

and operable in accordance with each of the following, assessed independently:

(a) *Operable without vision.* Provide at least one mode that does not require user vision.

(b) *Operable with low vision and limited or no hearing.* Provide at least one mode that permits operation by users with visual acuity between 20/70 and 20/200, without relying on audio output.

(c) *Operable with little or no color perception.* Provide at least one mode that does not require user color perception.

(d) *Operable without hearing.* Provide at least one mode that does not require user auditory perception.

(e) *Operable with limited manual dexterity.* Provide at least one mode that does not require user fine motor control or simultaneous actions.

(f) *Operable with limited reach and strength.* Provide at least one mode that is operable with user limited reach and strength.

(g) *Operable without time-dependent controls.* Provide at least one mode that does not require a response time. Alternatively, a response time may be required if it can be by-passed or adjusted by the user over a wide range.

(h) *Operable without speech.* Provide at least one mode that does not require user speech.

(i) *Operable with limited cognitive skills.* Provide at least one mode that minimizes the cognitive, memory, language, and learning skills required of the user.

§ 1193.43 Output, display, and control functions.

All information necessary to operate and use the product, including but not limited to, text, static or dynamic images, icons, labels, sounds, or incidental operating cues, shall comply with each of the following, assessed independently:

(a) *Availability of visual information.* Provide visual information through at least one mode in auditory form.

(b) *Availability of visual information for low vision users.* Provide visual information through at least one mode to users with visual acuity between 20/70 and 20/200 without relying on audio.

(c) *Access to moving text.* Provide moving text in at least one static presentation mode at the option of the user.

(d) *Availability of auditory information.* Provide auditory information through at least one mode in visual form and, where appropriate, in tactile form.

(e) *Availability of auditory information for people who are hard of hearing.* Provide audio or acoustic information, including any auditory feedback tones that are important for the use of the product, through at least one mode in enhanced auditory fashion (i.e., increased amplification, increased signal-to-noise ratio, or combination). For transmitted voice signals, provide a gain adjustable up to a minimum of 20 dB. For incremental volume control, provide at least one intermediate step of 12 dB of gain.

(f) *Prevention of visually-induced seizures.* Visual displays and indicators shall minimize visual flicker that might induce seizures in people with photosensitive epilepsy.

(g) *Availability of audio cutoff.* Where a product delivers audio output through an external speaker, provide an industry standard connector for headphones or personal listening devices (e.g., phone-like handset or earcup) which cuts off the speaker(s) when used.

(h) *Non-interference with hearing technologies.* Reduce interference to hearing technologies (including hearing aids, cochlear implants, and assistive listening devices) to the lowest possible level that allows a user to utilize the product.

(i) *Hearing aid coupling.* Where a product delivers output by an audio transducer which is normally held up to the ear, provide a means for effective wireless coupling to hearing aids.

Subpart D—Requirements for Compatibility With Peripheral Devices and Specialized Customer Premises Equipment

§ 1193.51 Compatibility.

When required by subpart B of this part, telecommunications equipment and customer premises equipment shall be compatible with peripheral devices and specialized customer premises

equipment commonly used by individuals with disabilities to achieve accessibility, and shall comply with the following provisions, as applicable:

(a) *External electronic access to all information and control mechanisms.* Information needed for the operation of products (including output, alerts, icons, on-line help, and documentation) shall be available in a standard electronic text format on a cross-industry standard port and all input to and control of a product shall allow for real time operation by electronic text input into a cross-industry standard external port and in cross-industry standard format. The cross-industry standard port shall not require manipulation of a connector by the user.

(b) *Connection point for external audio processing devices.* Products providing auditory output shall provide the auditory signal at a standard signal level through an industry standard connector.

(c) *Compatibility of controls with prosthetics.* Touchscreen and touch-operated controls shall be operable without requiring body contact or close body proximity.

(d) *TTY connectability.* Products which provide a function allowing voice communication and which do not themselves provide a TTY functionality shall provide a standard non-acoustic connection point for TTYs. It shall also be possible for the user to easily turn any microphone on and off to allow the user to intermix speech with TTY use.

(e) *TTY signal compatibility.* Products, including those providing voice communication functionality, shall support use of all cross-manufacturer non-proprietary standard signals used by TTYs.

APPENDIX TO PART 1193—ADVISORY GUIDANCE

INTRODUCTION

1. This appendix provides examples of strategies and notes to assist in understanding the guidelines and are a source of ideas for alternate strategies for achieving accessibility. These strategies and notes are not mandatory. A manufacturer is not required to incorporate all of these examples or any specific example. Manufacturers are free to use these or other strategies in addressing the guidelines. The examples listed

here are not comprehensive, nor does adopting or incorporating them guarantee an accessible product. They are meant to provide a useful starting point for evaluating the accessibility of a product or conceptual design and are not intended to inhibit innovation. For a more complete list of all of the published strategies to date, as well as for further information and links to on-going discussions, the reader is referred to the National Institute on Disability and Rehabilitation Research's Rehabilitation Engineering Center on Access to Telecommunications System's strategies Web site (<http://trace.wisc.edu/world/telecomm/>).

2. This appendix is organized to correspond to the sections and paragraphs of the guidelines in this part to which the explanatory material relates. This appendix does not contain explanatory material for every section and paragraph of the guidelines in this part.

SUBPART A—GENERAL

Section 1193.3 Definitions

Readily Achievable

1. Section 255 defines "readily achievable" as having the same meaning as in the Americans with Disabilities Act (ADA). However, the ADA applies the term to the removal of barriers in existing public accommodations. Not all of the factors cited in the ADA or the Department of Justice (DOJ) implementing regulations (July 26, 1991) are easy to translate to the telecommunications context where the term applies to telecommunications equipment and customer premises equipment which is designed, developed and fabricated after February 8, 1996, the effective date of the Telecommunications Act of 1996.

2. It may not be readily achievable to make every product accessible or compatible. Depending on the design, technology, or several other factors, it may be determined that providing accessibility to all products in a product line is not readily achievable. The guidelines do not require accessibility or compatibility when that determination has been made, and it is up to the manufacturer to make it. However, the assessment as to whether it is or is not readily achievable cannot be bypassed simply because another product is already accessible. For this purpose, two products are considered to be different if they have different functions or features. Products which differ only cosmetically, where such differences do not affect functionality, are not considered separate products.

3. Below is a list of factors provided as interim guidance to manufacturers to assist them in making readily achievable assessments. The factors are derived from the ADA itself and the DOJ regulations and are presented in the order in which they appear in

those sources. Ultimately, the priority or weight of these factors is a compliance issue, under the jurisdiction of the Federal Communications Commission (FCC). Factors applicable to a determination of whether an action is readily achievable include: the nature and cost of the action needed to provide accessibility or compatibility; the overall resources of the manufacturer, including financial resources, technical expertise, component supply sources, equipment, or personnel; the overall financial resources of any parent corporation or entity, only to the extent such resources are available to the manufacturer; and whether the accessibility solution results in a fundamental alteration of the product.

a. One factor in making readily achievable assessments is the nature and cost of the action needed to provide accessibility or compatibility. The term readily achievable means that an action is "easily accomplishable and able to be carried out without much difficulty or expense." The nature of the action or solution involves how easy it is to accomplish, including the availability of technology and expertise, and the ability to incorporate the solution into the production process. Obviously, knowing about an accessibility solution, even in detail, does not mean it is readily achievable for a specific manufacturer to implement it immediately. Even if it only requires substituting a different, compatible part, the new part must be ordered and integrated into the manufacturing process. A more extreme implementation might require re-tooling or redesign. On the other hand, a given solution might be so similar to the current design, development and fabrication process that it is readily achievable to implement it virtually overnight.

b. Another factor in making readily achievable assessments is the overall resources of the manufacturer, including financial resources, technical expertise, component supply sources, equipment, or personnel. The monetary resources of a manufacturer are obviously a factor in determining whether an action is readily achievable, but it may be appropriate to consider other resources, as well. For example, a company might have ample financial resources and, at first glance, appear to have no reason for not including a particular accessibility feature in a given product. However, it might be that the company lacks personnel with experience in software development, for example, needed to implement the design solution. One might reason that, if the financial resources are available, the company should hire the appropriate personnel, but, if it does, it may no longer have the financial resources to implement the design solution. One would expect that the company would develop the technical expertise over time

and that eventually the access solution might become readily achievable.

c. Another factor in making readily achievable assessments is the overall financial resources of any parent corporation or entity, only to the extent such resources are available to the manufacturer. Both the ADA statutory definition of readily achievable and the DOJ regulations define the resources of a parent company as a factor. However, such resources are considered only to the extent those resources are available to the subsidiary. If, for example, the subsidiary is responsible for product design but the parent company is responsible for overall marketing, it may be appropriate to expect the parent company to address some of the marketing goals. If, on the other hand, the resources of a parent company are not available to the subsidiary, they may not be relevant. This determination would be made on a case-by-case basis.

d. A fourth factor in making readily achievable assessments is whether the accessibility solution results in a fundamental alteration of the product. This factor, derived by extension from the "undue burden" criteria of the ADA, takes into consideration the effect adding an accessibility feature might have on a given product. For example, it may not be readily achievable to add a large display for low vision users to a small pager designed to fit in a pocket, because making the device significantly larger would be a fundamental alteration of the device. On the other hand, adding a voice output may not involve a fundamental alteration and would serve both blind and low vision users. In addition, adding an infrared port might be readily achievable and would allow a large-display peripheral device to be coupled to it. Of course fundamental alteration means a change in the fundamental characteristic of the product, not merely a cosmetic or esthetic change.

SUBPART B—GENERAL REQUIREMENTS

Section 1193.23 Product Design, Development and Evaluation

Paragraph (a)

1. This section requires manufacturers to evaluate the accessibility, usability, and compatibility of telecommunications equipment and customer premises equipment and incorporate such evaluation throughout product design, development, and fabrication, as early and consistently as possible. Manufacturers must develop a process to ensure that products are designed, developed and fabricated to be accessible whenever it is readily achievable. Since what is readily achievable will vary according to the stage of development (i.e., some things will be readily achievable in the design phase which

may not be in later phases), barriers to accessibility and usability must be identified throughout product design and development, from conceptualization to production. Moreover, usability can be seriously affected even after production, if information is not provided in an effective manner.

2. The details of such an evaluation process will vary from one company to the next, so this section does not specify its structure or specific content. Instead, this section sets forth a series of factors that a manufacturer must consider in developing such a process. How, and to what extent, each of the factors is incorporated in a specific process is up to the manufacturer.

3. Different manufacturers, or even the same manufacturer at different times, have the flexibility to tailor any such plan to its own particular needs. This section does not prescribe any particular plan or content. It does not require that such a process be submitted to any entity or that it even be in writing. The requirement is outcome-oriented, and a process could range from purely conceptual to formally documented, as suits the manufacturer.

4. The goal is for designers to be aware of access and incorporate such considerations in the conceptualization of new products. When an idea is just beginning to take shape, a designer would ask, "How would a blind person use this product? How would a deaf person use it?" The sooner a manufacturer makes its design team cognizant of design issues for achieving accessibility; and proven solutions for accessibility and compatibility, the easier this process will be.

Paragraph (b)(1)

Market Research

1. The guidelines do not require market research, testing or consultation, only that they be considered and incorporated to the extent deemed appropriate for a given manufacturer. If a manufacturer has a large marketing effort, involving surveys and focus groups, it may be appropriate to include persons with disabilities in such groups. On the other hand, some small companies do not do any real marketing, per se, but may just notice that a product made by XYZ Corporation is selling well and, based on this "marketing survey" it decides it can make a cheaper one. Clearly, "involvement" of persons with disabilities is not appropriate in this case.

2. A manufacturer must consider how it could include individuals with disabilities in target populations of market research. It is important to realize that any target population for which a manufacturer might wish to focus a product contains individuals with disabilities, whether it is teenagers, single parents, women between the ages of 25 and 40, or any other subgroup, no matter how

narrowly defined. Any market research which excludes individuals with disabilities will be deficient.

Paragraph (b)(2)

Product Design, Testing, Pilot Demonstrations, and Product Trials

1. Including individuals with disabilities in product design, testing, pilot demonstrations, and product trials will encourage appropriate design solutions to accessibility barriers. In addition, such involvement may result in designs which have an appeal to a broader market.

Paragraph (b)(3)

Working Cooperatively With Appropriate Disability-Related Organizations

1. Working cooperatively with appropriate disability-related organizations is one of the factors that manufacturers must consider in their product design and development process. The primary reason for working cooperatively is to exchange relevant information. This is a two-way process since the manufacturer will get information on barriers to the use of its products, and may also be alerted to possible sources for solutions. The process will also serve to inform individuals with disabilities about what is readily achievable. In addition, manufacturers will have a conduit to a source of subjects for market research and product trials.

2. Manufacturers should consult with representatives from a cross-section of disability groups, particularly individuals whose disabilities affect hearing, vision, movement, manipulation, speech, and interpretation of information.

3. Because of the complex interrelationship between equipment and services in providing accessibility to telecommunications products, coordination and cooperation between manufacturers and service providers will be beneficial. Involving service providers in the product development process will encourage appropriate design solutions to accessibility barriers and permit the exchange of relevant information.

Paragraph (b)(4)

Making Reasonable Efforts to Validate Unproven Access Solutions

1. Manufacturers must consider how they can make reasonable efforts to validate any unproven access solutions through testing with individuals with disabilities or with appropriate disability-related organizations that have established expertise with individuals with disabilities. It is important to obtain input from persons or organizations with established expertise to ensure that input is not based merely on individual preferences or limited experience.

2. This input should be sought from representatives from a cross-section of disability groups, particularly individuals whose disabilities affect hearing, vision, movement, manipulation, speech, and interpretation of information.

SUBPART C—REQUIREMENTS FOR
ACCESSIBILITY AND USABILITY

*Section 1193.33 Information, Documentation,
and Training*

Paragraph (a)

1. This section requires that manufacturers provide access to information and documentation. The information and documentation includes user guides, installation guides, and product support communications, regarding both the product in general and the accessibility features of the product. Information and documentation should be provided to people with disabilities at no additional charge. Alternate formats or alternate modes of this information is also required to be available. Manufacturers should also encourage distributors of their products to establish information dissemination and technical support programs similar to those established by the manufacturer.

Alternate Formats and Alternate Modes

1. Alternate formats may include, but are not limited to, Braille, ASCII text, large print, and audio cassette recording. Alternate modes may include, but are not limited to, voice, fax, relay service, TTY, Internet posting, captioning, text-to-speech synthesis, and video description.

2. In considering how to best provide product information to people with disabilities, it is essential that information be provided in an alternate format or mode that is usable by the person needing the information. For example, some individuals who are blind might require a manual in Braille to understand and use the product effectively. Other persons who are blind may prefer this information on a computer disk. Persons with limited reading skills may need this information recorded on audio cassette tape so they can listen to the manual. Still other persons with low vision may be able to read the text version of the manual if it is provided in a larger font. Likewise, if a tutorial video is provided, persons who are deaf may require a captioned version so that they will understand how to use the product effectively. Finally, individuals who rely on TTYs will need direct TTY access to a customer service line so they can ask questions about a product like everyone else.

3. This portion of the appendix explains how to provide information in alternate for-

ats (Braille, ASCII text, large print, audio cassette) to persons with disabilities.¹

Braille

4. Some persons who are blind rely on the use of Braille in order to obtain information that is typically provided in print. These persons may need Braille because of the nature of their disability (such as persons who are deaf-blind) or because of the complexity of the material. Most large urban areas have companies or organizations which can translate printed material to Braille. On the other hand, manufacturers may wish to consider producing Braille documents "in house" using a personal computer, Braille translation software, and a Braille printer. The disadvantage is the difficulty in ensuring quality control and accuracy. Software programs exist which can translate common word processing formats directly into Braille, but they are not always error free, especially if the document contains special characters, jargon, graphics, or charts. Since the typical office worker will not be able to proofread a Braille document, the initial apparent cost saving may be quickly lost by having to re-do documents. The Braille translation software costs approximately \$500 and most Braille printers sold range from \$2,000 to \$5,000, however some Braille printers, depending on the speed and other features, do cost more. Depending on the quality of Braille to be generated, a Braille printer in the \$4,000 range should be adequate for most users. By using automatic translation software, individuals who do not have knowledge of Braille or who have limited computer skills may be able to produce simple Braille documents without much trouble. If the document is of a complex format, however, such as a text box over multiple columns, a sophisticated knowledge of Braille translation software and formatting will be required.

Electronic Text

5. People who are blind or have low vision and who have access to computers may be able to use documents in electronic form. Electronic text must be provided in ASCII or a properly formatted word processor file. Using electronic text allows this information to be transmitted through e-mail or other on-line telecommunications. Blind or low vision persons who have access to a personal computer can then read the document using synthetic speech, an electronic Braille display, a large print computer monitor, or they can produce a hard copy in large print or Braille.

¹This information was provided by the American Foundation for the Blind.

6. Documents prepared for electronic transmission should be in ASCII. Documents supplied on disk should also be provided in either ASCII or a word processor format usable by the customer. Word processing documents should be properly formatted before distribution or conversion to ASCII. To be correctly formatted, the document should be in Courier 10 point size and formatted for an 80 character line. Tables should be converted to plain text. Graphics or text boxes should be deleted and explained or described in text format. This will allow the reader to understand all of the documentation being presented. Replace bullets (●) with "*" or "-" and convert other extended ASCII characters into text. When converting a document into ASCII or word processor formats, it is important to utilize the appropriate "tab key" and "centering key" rather than using the space bar. This is necessary because Braille translation software relies on the proper use of commands to automate the formatting of a Braille document.

Large Print

7. Persons with low vision may require documentation to be provided in large print. Large print documents can easily be produced using a scalable font from any good word processing program and a standard laser printer. Using the document enlargement option on a photocopier will usually yield unsatisfactory results.

8. To obtain the best results follow these guidelines:

a. It is preferable to use paper that is standard 8½ × 11 inches. Larger paper may be used, but care should be taken that a document does not become too bulky, thus making it difficult to read. Always use 1 inch margins. Lines longer than 6⅓ inches will not track well for individuals who must use a magnifier.

b. The best contrast with the least glare is achieved on very pale yellow or cream-colored non-glossy paper, such as paper that is used for photocopying purposes. To produce a more aesthetic looking document, an off-white paper may be used and will still give good contrast while producing less glare than white. Do not use dark colors and shades of red. Double-sided copying (if print does not bleed through) will produce a less bulky document.

c. Remove formatting codes that can make reading more difficult. For example, centered or indented text could be difficult to track because only a few words will fit on a line. All text should begin at the left margin. Use only left margin justification to maintain uniform spacing across lines. Right margin justification can produce uneven spacing between letters and words. Use 1¼ (1.25) line spacing; do not double space. Replace tabs with two spaces. Page numbering should be at the top or bottom left. Avoid

columns. If columns are absolutely necessary, use minimum space between columns. Use dot leaders for tabular material. For those individuals who are able to read graphics (via the use of a magnifier or other assistive device) graphics should be included, but placed on a separate page from the text. For those individuals with low vision who are unable to read graphics, tables, and charts this material must be removed from the document and an accurate description of this material should be included in a text format.

d. There is no standard typeface or point size. For more universal access, use 18 point type; anything larger could make text too choppy to read comfortably. Use a good strong bold typeface. Do not use italics, fine, or fancy typefaces. Do not use compressed typefaces; there should be normal "white space" between characters.

e. Use upper and lowercase letters.

f. Using these instructions, one page of print (11-12 point type) will equal approximately three pages of large print (14-18 point) depending on the density of the text.

Cassette Recordings

9. Some persons who are blind or who have learning disabilities may require documentation on audio cassettes. Audio materials can be produced commercially or in-house. Agencies sometimes record material in-house and purchase a high speed tape duplicator (\$1,000-2,000) which is used to make cassette copies from the master. The cost of a duplicator can be higher depending upon the number of copies produced on a single run, and whether the duplicator can produce standard speed two-sided copies or half-speed four-sided copies. Although unit costs can be reduced by using the four-track, half-speed format, this will require the reader to use a specially designed playback machine. Tapes should be produced with "tone indexing" to allow a user to skip back and forth from one section to another. By following a few simple guidelines for selecting readers and creating recordings, most organizations will be able to successfully record most simple documents.

10. Further guidance in making cassette recordings includes:

a. The reader should be proficient in the language being recorded.

b. The reader should be familiar with the subject. Someone who is somewhat familiar with the technical aspects of a product but who can explain functions in ordinary language would be a logical person to record an audio cassette.

c. The reader should have good diction. Recording should be done in a conversational tone and at a conversational pace; neither too slow nor too fast.

d. The reader should be familiar with the material to minimize stumbling and hesitation.

e. The reader should not editorialize. When recording a document, it should be read in full. Graphic and pictorial information available to sighted readers should be described in the narrated text. Tables and charts whose contents are not already contained in text should be converted into text and included in the recording.

f. The reader should spell difficult or unusual words and words of foreign origin.

g. At the beginning of the tape, identify the reader, i.e., "This document is being read by John Smith."

h. On each side of the tape, identify the document and the page number where the reader is continuing, i.e., "tape 2, side 1, Guide to Barrier Free Meetings, continuing on page 75."

i. For blind users, all cassettes should be labeled in Braille so that they can easily be referenced in the appropriate order.

Alternate Modes

11. Information is provided increasingly through a variety of means including television advertisements, Internet postings, information seminars, and telephone. This portion of the appendix explains how to provide information in some alternate modes (captioning, video description, Internet postings, relay service, and TTY).

Captioning

12. When manufacturers of telecommunications equipment or customer premises equipment provide videos with their products (such as tutorials or information explaining various components of a product) the video should be available with captioning. Closed captioning refers to assistive technology designed to provide access to television for persons with hearing disabilities that is visible only through the use of a decoder. Open captions are visible at all times. Captioning is similar to subtitles in that the audio portion of a television program is displayed as printed words on the television screen. Captions should be carefully placed to identify speakers, on-and off-screen sound effects, music and laughter. Increased captioning was made possible because of the Television Decoder Circuitry Act which requires all television sets sold in the United States with screens 13 inches or larger to have built-in decoder circuitry.

13. Although captioning technology was developed specifically to make television and video presentations accessible to deaf and hard of hearing people, there has been widespread interest in using this technology to provide similar access to meetings, classroom teaching, and conferences. For meetings, video-conferences, information seminars, and the like, real-time captioning is sometimes provided. Real-time captioning uses a stenographic machine connected to a

computer with translation software. The output is then displayed on a monitor or projected on a screen.

Video Description

14. Just as manufacturers of telecommunications equipment and customer premises equipment need to make their videos accessible to persons who are deaf or hard of hearing, they must also be accessible to persons who are blind or have low vision. This process is known as video description. Video description may either be a separate audio track that can be played simultaneously with the regular audio portion of the video material (adding description during pauses in the regular audio), or it can be added to (or "mixed" with) an existing soundtrack. The latter is the technique used for videotapes.

Internet Postings

15. The fastest growing way to obtain information about a product is through use of the Internet, and specifically the World Wide Web. However, many Internet users with disabilities have difficulty obtaining this information if it is not correctly formatted. This section provides information on how to make a World Wide Web site more accessible to persons with disabilities². Because of its structure, the Web provides tremendous power and flexibility in presenting information in multiple formats (text, audio, video, and graphic). However, the features that provide power and elegance for some users present potential barriers for people with sensory disabilities. The indiscriminate use of graphic images and video restrict access for people who are blind or have low vision. Use of audio and non-captioned video restrict access for people who are deaf or hard of hearing.

16. The level of accessibility of the information on the Web is dependent on the format of the information, the transmission media, and the display system. Many of the issues related to the transmission media and the display system cannot be affected by the general user. On the other hand, anyone creating information for a Web server has control of the accessibility of the information. Careful design and coding of information will provide access to all people without compromising the power and elegance of the Web site.

17. A few suggestions are:

²This information is based on the document "Writing HTML Documents and Implementing Accessibility for the World Wide Web" by Paul Fountaine, Center for Information Technology Accommodation, General Services Administration. For further information, see <http://www.gsa.gov/coca>.

a. Every graphic image should have associated text. This will enable a person using a character-based program, such as Lynx, to understand the material being presented in the graphical format. It also allows anyone who does not want to wait for graphics to load to have quick access to the information on the site.

b. Provide text transcriptions or descriptions for all audio output. This will enable people who are deaf or hard of hearing to have access to this information, as well as individuals who do not have sound cards.

c. Make any link text descriptive, but not verbose. For example, words like "this", "here", and "click" do not convey enough information about the nature of the link, especially to people who are blind. Link text should consist of substantive, descriptive words which can be quickly reviewed by the user. Conversely, link text which is too long bogs down efficient browsing.

d. Provide alternate mechanisms for online forms. Forms are not supported by all browsers. Therefore, it is important to provide the user with an opportunity to select alternate methods to access such forms.

e. All Web pages should be tested using multiple viewers. At a minimum, pages should be tested with the latest version of Lynx to ensure that they can be used with screen reader software.

Telecommunications Relay Services (TRS)

18. By using telecommunications relay services (TRS), it has now become easier for persons with hearing and speech disabilities to communicate by the telephone. TRS links TTY users with those who do not have a TTY and use standard telephones. With TRS, a TTY user communicates with another person with the help of a communications assistant who is able to talk on the telephone and then communicate by typing the message verbatim, to the TTY user. The communications assistant also reads the message typed by the TTY user, or the TTY user may speak for him or herself using voice carry over.

19. There are now TRS programs in every state. Although TRS is very valuable, it does have limitations. For example, relay calls take longer, since they always involve a third party, and typing words takes longer than speaking words.

Text Telephones (TTYs)

20. A TTY also provides direct two-way typed conversations. The cost of these devices begins at approximately \$200 and they can be operated by anyone who can type.

21. The following information is excerpted from the brochure "Using a TTY" which is available free of charge from the Access Board:

a. If the TTY line is also used for incoming voice calls, be sure the person who answers

the phone knows how to recognize and answer a TTY call. You will usually hear silence, a high-pitched, electronic beeping sound, or a pre-recorded voice message when it is a TTY call. If there is silence, assume it is a TTY call.

b. TTYs should be placed near a standard telephone so there is minimal delay in answering incoming TTY calls.

c. To initiate a TTY call, place the telephone headset in the acoustic cups of the TTY adapter. If the TTY unit is directly connected to the phone line, there is no need to put the telephone headset in the acoustic cups. Turn the TTY on. Make sure there is a dial tone by checking for a steady light on the TTY status indicator.

d. Dial the number and watch the status indicator light to see if the dialed number is ringing. The ring will make a long slow flash or two short flashes with a pause in between. If the line is busy, you will see short, continuous flashes on the indicator light. When the phone is answered, you will see an irregular light signal as the phone is picked up and placed in the cradle. If you are calling a combination TTY and voice number, tap the space bar several times to help the person on the other end identify this as a TTY call.

e. The person who answers the call is the first to type. Answer the phone as you would by voice, then type "GA".

f. "GA" means "I'm done, go ahead and type". "HD" means hold. "GA or SK" means "Is there anything more, I'm done". "SK" means stop keying. This is how you show that the conversation is ended and that you will hang up. It is polite to type good-bye, thank you for calling, or some other closing remark before you type "SK". Stay on the line until both parties type SKSK.

22. Because of the amount of time it takes to send and receive messages, it is important to remember that short words and sentences are desired by both parties. With some TTY calls it is often not possible to interrupt when the other person is typing. If you get a garbled message in all numbers or mixed numbers and letters, tap the space bar and see if the message clears up. If not, when the person stops typing, you should type, "Message garbled, please repeat." If the garbled messages continue, this may mean that one of the TTYs is not working properly, there is background noise causing interference, or that you may have a bad connection. In this case you should say something like, "Let's hang up and I'll call you back."

23. The typical TTY message will include many abbreviations and jargon. The message may also include misspelled words because, if the meaning is clear, many callers will not bother to correct spelling since it takes more time. Also, some TTY users communicate in American sign language, a language with its own grammar and syntax. English may be a second language. Extend the same patience

and courtesy to TTY callers as you do to all others.

Paragraph (b)

1. This paragraph requires manufacturers to supply a point of contact for obtaining information about accessibility features of the product and how to obtain documents in alternate formats. This could be the name of a specific person, a department or an office. Supplying a telephone number, and preferably a separate TTY number, is the most universal method. Web site and e-mail addresses are also desirable, but should not substitute for a telephone number since many more people have access to a telephone than have e-mail or Internet access. Of course, the means for requesting additional accessibility information must, itself, be accessible.

2. Automated voice response systems are not usable by deaf and hard of hearing persons. An approach to consider is to augment an automated voice response system with an automated TTY response system that also detects whether a caller is using voice or TTY.

3. The phone number should be prominently displayed in product literature. Ideally, it should be displayed on the outside of the package so that a potential buyer can obtain information about the accessibility before purchase. In addition, manufacturers should acquaint their distributors with this information so that they can assist customers with disabilities, such as a blind person unable to read the package information.

Paragraph (c)

1. This paragraph requires manufacturers to consider including information on accessibility in training a manufacturer provides to its staff. For example, if technical support staff are trained on how to provide good technical support, such a program should be expanded to include information on accessibility features of the manufacturer's products and peripheral devices that are compatible with them. Such staff should also have basic information on how to handle TTY and relay calls. Personnel who deal directly with the public, including market researchers, should be trained in basic disability "etiquette."

*Section 1193.35 Redundancy and Selectability
[Reserved]*

1. Although this section is reserved, manufacturers of telecommunications equipment and customer premises equipment are encouraged to provide redundancy such that input and output functions are available in more than one mode.

2. Alternate input and output modes should be selectable by the user.

3. Products should incorporate multiple modes for input and output functions so the user is able to select the desired mode.

a. Since there is no single interface design that accommodates all disabilities, accessibility is likely to be accomplished through various product designs which emphasize interface flexibility to maximize user configurability and multiple, alternative and redundant modalities of input and output.

b. Selectability is especially important where an accessibility feature for one group of individuals with disabilities may conflict with an accessibility feature for another. This potential problem could be solved by allowing the user to switch one of the features on and off. For example, a conflict may arise between captioning (provided for persons who are deaf or hard of hearing) and a large font size (provided for persons with low vision). The resulting caption would either be so large that it obscures the screen or need to be scrolled or displayed in segments for a very short period of time.

c. It may not be readily achievable to provide all input and output functions in a single product or to permit all functions to be selectable. For example, switching requires control mechanisms which must be accessible and it may be more practical to have multiple modes running simultaneously. Whenever possible, it is preferable for the user to be able to turn on or off a particular mode.

4. Some experiments with smart cards are showing promise for enhancing accessibility. Instead of providing additional buttons or menu items to select appropriate input and output modes, basic user information can be stored on a smart card that triggers a custom configuration. For example, insertion of a particular card can cause a device to increase the font size on a display screen or activate speech output. Another might activate a feature to increase volume output, lengthen the response time between sequential operations, or allow two keys to be pressed sequentially instead of simultaneously. This technology, which depends on the issuance of a customized card to a particular individual, would allow redundancy and selectability without adding additional controls which would complicate the operation. As more and more functions are provided by software rather than hardware, this option may be more readily achievable.

5. The increasing use of "plug-ins" allow a product to be customized to the user's needs. Plug-ins function somewhat like peripheral devices to provide accessibility and there is no fundamental problem in using plug-ins to provide access, as long as the accessibility plug-ins are provided with the product. For example, at least one computer operating system comes packaged with accessibility enhancements which a user can install if wanted. In addition, modems are typically

sold with bundled software that provides the customer premises equipment functionality. A compatible screen reader program, for example, could be bundled with it. At least one software company has developed a generalized set of accessibility tools designed to be bundled with a variety of software products to provide access. As yet, such developments are not fully mature; most products are still installed by providing on-screen visual prompts, not accompanied by meaningful sounds.

Section 1193.41 Input, Controls, and Mechanical Functions

Paragraph (a)

Operable Without Vision

1. Individuals who are blind or have low vision cannot locate or identify controls, latches, or input slits by sight or operate controls that require sight. Products should be manufactured to be usable independently by these individuals. For example, individuals who cannot see must use either touch or sound to locate and identify controls. If a product uses a flat, smooth touch screen or touch membrane, the user without vision will not be able to locate the controls without auditory or tactile cues.

2. Once the controls have been located, the user must be able to identify the various functions of the controls. Having located and identified the controls, individuals must be able to operate them.

3. Below are some examples of ways to make products accessible to persons with visual disabilities:

a. If buttons are used on a product, make them discrete buttons which can be felt and located by touch. If a flat membrane is used for a keyboard, provide a raised edge around the control areas or buttons to make it possible to locate the keys by touch. Once an individual locates the different controls, he or she needs to identify what the keys are. If there is a standard number pad arrangement, putting a nib on the “5” key may be all that is necessary for identifying the numbers. On a QWERTY keyboard, putting a tactile nib on the “F” and “J” keys allows touch typists to easily locate their hands on the key.

b. Provide distinct shapes for keys to indicate their function or make it easy to tell them apart. Provide Braille labels for keys and controls for those who read Braille to determine the function and use of controls.

c. Provide large raised letters for short labels on large objects. Where it is not possible to use raised large letters, a voice mode selection could be incorporated that announces keys when pressed, but does not activate them. This would allow people to turn on the voice mode long enough to explore and locate the item they are interested in, then release the voice mode and press the control. If

it is an adjustable control, voice confirmation of the status may also be important.

d. Provide tactile indication on a plug which is not a self-orienting plug. Wireless connections, which eliminate the need to orient or insert connectors, also solve the problem.

e. Avoid buttons that are activated when touched to allow an individual to explore the controls to find the desired button. If touch-activated controls cannot be avoided (for example, on a touch screen), provide an alternate mode where a confirm button is used to confirm selections (for example, items are read when touched, and activated when the confirm button is pressed). All actions should be reversible, or require confirmation before executing non-reversible actions.

f. Once controls have been located and users know what the functions are, they must be operable. Some types of controls, including mouse devices, track balls, dials without markings or stops, and push-button controls with only one state, where the position or setting is indicated only by a visual cue, will not be usable by persons who are blind or have low vision. Providing a rotational or linear stop and tactile or audio detents is a useful strategy. Another is to provide keyboard or push-button access to the functions. If the product has an audio system and microprocessor, use audio feedback of the setting. For simple products, tactile markings may be sufficient.

g. Controls may also be shaped so that they can easily be read by touch (e.g., a twist knob shaped like a pie wedge). For keys which do not have any physical travel, some type of audio or tactile feedback should be provided so that the individual knows when the key has been activated. A two-state key (on/off) should be physically different in each position (e.g., a toggle switch or a push-in/pop-out switch), so the person can tell what state the key is in by feeling it.

h. If an optional voice mode is provided for operating a product, a simple “query” mode can also be provided, which allows an individual to find out the function and state of a switch without actually activating it. In some cases, there may be design considerations which make the optimal mode for a sighted person inaccessible to someone without vision (e.g., use of a touch screen or mouse). In these cases, a primary strategy may be to provide a closely linked parallel method for efficiently achieving the same results (e.g., keyboard access) if there is a keyboard, or “SpeedList” access for touch screens.

Paragraph (b)

Operable With Low Vision and Limited or No Hearing

1. Individuals with low vision often also have hearing disabilities, especially older individuals. These persons cannot rely solely on audio access modes commonly used by people who are blind. Tactile strategies are still quite useful, although many older persons may not be familiar with Braille. The objective, therefore, is to maximize the number of people who can use their residual vision, combined with tactile senses, to operate a product.

2. Strategies for addressing this provision may include the following: a. Make the information on the product easier to see. Use high-contrast print symbols and visual indicators, minimize glare on the display and control surfaces, provide adequate lighting, position controls near the items they control to make them easy to find, and use Arabic instead of Roman numerals.

b. The type-face and type-spacing used can greatly affect legibility. The spacing between letters should be approximately 1/16 the height of uppercase letters and the spacing should be uniform from one label to the next. Also, symbols can sometimes be used which are much more legible and understandable than fine print.

c. Where the display is dynamic, provide a means for the user to enlarge the display and to "freeze" it. In addition to making it easier to see, there are strategies which can be used to reduce the need to see things clearly in order to operate them.

d. A judicious use of color-coding, always redundant with other cues, is extremely helpful to persons with low vision. These cues should follow standard conventions, and can be used to reduce the need to read labels (or read labels more than the first time). In addition, all of the tactile strategies discussed under section 1193.41 (a) can also be used here.

Paragraph (c)

Operable With Little or No Color Perception

1. Many people are unable to distinguish between certain color combinations. Others are unable to see color at all.

2. Strategies for addressing this provision include:

a. Eliminate the need for a person see color to operate the product. This does not eliminate the use of color completely but rather requires that any information essential to the operation of a product also be conveyed in some other fashion.

b. Avoid color pairs such as red/green and blue/yellow, that are indistinguishable by people with limited color perception.

c. Provide colors with different hues and intensity so that colored objects can be dis-

tinguished even on a black and white screen by their different appearance. Depending upon the product, the manufacturer may also be able to allow users to adjust colors to match their preferences and visual abilities.

d. Avoid colors with a low luminance.

Paragraph (d)

Operable Without Hearing

1. Individuals who are deaf or hard of hearing cannot locate or identify controls that require hearing. Products that provide only audio prompts cannot be used by individuals who are deaf or hard of hearing. For example, a voice-based interactive product that can be controlled only by listening to menu items and then pressing buttons is not accessible. By addressing the output issues under section 1193.43(d) many accessibility problems that affect input under this section can be solved.

2. Some strategies include:

a. Text versions of audio prompts could be provided which are synchronized with the audio so that the timing is the same.

b. If prompts are provided visually and no speech or vocalization is required, most problems associated with locating, identifying, and operating controls without hearing will be solved.

Paragraph (e)

Operable With Limited Manual Dexterity

1. Individuals may have difficulty manipulating controls on products for any number of reasons. Though these disabilities may vary widely, these persons have difficulty grasping, pinching, or twisting objects and often have difficulty with finer motor coordination. Some persons may use a headstick, mouthstick, or artificial limb.

2. Below are some strategies which will assist in designing products which will meet the needs of these persons:

a. Provide larger buttons and controls, or buttons which are more widely spaced, to reduce the likelihood that a user will accidentally activate an adjacent control.

b. Provide guard bars between the buttons or near the buttons so that accidental movements would hit the guard bars rather than accidentally bumping switches.

c. Provide an optional mode where buttons must be depressed for a longer period of time (e.g., SlowKeys) before they would accept input to help separate between inadvertent motions or bumps and desired activation.

d. Where two buttons must be depressed simultaneously, provide an option to allow them to be activated sequentially (e.g., StickiKeys).

e. Avoid buttons which are activated merely by touch, such as capacitance switches. Where that is difficult to do (e.g., with touchscreens), provide a "confirm" button

which an individual can use to confirm that the item touched is the desired one. Also, make all actions reversible, or request confirmation before initiating non-reversible actions.

f. Avoid latches, controls, or key combinations which require simultaneous activation of two or more buttons, or latches. Also, avoid very small controls or controls which require rotation of the wrist or pinching and twisting. Where this is not possible, provide alternate means for achieving the same functions.

g. Controls which have non-slip surfaces and those that can be operated with the side of the hand, elbow or pencil can be used to minimize physical activity required. In some cases, rotary controls can be used if they can be operated without grasping and twisting (e.g., a thin pie slice shape control or an edge control). Providing a concave top on buttons makes them easier to use.

h. Make it easier to insert cards or connectors by providing a bevel around the slot or connector, or use cards or connectors which can be inserted in any orientation or which self-center or self-align. Placing the slot or connector on the front and near a ledge or open space allows individuals to brace their hands or arms to make use of the slot or connector easier.

i. For some designs, controls which pose problems for individuals with disabilities may be the most efficient, logical or effective mechanism for a majority of users. In these cases, provide alternate strategies for achieving the same functions, but which do not require fine manipulation. Speech input or voice recognition could be provided as an alternate input, although it should not be the only input technique.

Paragraph (f)

Operable With Limited Reach and Strength

1. Some individuals may have difficulty operating systems which require reach or strength. The most straight-forward solution to this problem is to place the controls where they can be easily reached with minimal changes to body position. Many products also have controls located on different parts of the product.

2. When this is the case, the following strategies may be used:

a. Allow the functions to be controlled from the keyboard, which is located directly in front of the user.

b. Allow voice recognition to be used as an option. This provides input flexibility, but should never be the only means for achieving a function.

c. Provide a remote control option that moves all of the controls for the product together on a unit that can be positioned optimally for the individual. This allows the individual to operate the product without hav-

ing to move to it. If this strategy is used, a standard communication format would be important to allow the use of alternate remote controls for those who cannot use the standard remote control.

d. Reduce the force needed to operate controls or latches and avoid the need for sustained pressure or activity (e.g., use guards rather than increased strength requirements to avoid accidental activation of crucial switches).

e. Provide arm or wrist rests or supports, create short cuts that reduce the number of actions needed, or completely eliminate the need to operate controls wherever possible by having automatic adjustments.

f. Section 4.34.3 of the Americans with Disabilities Act Accessibility Guidelines (ADAAG) also contains specific information concerning reach ranges. ADAAG gives specific guidance concerning access to the built environment. Section 4.34.3 indicates the reach ranges for a front or parallel approach to equipment for individuals using a wheelchair. This information may prove useful for those telecommunications manufacturers whose equipment is stationary, such as an information kiosk.

Paragraph (g)

Operable Without Time-Dependent Controls

1. Many persons find it very difficult to operate time-dependent controls.

2. Some strategies which address this problem include:

a. Avoid any timed-out situations or provide instances where the user must respond to a question or moving display in a set amount of time or at a specific time (e.g., a rotating display).

b. Where timed responses are required or appropriate, allow the user to adjust them or set the amount of time allotted to complete a given task. Warn users that time is running out and allow them to secure extended time.

c. If the standard mode of operation would be awkward or inefficient, then provide an alternate mode of operation that offers the same functions.

Paragraph (h)

Operable Without Speech

1. Many individuals cannot speak or speak clearly. Products which require speech in order to operate them should also provide an alternate way to achieve the same function.

2. Some strategies to achieve this include:

a. Provide an alternate mechanism for achieving all of the functions which are controlled by speech. If a product includes speech identification or verification, provide an alternate mechanism for this function as well.

b. Include individuals who are deaf or who have speech disabilities in the subject populations that are used to develop voice recognition algorithms, so that the algorithms will better accommodate a wider range of speech patterns.

Paragraph (i)

Operable With Limited Cognitive Skills

1. Many individuals have reduced cognitive abilities, including reduced memory, sequence tracking, and reading skills. This does not necessarily prevent these persons from using a telecommunications product or feature.

2. The following strategies are extensions of techniques for making products easier for everyone to learn and use:

a. Use standard colors and shapes and group similar functions together. On products which have some controls that are used by everyone and other controls which would only be used by advanced users, it is generally good practice to separate the two, putting the more advanced features behind a door or under a separate menu item.

b. Products which read the contents of the display aloud, or controls which announce their settings, are easier for individuals who have difficulty reading.

c. Design products that are self-adjusting to eliminate additional controls which must be learned, and reduce the visual clutter.

d. On products which have sign-in procedures, allow user settings to be associated with them when they sign in or insert their identification card. The system can then autoconfigure to them. Some new "smart cards" are being designed with user preferences encoded on the card.

e. Where a complex series of steps is required, provide cuing to help lead the person through the process. It is also helpful to provide an "undo" or back up function, so that any mistakes can be easily corrected. Most people will find this function helpful.

f. Where functions are not reversible, request some type of confirmation from the user before proceeding. On labels and instructions, it is helpful to use short and simple phrases or sentences. Avoid abbreviations wherever possible. Eliminate the need to respond within a certain time or to read text within a certain time.

Section 1193.43 Output, Displays, and Control Functions

Paragraph (a)

Availability of Visual Information

1. Just as persons with visual or cognitive disabilities need to be able to operate the input, controls, and mechanical functions of a product, they must also have access to the output functions.

2. The following are strategies for addressing this provision:

a. Provide speech output of all displayed text and labels. For information which is presented in non-text form (e.g., a picture or graphic), provide a verbal description unless the graphic is just decorative. When speech output is provided, allow for the spoken message to be repeated if the message is very long. Also, if the information being provided is personal in nature, it is recommended that headphones be provided in order to assure privacy. A message for stepping through menus is also helpful.

b. Providing Braille labels for controls is an extremely effective mechanism for those individuals who read Braille.

c. Large raised print can also be used but is generally restricted to rather large objects due to the size of the letters.

Paragraph (b)

Availability of Visual Information for Low Vision Users

1. Individuals with low vision often also have hearing disabilities, especially older individuals. These persons cannot rely solely on audio access modes commonly used by people who are blind. Tactile strategies are still quite useful. Many people who have low vision can use their vision to access visually presented information on a product.

2. Strategies for meeting this provision involve:

a. Provide larger, higher contrast text and graphics. Individuals with 20/200 vision can see lettering if they get close to it, unless it is very small or has very poor contrast. Although 14 or 18 point type is recommended for visual displays, it is usually not possible to put this size text on small products.

b. Make the lettering as large and high contrast as possible to maximize the number of people who can use the product.

c. On displays where the font size can be varied, allow the user to increase the font size, even if it means that the user must pan or move in order to see the full display.

Paragraph (c)

Access to Moving Text

1. Moving text can be an access problem because individuals with low vision, or other disabilities may find it difficult or impossible to track moving text with their eyes.

2. Strategies to address this requirement may include the following:

a. Provide a mechanism for freezing the text. Thus, persons could read the stationary text and obtain the same information.

b. Provide scrolling to display one full line at a time, with a pause before the next line replaces it.

c. Provide the same information in another type of display which does not move. The

right-to-left scrolling text on a TTY does not usually present a problem because it can be controlled by asking the sender to type slower or pause at specified intervals.

Paragraph (d)

Availability of Auditory Information

1. Individuals who have hearing disabilities are unable to receive auditory output, or mechanical and other sounds that are emitted by a product. These sounds are often important for the safe or effective operation of the product. Therefore, information which is presented auditorially should be available to all users.

2. Some strategies to achieve this include the following:

a. Provide a visual or tactile signal that will attract the person's attention and alert the user to a call, page, or other message, or to warn the user of significant mechanical difficulties in the product.

b. In portable products, a tactile signal such as vibration is often more effective than a visual signal because a visual signal may be missed. An auxiliary vibrating signaler might be effective if it is not readily achievable or effective to build vibration into a portable product.

c. For stationary products, a prominent visual indicator in the field of vision (e.g., a screen flash for a computer, or a flashing light for a telephone) is effective. To inform the user of the status of a process (e.g., line status on a telephone call, power on, saving to disk, or disconnected), text messages may be used. It is also desirable to have an image or light that is activated whenever acoustic energy is present on a telephone line.

d. Speech messages should be portrayed simultaneously in text form and displayed where easily seen by the user. Such captions should usually be verbatim and displayed long enough to be easily read. If the product provides speech messages and the user must respond to those messages (e.g., interactive voice response and voice mail), a TTY accessible method of accessing the product could be provided.

e. TTY to TTY long distance and message unit calls from pay telephones are often not possible because an operator says how much money must be deposited. Technology exists to have this information displayed on the telephone and a test installation is currently operating at the Butler plaza on the Pennsylvania Turnpike. In addition, if the product provides interactive communication using speech and video, it would be helpful to provide a method and channel for allowing non-speech communication (e.g., text conversation) in parallel with the video.

f. Certain operations of products make sounds that give status information, although these sounds are not programmed signals. Examples include the whir of an op-

erating disk drive and the click of a key being pushed. Where sounds of this type provide information important for operating the product, such as a "beep" when a key is activated, provide a light or other visual confirmation of activation.

Paragraph (e)

Availability of Auditory Information for People Who Are Hard of Hearing

1. People who are hard of hearing but not deaf can often use their hearing to access auditory information on a product.

2. Strategies for addressing this requirement may include the following:

a. Improve the signal to noise ratio by making the volume adjustable, between 18–25 dB, increasing the maximum undistorted volume, and minimizing background noise by such methods as better coupling between the signal source and the user.

b. Alerting tones are most likely to be heard if they involve multiple tones, separated in frequency, which contrast with the environment.

c. Occasionally, varying tones may be preferred for attracting attention. If speech is used, it is best to test its intelligibility with individuals who are hard of hearing to maximize its clarity and ease of understanding. Provide the ability for the user to have any messages repeated or to repeat the message if no response is received from the user.

d. For essential auditory information, the information might be repeated and an acknowledgment from the user requested.

e. The intelligibility of the output can also be maximized by the location of the speakers and by keeping the speakers away from noise sources. However, visual displays are often more desirable than loud prompts or alerts, because the latter reduce privacy and can annoy others unless the amplified signal is isolated by means of a headphone, induction coupling, direct plug-in to a hearing aid, or other methods.

f. The use of a telephone handset or earcup which can be held up to the ear can improve intelligibility without disturbing others in the area. If a handset or earcup is used, making it compatible with a hearing aid allows users to directly couple the auditory signal to their hearing aids. If the microphone in the handset is not being used, turning it off will also reduce the amount of background noise which the person hears in the earpiece. Providing a headphone jack also allows individuals to plug in headphones, induction loops, or amplifiers which they may use to hear better.

Paragraph (f)

Prevention of Visually-Induced Seizures

1. Individuals with photo-sensitive epilepsy can have a seizure triggered by displays

which flicker or flash, particularly if the flash has a high intensity and within certain frequency ranges.

2. Strategies to address this requirement involve reducing or eliminating screen flicker or image flashing to the extent possible. In particular, the rates of 2 Hz or lower or 70 Hz or higher are recommended. This recommendation reflects current research data on people with photosensitive epilepsy which indicates that the peak sensitivity for these individuals is 20 Hz and that the sensitivity then drops off in both directions.

3. The chance of triggering seizures can also be reduced by avoiding very bright flashes which occupy a large part of the visual field (particularly in the center of the visual field) in order to minimize the impact on the visual cortex.

Paragraph (g)

Availability of Audio Cutoff

1. Individuals using the audio access mode, as well as those using a product with the volume turned up, need a way to limit the range of audio broadcast.

2. If an audio headphone jack is provided, a cut-off switch can be included in the jack so that insertion of the jack would cut off the speaker. If a telephone-like handset is used, the external speakers can be turned off when the handset is removed from the cradle.

Paragraph (h)

Non-Interference With Hearing Technologies

1. Individuals who are hard of hearing use hearing aids and other assistive listening devices but these devices cannot be used if a telecommunications product introduces noise into the listening aids because of stray electromagnetic interference.

2. Strategies for reducing this interference (as well as improving hearing aid immunity) are being researched. The most desirable strategy is to avoid the root causes of interference when a product is initially designed. If the root sources of interference cannot be removed, then shielding, placement of components to avoid hearing aid interference, and field-canceling techniques may be effective. Standards are being developed to limit interference to acceptable levels, but complete elimination for some technologies may not yet be practical.

3. In April 1996, the American National Standards Institute (ANSI) established a task group (ANSI C63) under its subcommittee on medical devices to develop standards to measure hearing aid compatibility and accessibility to digital wireless telecommunications. The C63.19 task group is continuing to develop its standard, C63.19-199X, American National Standard for Methods of Measurement for Hearing Aid Compatibility with Wireless Communications De-

vices. When the standard is completed, the Board intends to reference it in this appendix.

Paragraph (i)

Hearing Aid Coupling

1. Many individuals who are hard of hearing use hearing aids with a T-coil (or telecoil) feature to allow them to listen to audio output of products without picking up background noise and to avoid problems with feedback, signal attenuation or degradation.

2. The Hearing Aid Compatibility (HAC) Act defines a telephone as hearing aid compatible if it provides internal means for effective use with hearing aids and meets established technical standards for hearing aid compatibility.

3. The technical standards for HAC telephones are specified in ANSI/EIA-504-1989, "Magnetic Field Intensity Criteria for Telephone Compatibility with Hearing Aids," ANSI/TIA/EIA-504-1-1994, "An Addendum to EIA-504," which adds the HAC requirements, and the FCC regulations at 47 CFR 68.317 (a).

4. A good strategy for addressing this requirement for any product held up to the ear would be to meet these same technical requirements. If not readily achievable to provide built-in telecoil compatibility, other means of providing the electro-magnetic signal is the next strategy to be considered.

SUBPART D—REQUIREMENTS FOR COMPATIBILITY WITH PERIPHERAL DEVICES AND SPECIALIZED CUSTOMER PREMISES EQUIPMENT

Section 1193.51 Compatibility

Paragraph (a)

External Electronic Access to All Information and Control Mechanisms

1. Some individuals with severe or multiple disabilities are unable to use the built-in displays and control mechanisms on a product.

2. The two most common forms of manipulation-free connections are an infrared connection or a radio frequency connection point. Currently, the Infrared Data Association (IrDA) infrared connection point is the most universally used approach.

3. The Infrared Data Association together with dominant market players in the cellular and paging industries, Ericsson, Matsushita/Panasonic, Motorola, NEC, Nokia, NTT DoCoMo, Puma, and TU-KA Phone Kansai, announced on April 25, 1997 a proposed set of standards that will empower wireless communication devices, such as cellular phones, pagers and personal computers to transfer useful information over short distances using IrDA infrared data communication ports. Because the proposed standard is designed to be scalable, it is easy-to-adopt by a wide range of wireless devices from pagers

to more enhanced communications tools such as smart phones. (See <http://www.irda.org>).

4. Adding an infrared connector to the serial port of a peripheral device or specialized customer premises equipment will make these products more compatible with each other and with customer premises equipment.

5. An infrared link can provide a mechanism for providing access to smaller, more advanced telecommunication devices and provide a safety net for products which are unable to incorporate other technologies. There is a joint international effort to develop a Universal Remote Console Communication (URCC) protocol which would achieve this functionality. (See <http://trace.wisc.edu/world/urc>).

Paragraph (b)

Connection Point for External Audio Processing Devices

1. Individuals using audio peripheral devices such as amplifiers, telecoil adapters, or direct-connection into a hearing aid need a standard, noise free way to tap into the audio generated by a product.

2. Individuals who cannot hear well can often use products if they can isolate and enhance the audio output. For example, they could plug in a headphone which makes the audio louder and helps shut out background noise; they might feed the signal through an amplifier to make it louder, or through filters or frequency shifters to make it better fit their audio profile. If they are wearing a hearing aid, they may directly connect their hearing aid to the audio signal or plug in a small audio loop which allows them to couple the audio signal through their hearing aid's built-in T-coil.

3. Devices which can process the information and provide visual and/or tactile output are also possible. The most common strategy for achieving this requirement is the use of a standard 9 mm miniature plug-in jack, common to virtually every personal tape player or radio. For small products, a sub-miniature phone jack could be used.

Paragraph (c)

Compatibility of Controls With Prosthetics

1. Individuals who have artificial hands or use headsticks or mouthsticks to operate products have difficulty with capacitive or heat-operated controls which require contact with a person's body rather than a tool. Individuals who wear prosthetics are unable to operate some types of products because they either require motions that cannot easily be made with a prosthetic hand, or because products are designed which require touch of the human skin to operate them (e.g., capacitive touchscreen kiosks), making it im-

possible for individuals with artificial arms or hands to operate, except perhaps with their nose or chin. Some individuals who do not have the use of their arms use either a headstick or a mouthstick to operate products. Controls and mechanisms which require a grasping and twisting motion should be avoided.

Paragraph (d)

TTY Connectability

1. Acoustic coupling is subject to interference from ambient noise, as many handsets do not provide an adequate seal with TTYs. Therefore, alternate (non-acoustic) connections are needed. Control of the microphone is needed for situations such as pay-phone usage, where ambient noise picked up by the mouthpiece often garbles the signal. For the use of voice carry-over, where the person can speak but not hear, the user needs to be able to turn the microphone on to speak and off to allow them to receive the TTY text replies.

2. A TTY can be connected to and used with any telecommunications product supporting speech communication without requiring purchase of a special adapter, and the user is able to intermix speech and clear TTY communication. The most common approach today is to provide an RJ-11 jack. On very small products, where there may not be room for this large jack, a miniature or sub-miniature phone-jack wired as a "headset" jack (with both speaker and microphone connections) could be used as an alternate approach. In either case, a mechanism for turning the phone mouthpiece (microphone) on and off would reduce garbling in noisy environments, while allowing the user to speak into the microphone when desired (to conduct conversations with mixed voice and TTY). For equipment that combines voice communications, displays, keyboards and data communication functions, it is desirable to build in direct TTY capability.

Paragraph (e)

TTY Signal Compatibility

1. Some telecommunications systems compress the audio signal in such a manner that standard signals used by a TTY is distorted or attenuated preventing successful TTY communication over the system. A TTY can be used with any product providing voice communication function.

2. The de facto standard of domestic TTYs is Baudot which has been defined in ITU-T Recommendation V.18. Although the V.18 standard has been adopted, products are not yet available which meet its requirements.

3. This provision can be addressed by ensuring that the tones used can travel

through the phones compression circuits undistorted. It is even more desirable to provide undistorted connectivity to the telephone line in the frequency range of 390 Hz to 2300 Hz (ITU-T Recommendation V.18), as this range covers all of the TTY protocols known throughout the world. Although it may not be achievable with current technology, an alternate strategy might be to recognize the tones, transmit them as codes, and resynthesize them at the other end. In addition, it should be possible for individuals using TTYs to conduct conversations with mixed voice and TTY, and to control all aspects of the product and receive any messages generated by the product.

PART 1194—ELECTRONIC AND INFORMATION TECHNOLOGY ACCESSIBILITY STANDARDS

Subpart A—General

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- 1194.41 Information, documentation, and support.

FIGURES TO PART 1194

AUTHORITY: 29 U.S.C. 794d.

SOURCE: 65 FR 80523, Dec. 21, 2000, unless otherwise noted.

Subpart A—General

§ 1194.1 Purpose.

The purpose of this part is to implement section 508 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794d). Section 508 requires that when Federal agencies develop, procure, maintain, or

use electronic and information technology, Federal employees with disabilities have access to and use of information and data that is comparable to the access and use by Federal employees who are not individuals with disabilities, unless an undue burden would be imposed on the agency. Section 508 also requires that individuals with disabilities, who are members of the public seeking information or services from a Federal agency, have access to and use of information and data that is comparable to that provided to the public who are not individuals with disabilities, unless an undue burden would be imposed on the agency.

§ 1194.2 Application.

(a) Products covered by this part shall comply with all applicable provisions of this part. When developing, procuring, maintaining, or using electronic and information technology, each agency shall ensure that the products comply with the applicable provisions of this part, unless an undue burden would be imposed on the agency.

(1) When compliance with the provisions of this part imposes an undue burden, agencies shall provide individuals with disabilities with the information and data involved by an alternative means of access that allows the individual to use the information and data.

(2) When procuring a product, if an agency determines that compliance with any provision of this part imposes an undue burden, the documentation by the agency supporting the procurement shall explain why, and to what extent, compliance with each such provision creates an undue burden.

(b) When procuring a product, each agency shall procure products which comply with the provisions in this part when such products are available in the commercial marketplace or when such products are developed in response to a Government solicitation. Agencies cannot claim a product as a whole is not commercially available because no product in the marketplace meets all the standards. If products are commercially available that meet some but not all of the standards, the agency must procure the product that best meets the standards.