

GUIDELINES FOR IMPLEMENTATION

**CHARACTERISTICS OF ANALOGUE
INTERFACE (R-INTERFACE) OF ISDN
TERMINAL ADAPTER**

Foreword

This GFI document defines the characteristics of the ISDN terminal adapter in order to enable a user of an analogue terminal equipment to control ISDN supplementary services. The definitions have no impact on the ISDN access signalling specifications. ISDN access signalling is as specified in the international ISDN standards and the national guideline documents prepared to ensure the interoperability of ISDN implementations in Finland.

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1 REFERENCES

1. SFS 5665: Televerkon keskukset. Liitännät.
2. SFS 5664: Televerkon keskukset. Siirto-ominaisuudet.
3. Laki yksityisyyden suojasta televiestinnässä ja teletoiminnan tietoturvasta.
4. THK:n työryhmäraportti: 2A/96 Tilaajien numerotietojen siirto puhelujen yhteydessä.
5. GFI 9303 ed.2: Guidelines for Implementation; ISDN Supplementary Services, Keypad protocol.
6. GFI 9302 ed.3: Guidelines for Implementation; ISDN Supplementary Services, Functional protocol.
7. GFI 9802: Guidelines for Implementation; Kansalliset tilaajatoiminteet.
8. ETSI EG 201 018: Integrated Services Digital Network (ISDN); Application of the Bearer Capability (BC), High Layer Compatibility (HLC) and Low Layer Compatibility (LLC) information elements by terminals supporting ISDN services.
9. GFI 9802 ed.2: Guidelines for Implementation: Supplementary service codes.
10. SFS 5876: Televerkon keskukset. Merkkiäänet ja soittosignaalit.
11. GFI 9301 ed.3: ISDN access signalling; Basic call control procedures.
12. ETSI TBR 008: Integrated Services Digital Network (ISDN) Telephony 3,1 kHz teleservice; Attachment requirements for handset terminals.
13. ETSI ETS 300 186: Integrated Services Digital Network (ISDN); Three-Party (3PTY) supplementary service, Service description.
14. ETSI EN 300 367: Integrated Services Digital Network (ISDN); Explicit Call Transfer (ECT) supplementary service, Service description.
15. ETSI EN 300 196: Integrated Services Digital Network (ISDN); Generic functional protocol for the support of supplementary services; Digital Subscriber Signalling System No. one (DSS1) protocol.
16. ETSI EN 300 122: Integrated Services Digital Network (ISDN); Generic keypad protocol for the support of supplementary services; Digital Subscriber No. one (DSS1) protocol.
17. GFI 9702: Guidelines for Implementation; Public Switched Telephone Network (PSTN); Subscriber line protocol over the local loop for display (and related) services.
18. ETSI ETS 300 659: Public Switched Telephone Network (PSTN); Subscriber line protocol over the local loop for display (and related) services; Part 1: On hook data transmission.
19. ETSI ETS 300 139: Integrated Services Digital Network (ISDN); Call Hold (HOLD) supplementary service, Service description.
20. ETSI ETS 300 056: Integrated Services Digital Network (ISDN); Call Waiting (CW) supplementary service, Service description.

2 ELECTRICAL CHARACTERISTICS

The electrical characteristics of the analogue interface shall comply with the following documents:

- SFS standard 5664 (ref. 2); chapter 5 "Tilaajaliitöntöjen (Z-liitäntä) siirto-ominaisuudet".

NOTE: Transmission characteristics comprise the functions of terminal adaption, network termination, line termination and exchange termination.

INFORMATIVE NOTE: The requirements defined in TBR 8 (ref. 12) can be used to verify the relative levels in the following way: The analogue telephone is connected to the ab-interface. The sending and receiving loudness ratings at the S-interface are measured as specified in TBR 8. These values are compared to the loudness rating values of the telephone.

- SFS 5665 (ref.1); chapter 3.1 "Analoginen tilaajaliitäntä" with the following exceptions:
a) the requirement for maximum loop resistance (2400 ohm) is not relevant (3.1.3)
b) the requirement for surge protection is not relevant (3.1.7).

3 LAYER 2

It is recommended that the terminal adapter disconnects layer 2 (LAPD) when layer 3 (DSS1) is deactivated.

4 FUNCTIONAL CHARACTERISTICS

4.1 General

The functionality is defined as an ability to establish and receive calls and as an ability to use selected ISDN supplementary services.

The mapping of loop signalling to DSS1 keypad protocol and the mapping of loop signalling to DSS1 functional protocol are defined on general level. In addition, some services are defined more specifically.

DTMF dialling (1...0, *, #) and flash (R) are used to control supplementary services at the analogue interface.

If terminal adapter can be programmed by using an analogue telephone set, the access into the internal programming mode should be clearly distinguished from the control of supplementary services.

4.2 Basic call/Call setup and call release

When a terminal equipment is set into an off-hook state the adapter sends the SETUP message to the exchange and connects to the terminal the dial tone received from the network. The programmed MSN (Multiple Subscriber Number) number is sent to the network in a Calling party number information element. When the terminal equipment is set into an on-hook state the adapter sends a DISCONNECT message to the exchange in order to release the call. These functions are described in GFI 9301 (ref. 11).

When the SETUP message is received from the network and there is no contradiction in compatibility and the MSN matches, the ringing signal is sent to the analogue interface. The voltage and the timing of the ringing signal shall be as specified in standard SFS 5876 (ref. 10: Tones and ringing signals in the public switched telephone network (PSTN) exchanges). The voltage requirement (75 V) is not relevant.

The coding of the information elements Bearer Capability (BC), High Layer Compatibility (HLC) and Low Layer Compatibility (LLC) is defined in EG 201 018 (ref. 8); chapter 4.

The DISCONNECT message received from the network disconnects the call at the analogue interface and the busy tone is sent to the terminal.

The tones generated locally for call setup, call release and supplementary services are specified in standard SFS 5876 (ref. 10).

4.3 Services, general

Both the functional and the keypad control of the supplementary services are applied in the Finnish ISDN networks.

The subscriber control procedures (service codes) shall be as used in the Finnish digital telephone network and specified in ref. 5 and 9.

The functional protocol for the support of supplementary services is defined in EN 300 196 (ref. 15) and in GFI 9302 (ref. 6).

The keypad control of the supplementary services is defined in EN 300 122 (ref. 16) and GFI 9303 (ref. 5). Keypad control is standardized only for some of the supplementary services.

In the active call state DTMF is transparently sent to the network in order to make the external services (eg. the voice-mailbox) available. The flash R is used to start the DTMF control of the supplementary services in the active call state.

The subscriber control procedures and corresponding layer 3 ISDN signalling between the terminal adapter and the network shall be as specified in the relevant ETSI standards and national guideline documents.

4.4 Keypad control of supplementary services

The terminal adapter shall have the ability to insert dialled keypad information into the keypad facility. These elements are inserted into the SETUP and INFORMATION messages as described in GFI 9303 (ref. 5).

The exact coding of keypad sequences and the rules to indicate the last keypad character are described in GFI 9303; Part I; Table 2.

4.4.1 Non call associated supplementary services

The general subscriber control sequence is as follows:

* SC * PM1 * PM2 * ... PMn #

or

SC # PM1 # PM2 # ... PMn

where

SC = Service Code

PM = keyword/parameter (optional)

This means that the activation procedure may be either *SC# or it may consist all the parameters. Irrespective of the case, the adapter shall send all the dialled keypad information inserted into a Keypad facility information element in separate Information messages.

When the # character is received by the adapter as a third or subsequent character of the facility information string, it shall be interpreted as a Sending complete information.

When the # character is received before any other digits or after the character *, it shall not be interpreted as a Sending complete signal.

No keypad control of the supplementary services is defined during the active call state.

4.4.2 Call associated supplementary services

When the # character is received by the adapter as the third or subsequent character in the facility information string, it shall be interpreted as the Sending complete information. When the # character is received before any digits or after *, it shall not be interpreted as a Sending complete signal.

Additionally, if the keypad string ended with the # character, the adapter shall insert the remaining digits into the called party address information element (ref. GFI 9303, chapter 6).

NOTE: Some exceptions in the procedures between analogue and ISDN interface exist. E.g. the subscriber control procedures for CUG *SC*CUG-index*B-number# vs. *SC*CUG-index#B-number# and CUG *SC*CUG-index*B-number# vs. *SC*CUG-index#B-number#. The adapter shall follow the procedures of the ISDN interface.

4.5 The functional control of the supplementary services

The subscriber control procedures shall be similar in ISDN basic access than in the analogue subscriber interface. The aim is that a user does not see the difference in controlling services after upgrading into ISDN. The appropriate subscriber procedures are defined in GFI 9802 (ref. 7).

In the basic call procedures programmed functions (e.g. EEPROM, slideswitch) can be used to control supplementary services (eg. CLIR, MSN).

4.5.1 Non call associated supplementary services

The functional protocol can be used to control supplementary services but no change to the subscriber control procedures is allowed.

4.5.2 Supplementary services during the active call state

During the active call state several supplementary services can be controlled via the adapter which, after the user has dialled flash (R), converts the DTMF dialling into the DSS1 functional protocol. The supplementary services are defined in the appropriate standards and specifications.

4.5.3 Call associated supplementary services

The functional protocol can be used to control supplementary services but no change to the subscriber control procedures is allowed.

5 FLASH (R)

If the user dials the flash (R) character in the active state the adapter shall activate the ISDN HOLD supplementary service. The adapter generates the dial tone and starts a supervision period of five seconds. If the user stops dialling, the adapter returns to the active call state after the supervision time period and Retrieve message is sent to the exchange. The adapter can be returned to the active call state by dialling the flash R during the supervision period.

6 SUPPLEMENTARY SERVICES

6.1 Advice of charge

The *SC# string for the Advice of Charge (AOC) supplementary service with a keypad protocol is defined in GFI 9303.

In the terminal adapter the advice of charge (AOC-D, AOC-E) information may be transformed to 16 kHz metering pulses (AOCChargingUnit) or to display units (AOCChargingUnit AOCurrency).

NOTE: The advice of charge using 16 kHz metering pulses is not implemented in all networks.

6.2 CLIP

The calling line information in the Calling party number information element of the SETUP message is transformed to DTMF signalling as specified in document GFI 9502 (ref. 17) or to FSK signalling according to ETS 300 659 (ref. 18).

6.3 CLIR

In case of keypad protocol CLIR can be used by dialling #31#123456 where #31# is inserted into the Keypad facility information element and 123456 into the Called party address information element. If the functional protocol is used the Presentation indicator of the Calling party number information element is set to the value Presentation restricted.

The procedure *31# is used for allowing the presentation of the calling line identification.

The calling line and connected line identification presentation and restriction are regulated services (ref. 3). From the terminal adapter's point of view they may be:

- associated with a call and controlled (keypad or functional) by a user
- permanent characteristics of the adapter,
- permanent by subscription

6.4 CW

The waiting call can be accepted, rejected or ignored by the following user procedures:

- R0: the adapter sends Release complete message and no more CW calls are accepted during this call. Neither the waiting call is accepted.
- R1: the active call is released and the waiting call is established
- R2: the active call is transferred to ISDN HOLD and the waiting call is established.

CW service is specified in ETS 300 056 (ref. 20) and HOLD in ETS 300 139 (ref. 19)

6.5 Three party services/Enquiry call/Hold

The Three party services can be used in the following way:

In the state of one active call:

- R: The active call is set onto hold. The dialled B-number is sent in the Called party address information element.

In the state of two calls (one on hold (N10), one in active call state (N4)) the following procedures apply:

- R0: The call which is on hold is released (normal ISDN call release).
- R1: The active call is released. The call on hold is switched into active state.
- R2: Switch the call on hold into active state and call in active state onto hold.
In three party state: release the three party state, switch the second connection onto hold and the first connection into active state.
- R3: Three Party (3PTY) supplementary service is invocated
- R4: Explicit Call Transfer (ECT) supplementary service is invocated

3PTY service is specified in ETS 300 186 (ref. 13), HOLD in ETS 300 139 (ref. 19) and ECT in EN 300 367 (ref. 14).

6.6 Call diversion

The keypad control procedures of the call diversion supplementary services (CFU, CFB, CFNR) shall comply with GFI 9303 (ref. 5).

6.7 Closed User Group

The keypad control procedures of the Closed User Group (CUG) supplementary service shall be as defined in GFI 9303 (ref. 5).

6.8 Completion of Calls to a Busy Subscriber (CCBS)

The Completion of Calls to a Busy Subscriber (CCBS) supplementary service is activated by using the procedure R 5.

7. EMERGENCY MODE

In the restricted power condition at least one analogue telephone shall be fed by the terminal adaptor.