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Foreword

This ETSI Technical Report (ETR) was produced by the Human Factors (HF) Technical Committee of the European Telecommunications Standards Institute (ETSI).

ETRs are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or the application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or I-ETS.

A user's acceptance of new telecommunication services and products depends on their usability. Usability can be defined in terms of its two main components, performance and satisfaction.

In the present checklist, usability components contributing to the usability of Integrated Services Digital Network (ISDN) telephone terminal equipment are identified. The usability components are selected on the basis of standards and guidelines relevant to the specific user-interface for achieving a high degree of usability.

In an early stage of the usability evaluation process, the usability checklist can be used to obtain a rough estimate of the usability of the specific user-interface.

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1 Scope

The usability checklist described below is primarily designed for evaluating the usability of ISDN telephone terminal equipment. Only the telephony functions are considered but the checklist includes the use of functional keys, displays and screens to support the basic telephony functions.

The checklist is aimed at developers of ISDN terminal equipment, procurement staff, customers and consumer's associations but it can also be used by developers as a guideline for ensuring the usability of new terminal equipment.

The usability checklist for ISDN telephone terminal equipment is based on the usability component model introduced in ETR 051 [1]. The checklist does not cover more advanced multimedia workstations even if they can also support the basic ISDN telephony service.

In ETR 051 [1], the usability component model was used to generate a set of general usability goals and principles. For this ETR the approach is to generate more specific usability statements which can be used to explicitly check the usability of the terminal. One consequence of this is that some of the statements concerning the physical interface components will be common to both ISDN and Public Switched Telephone Network (PSTN) telephone terminals. User requirements for people with special needs also are considered.

The checklist identifies a number of usability components each contributing to the total usability of ISDN telephone terminal equipment. The checklist does not include specifications for testing the usability components. For a complete evaluation of a telephony terminal specific human factors expertise and support from a test laboratory may be needed.

Not all usability components identified in the checklist need to be applicable to a specific type of terminal.

ETR 095 [2] is a source of further information on undertaking usability evaluations of terminal products or services.

2 References

For the purposes of this ETR, the following references apply:

[1] ETR 051: "Human Factors (HF); Usability checklist for telephones, Basic requirements".

[2] ETR 095: "Human Factors (HF); Guide for usability evaluations of telecommunication systems and services".

[3] CCITT Recommendation P.35 (1988): "Handset telephones".

[4] ETR 116 (1994): "Human Factors (HF); Human factors guidelines for ISDN terminal equipment design".

[5] ISO DIS 9241-4: "Ergonomic requirements for office work with visual display terminals (VDTs), Part 4: Keyboard requirements".

[6] Nordiska Nämnden för Handikappfrågor, NNH (1993): "Nordic Guidelines for Computer Accessibility".

[7] E.T. Klemmer and K.A. Haig, Applied Ergonomics (1988), 19.4, pages 271 to 274: "Weight and balance of a new telephone handset".

[8] Bellcore, NI BRI Terminal Guidelines, SR-NWT-002661 (DRAFT), Appendix A (1993): "Human Factors Guidelines for ISDN Terminals".

[9] ISO DIS 9241-3: "Ergonomic requirements for office work with visual display terminals (VDTs), Part 3: Visual display requirements".

[10] ISO/IEC DIS 9995: "Information technology - Keyboard layouts for text and office systems".

[11] ITU-T Recommendation E.161 (1993): "Arrangement of digits, letters and symbols on telephones and other devices that can be used for gaining access to a telephone network".

[12] S. Ravden and G. Johnson: "Evaluating Usability of Human-Computer Interfaces", Ellis Horwood Books in Information Technology.

[13] EEC Directive 90/270 EEC: "Minimum safety and health requirements for work with display screen equipment".

3 Usability component model

APPLICATION DOMAIN

User/interface dialogue				
User input/output				
Physical interface				
	Anthropometric	Motoric	Perceptual	Cognitive

USER/SYSTEM INTERFACE

USER CAPABILITIES

Figure 1

Usability evaluation of an ISDN telephone terminal equipment includes the evaluation of a large number of usability components each contributing to the usability of the equipment. To make it easier to identify the usability components, the user capabilities are subdivided into anthropometric, motoric, perceptual and cognitive elements. The user interface is subdivided into the physical interface parameters, the input/output parameters covering the hardware elements and the user/interface dialogue covering the software elements. For a more specific description of the usability component model see ETR 051 [1].

For the application domain considered, each of the shaded areas of the usability component model in figure 1 illustrates a number of possible relationships between the relevant user/system interface element and the relevant user capability element. Each possible relationship represents a usability component. The relationships can be translated into questions or statements suitable for a usability checklist.

4 Preconditions of use

The usability components identified are, in principle, related to the user's performance on terminal functions and features. This performance can be considered independent of the users task. A more complete usability evaluation needs to consider the user capability, the task and the environment (see ETR 095 [2]).

Depending on the actual user capability, the task performed and the environment, the evaluator needs to judge how much each usability component contributes to the total usability of a specific user interface.

The checklist refers to a normative range of user performance. Within this range user requirements for people with special needs are considered. In cases where the normative approach is not appropriate, a companion ETR on "Evaluation of telephones for People with Special Needs" is being produced.

It is assumed that the users have learned the meaning of the tone signals and spoken messages used in the network - and that they know the necessary procedures for operating the ISDN terminal.

The functions considered support the performance of the following basic telephone services involving:

- setting up a call;
- receiving a call;
- performing a communication;
- termination a call.

When using the checklist it is assumed that the ISDN terminal is being used in an environment where the light setting, the acoustic room noise level and electromagnetic disturbances do not have an impact on the functionality of the terminal.

5 Checklist

The source references and ETR 095 [2] provide more general information about checklist methods. It should be noted that, in some cases, the evaluators need to use their own judgement as to whether or not the item has been checked satisfactorily.

Using the relevant areas of the usability component model the following usability components can be identified.

5.1 Physical interface - anthropometric usability components

5.1.1 Physical design and shape requirements

Check that:		
a)	the handset is convenient to pick up and to hold in the hand during conversation.	Yes □ No □
b)	the receiver and the microphone can be correctly placed relative to the human ear and to the human mouth.	Yes □ No □
c)	the shape of the earpiece ensures an appropriate sealing to the human ear.	Yes □ No □
d)	the keys in the keypad are provided with flat or concave sculptured key caps.	Yes □ No □
e)	the minimum surface area of each key is larger than 113 mm^2 and that the smallest dimension is larger than 12 mm.	Yes □ No □
f)	the clearance around each key is larger than 18 mm in the smallest dimension.	Yes □ No □

References:

CCITT Recommendation P.35 [3];
ETR 116 [4];
ETR 051 [1];
ISO DIS 9241-4 [5];
Nordic Guidelines for Computer Accessibility [6].

5.2 Physical interface - motoric usability components

5.2.1 Weight and force requirements

Check that:		
a)	the weight of the handset is distributed equally between the microphone end and the receiver end.	Yes □ No □
b)	the weight of the handset is between 150 grammes and 200 grammes excluding the weight of the cord.	Yes □ No □
c)	the force/travel characteristic of the keys are within the following limits: - travel: 1mm to 8 mm; - force: 0,25 to 1,5 N.	Yes □ No □

References:

E.T. Klemmer and K.A.Haig: "Weight and balance of a new telephone handset" [7];
Applied Ergonomics 1988, 19.4, 271-274;

ETR 116 [4].

5.3 Physical interface - perceptual usability components

5.3.1 Surface structure requirements

Check that:		
a)	the diffuse reflectance of surfaces is in the interval 15 % to 50 %.	Yes □ No □
b)	the specular reflectance of surfaces does not exceed 45 gloss units measured according to ISO 2813 [8] (quoted in ISO DIS 9241-4 [5]).	Yes □ No □
c)	the minimum contrast ratio of the key cap/inscriptions is larger than 1:3.	Yes □ No □
d)	raised dots or lines on the touched surface of certain keys are used to facilitate unsighted navigation around the array of keys.	Yes □ No □
e)	the surface of controls does not contain chromium, nickel or other material which may cause an allergic reaction.	Yes □ No □

References:

ETR 116 [4];
Nordic Guidelines for Computer Accessibility [6].

5.4 User input/output - perceptual usability components

5.4.1 Control requirements

Check that:		
a)	controls are marked so that they can be identified either by touch or by means of a mark placed on the control itself or close to the control.	Yes □ No □
b)	inscriptions used to describe keys are at least 6 mm in height.	Yes □ No □
c)	the status of a control setting can easily be perceived.	Yes □ No □
d)	controls are placed so they can easily be manipulated, e.g. by a person in a wheelchair.	Yes □ No □
e)	different types of controls are placed sufficiently separate from each other to avoid confusion.	Yes □ No □

References:

Nordic Guidelines for Computer Accessibility [6].

5.4.2 Tones and indications requirements

Check that:		
a)	the user can receive a tactile and audible feedback when pressing a key, and that it is possible to adjust and switch off the audible feedback.	Yes □ No □
b)	the frequency of applied acoustic signals and tones is in the interval 300 Hz to 3 000 Hz where the human ear is most sensitive.	Yes □ No □
c)	a volume control is available for adjusting the listening level of acoustic signals and tones for personal preference	Yes □ No □
d)	acoustic signals and tones can be supplemented by further visual or speech outputs.	Yes □ No □
e)	the use of auditory signals is consistent.	Yes □ No □

References:

Nordic Guidelines for Computer Accessibility [6];
Bellcore: Human Factors Guidelines for ISDN Terminals [8];
ETR 116 [4].

5.4.3 Screen display requirements

Check that:

a) the screen is free from noticeable flicker. Yes □ No □

b) the screen offers positive contrast with contrast ratio larger than 3:1 and a refreshment rate of at least 70 Hz. Yes □ No □

c) contrast, brightness or background light is adjustable by the user. Yes □ No □

d) characters appear clear and sharp in all parts of the screen. Yes □ No □

e) the height of a capital letter in relation to the viewing distance is larger than: Yes □ No □

Viewing distance	Character height
406 mm (16")	2,1 mm
508 mm (20")	2,6 mm
610 mm (24")	3,1 mm
711 mm (28")	3,7 mm

f) the character width is within 50 % - 100 % of character height. Preferred range is 70 % - 90 %. Yes □ No □

g) the stroke width is within 8 % -20 % of character height. Yes □ No □

h) the separation between text lines is larger than 1 stroke width between the top of diacritical marks on upper case letters and the bottom of descenders. Yes □ No □

j) the display is free of glare and reflections. Yes □ No □

k) display density is 30 % or less, i.e. that less than 30 % of total available characters are used. Yes □ No □

l) the surface of the display can be placed in an angle between 60° and 80° in relation to horizontal. Yes □ No □

m) the display technology does not imply limitation in viewing angle, especially with LCD displays. Yes □ No □

n) the display technology does not imply requirements to the environment, e.g visibility of green and yellow LEDs in bright light. Yes □ No □

References:

ISO DIS 9241-3 [9];
The European Community Council Directive 90/270 EEC [13];
Nordic Guidelines for Computer Accessibility [6];
Bellcore: Human Factor Guidelines for ISDN Terminals [8];
ETR 116 [4].

5.5 User input/output - cognitive usability components

5.5.1 Control key lay-out requirements

Check that:		
a)	dedicated control keys are used to support casual and novice users.	Yes □ No □
b)	meaningful labels are used on the keys.	Yes □ No □
c)	there is a closely aligned relationship between display and softkeys.	Yes □ No □
d)	control keys are grouped by sequence and by frequency of importance.	Yes □ No □
e)	function keys are used consistently across related applications.	Yes □ No □
f)	the arrangement of letters, digits and symbols on a alphanumeric keyboard comply with the ISO DIS 9995 [10] layout or national options.	Yes □ No □
g)	the arrangement of digits and symbols on the 12 button telephone key pad comply with ITU-T Recommendation E.161 [11].	Yes □ No □
h)	a function is provided which cancels an erroneous keystroke to help persons with reduced precision in their hand movements.	Yes □ No □

References:

ETR 116 [4];
ISO DIS 9995 [10];
ITU-T Recommendation E.161 [11];
Nordic Guidelines for Computer Accessibility [6].

5.5.2 Screen message requirements

Check that:		
a)	display identifiers such as screen title or application name are used.	Yes □ No □
b)	the size of the screen is adequate for the required tasks and response times.	Yes □ No □
c)	the screen layout, the reservation of specific areas of the screen for specific types of messages is consistent.	Yes □ No □
d)	information components that are critical to the system or to the task are placed in a prominent position on the display.	Yes □ No □
e)	screen messages are short, factual and informative.	Yes □ No □
f)	information is grouped according to conceptual relationship, sequence, frequency of use, importance, chronological sequence or alphabetic order.	Yes □ No □
g)	the way information is presented progresses from generalities to specifics.	Yes □ No □
h)	data are presented in columns.	Yes □ No □
j)	warnings and other alert messages remain on the screen until they are cancelled by the user.	Yes □ No □
k)	highlighting techniques are used with discretion and consistency.	Yes □ No □
l)	help text, warnings, menus and other messages from the application are presented in the national language of the user.	Yes □ No □
m)	visual information can be supplemented by speech or tone indications.	Yes □ No □
n)	information is not presented only by showing a certain colour.	Yes □ No □
p)	the number of colours in a single display is limited to four.	Yes □ No □
q)	the use of abbreviations is kept to a minimum.	Yes □ No □

References:

ETR 116 [4];
Nordic Guidelines for Computer Accessibility [6];
Bellcore: Human Factor Guidelines for ISDN Terminals [9].

5.6 User/interface - cognitive usability components

5.6.1 Dialogue: General requirements

Check that:		
a)	the interface dialogue is adapted to the user's skill - e.g. menus for novice and casual users and commands for skilled users.	Yes □ No □
b)	appropriate levels of help are provided either on-line or through instruction manuals.	Yes □ No □
c)	feedback on the current state of the terminal and/or service is provided.	Yes □ No □
d)	all user inputs can be easily and readily corrected - e.g. by an "Insert" or "Delete" key.	Yes □ No □
e)	users can easily reset to a previous state - e.g. by a "Reset" or "Escape" key.	Yes □ No □
f)	appropriate macros or function keys are available instead of long, critical or frequently used keystroke procedures.	Yes □ No □
g)	the users are supported when navigating through the procedures or dialogues - e.g. by "Prompts".	Yes □ No □

References:

ETR 116 [4];
S.Ravden & G.Johnson: Evaluation Usability of Human-Computer Interfaces [12].

5.6.2 Dialogue: Command language requirements

Check that:		
a)	a command language style is available for skilled and expert users.	Yes □ No □
b)	command names and mnemonics are meaningful within the task, the application and the user experiences and expectations.	Yes □ No □
c)	the number of numeric codes is limited (e.g. less than 7), unless additional aids to recognition and learning are provided.	Yes □ No □
d)	the numeric codes are arranged in meaningful groups, e.g. beginning with the same initial digit.	Yes □ No □

References:

ETR 116 [4].

5.6.3 Dialogue: Menu structure requirements

Check that:		
a)	the context is clearly indicated to the user, i.e. that the service and the location in the service is indicated.	Yes □ No □
b)	the menu title clearly indicates the contents.	Yes □ No □
c)	menu options have informative names.	Yes □ No □
d)	options are grouped meaningfully to the user.	Yes □ No □
e)	all options provided are displayed and that low contrast or other techniques are used to indicate options currently not available.	Yes □ No □
f)	selection is indicated by highlighting, and executed by using a cursor, by a pointing device, by numeric entry or by entry of an initial letter.	Yes □ No □
g)	shortcuts are allowed for skilled operators.	Yes □ No □
h)	the number of options presented is less than 12.	Yes □ No □
j)	the number of levels in the menu hierarchy is limited to 3.	Yes □ No □

References:

ETR 116 [4];
Bellcore: Human Factors Guidelines for ISDN Terminals [9].

5.6.4 User support: help and error management requirements

Check that:		
a)	a user guide containing explicit description of the capabilities is available.	Yes □ No □
b)	user guidance in the form of on-line help, on-product graphics, prompt cards or reference documentation is available and consistent with the guide.	Yes □ No □
c)	users can review entries.	Yes □ No □
d)	context sensitive error messages are provided to allow the user to recover from an error situation.	Yes □ No □
e)	meaningful error messages rather than codes are used.	Yes □ No □
f)	error messages and help prompts can be switched off.	Yes □ No □
g)	only a minimum of written instructions are provided.	Yes □ No □

References:

ETR 116 [4];
Bellcore: Human Factors Guidelines for ISDN Terminals [9].

5.6.5 User support: response time requirements

Check that:		
a)	response times are consistent, e.g. that terminal generated response times are consistent with network generated response times for the same feature.	Yes □ No □
b)	the response time for the execution of a single keystroke or presentation of acknowledgement for a single keystroke is of the magnitude of 0,1 seconds.	Yes □ No □
c)	the response time for complex commands is of the magnitude of 2 seconds.	Yes □ No □
d)	the indication of a longer delay is given as an immediate acknowledgement, if possible together with an indication of how long the delay will last.	Yes □ No □
e)	an option is available allowing to abort if the delay is unacceptable.	Yes □ No □

References:

ETR 116 [4];
Nordic Guidelines for Computer Accessibility [6];
Bellcore: Human Factors Guidelines for ISDN Terminals [9].

History

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