is based in Sunnyvale, California, and has regional offices and partners worldwide. For more information, visit www.shoretel.com.

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