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Assessment and definition of a harmonized minimum
man-machine interface (MMI) for accessing and controlling
public network based supplementary services;
Part 6: Survey of existing PSTN, ISDN and mobile networks,
and a user survey of supplementary service use
within Centrex and PBX environments**

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Foreword

This ETSI Technical Report (ETR) has been 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 an I-ETS.

Introduction

The Technical Committee for Human Factors has prepared this ETSI Technical Report to report publicly its work on the assessment and definition of a harmonized minimum man-machine interface for the access and control of public network based supplementary services. It is intended to complement ETS 300 738 [3].

This ETR constitutes part 6 of a multi-part ETR ("Assessment and definition of a harmonized minimum man-machine interface (MMI) for accessing and controlling public network based supplementary services"), whose parts have the following titles:

- Part 1: "General approach and summary of findings";
- Part 2: "Literature review - Memory and related issues for dialling supplementary services using number codes";
- Part 3: "Experimental comparison of two MMIs - Simulated UPT access and prototype ISDN supplementary services";
- Part 4: "Experimental comparison of the effect of categorized and non-categorized formats within user instructions";
- Part 5: "Experimental comparison of the CEPT and GSM codes schemes";
- Part 6: "Survey of existing PSTN, ISDN and mobile networks, and a user survey of supplementary service use within Centrex and PBX environments";**
- Part 7: "Experimental evaluation of draft ETS 300 738".

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1 Scope

This multi-part ETSI Technical Report (ETR) presents the results of the research work conducted to develop a European Telecommunication Standard (ETS) defining a harmonized minimum man-machine interface (MMI) for the access and control of public network based telecommunications services, and in particular supplementary services.

This part 6 of the ETR describes the questionnaire and survey data collected. This occurred in two surveys. The first survey was of PSTN, ISDN and mobile network implementations of supplementary services and the MMI used to access and control these. The second survey was of users of supplementary services within a Centrex and a PBX environment.

2 References

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

- [1] CEPT T/CAC 02: "Subscriber control procedures for supplementary services in modern telecommunication system".
- [2] ETS 300 511: "European digital cellular telecommunications system (Phase 2); Man Machine interface (MMI) of the mobile station (MS) (GSM 02.30)".
- [3] ETS 300 738: "Human Factors (HF); Minimum Man Machine Interface (MMI) to public network based supplementary services".
- [4] ETR 261-1: "Human Factors (HF); Assessment and definition of a harmonized minimum man-machine interface (MMI) for accessing and controlling public network based supplementary services; Part 1: General approach and summary of findings".
- [5] ETR 261-2: "Human Factors (HF); Assessment and definition of a harmonized minimum man-machine interface (MMI) for accessing and controlling public network based supplementary services; Part 2: Literature review - Memory and related issues for dialling supplementary services using number codes".
- [6] ETR 261-3: "Human Factors (HF); Assessment and definition of a harmonized minimum man-machine interface (MMI) for accessing and controlling public network based supplementary services; Part 3: Experimental comparison of two MMIs - Simulated UPT access and prototype ISDN supplementary services".
- [7] ETR 261-4: "Human Factors (HF); Assessment and definition of a harmonized minimum man-machine interface (MMI) for accessing and controlling public network based supplementary services; Part 4: Experimental comparison of the effect of categorized and non-categorized formats within user instructions".
- [8] ETR 261-5: "Human Factors (HF); Assessment and definition of a harmonized minimum man-machine interface (MMI) for accessing and controlling public network based supplementary services; Part 5: Experimental comparison of the CEPT and GSM codes schemes".
- [9] ETR 261-7: "Human Factors (HF); Assessment and definition of a harmonized minimum man-machine interface (MMI) for accessing and controlling public network based supplementary services; Part 7: Experimental evaluation of draft ETS 300 738".
- [10] Israelski E (1988): "An experimental comparison of user performance with alternative access codes for PBX features". 12th Symposium on Human Factors in Telecommunications, The Hague.
- [11] ITU-T Recommendation E.131: "Subscriber control procedures for supplementary telephone services".

- [12] ITU-T Recommendation E.161: "Arrangement of figures, letters and symbols on telephones and other devices that can be used for gaining access to a telephone network".
- [13] Jones MLR (1990): "Making numeric command languages more usable". 13th Symposium on Human Factors in Telecommunications, Turin, pp 99-106.
- [14] Lindgaard G (1993): "Wow - 568 smart features on your PABX: What really determines the uptake of technology?" 14th Symposium on Human Factors in Telecommunications, Darmstadt.
- [15] Schwartz B (1993): "Advanced screen telephony - making today's services easier to use". 14th Symposium on Human Factors in Telecommunications, Darmstadt.
- [16] Zeidler G (1970): "How to co-ordinate operational procedures for new telephone facilities". 5th Symposium on Human Factors in Telecommunications, London.

3 Definitions, symbols and abbreviations

For the purposes of this part of the ETR, the definitions, symbols and abbreviations given in part 1 [4] of the ETR apply.

4 Survey of current supplementary service implementations

This clause presents the results of a survey of fixed and mobile network operators with respect to current and planned supplementary service implementations. A questionnaire was sent in January 1994 to all the European Network Operators, both fixed and mobile, registered with ETSI at that time. See annex A, for the letter of introduction and the Fixed and Mobile Network questionnaires. As far as possible these were sent to known contacts within each organization in order to maximize the return. Replies were received from 18 Fixed Network Operators covering both PSTN and ISDN services. This number probably represents 80 % to 90 % of European fixed network subscribers. Replies were also received from five Mobile Network Operators covering TACS, NMT and GSM services.

4.1 Fixed network results

The questionnaire data was collated separately for the two types of network, PSTN and ISDN. They are presented tabularly and graphically as appropriate.

4.1.1 PSTN services

4.1.1.1 Who provides what in PSTN?

Table C1 (annex C) presents the recorded year of implementation for each supplementary service for each of the responding PSTN networks/countries. The total number of services reported by each respondent is shown in figure 1. Unfortunately, the Finish report did not identify which services they had implemented, they concentrated their response on the man-machine interface they offered to the user.

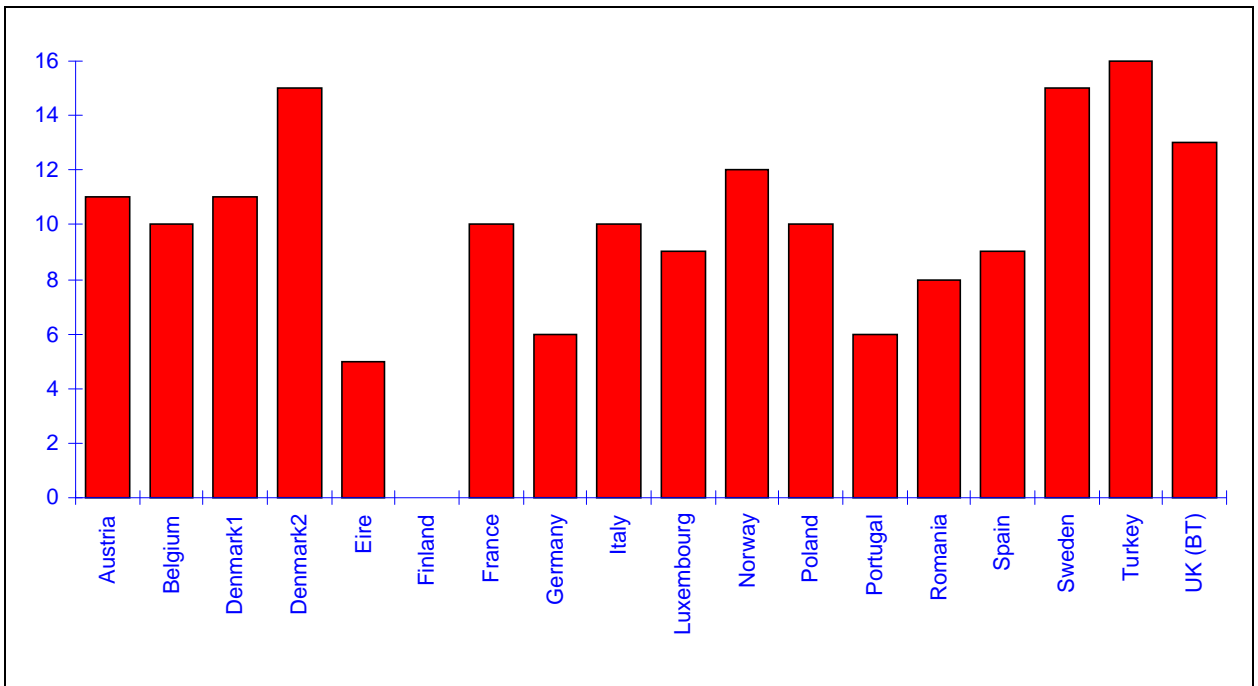


Figure 1: Number of reported services for each respondent - PSTN

Figure 2 shows the number of respondents offering each of the services under investigation and the mean year of its implementation. The main services offered by over half the respondents are:

- Call Barring - Incoming
- Call Barring - Outgoing
- Call Forward on Busy
- Call Forward on No Reply
- Call Forward Unconditional
- Hold
- Call Waiting
- Three Party Conference
- Direct Inward Dialling
- Freephone
- Malicious Caller Identification

Almost all of these services have been implemented after 1980 and probably more than half since 1985.

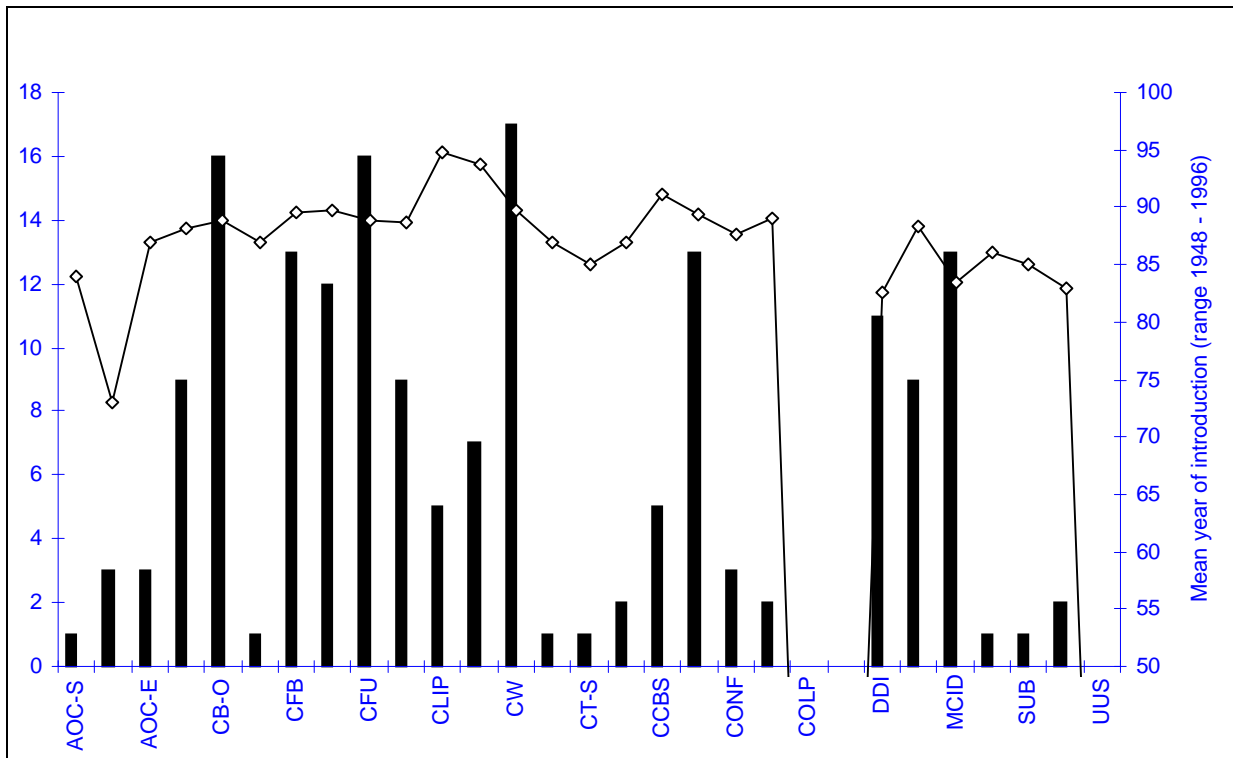


Figure 2: Number of respondents offering each service and mean year of implementation - PSTN

4.1.1.2 How do PSTN networks charge for different services?

Figure 3 summarizes the data found in table C2 (see annex C) and compares the charging policy different networks have for the different services. Clearly few services are provided free within the PSTN, those reported include:

- Call Barring - Incoming
- Call Barring - Outgoing
- Hold
- Calling Line Identification Restriction
- Call Waiting
- Three Party Conference
- Freephone (free to calling party, paid for by called party)
- Malicious Caller Identification

Similarly a few are charged only when they are used. These include:

- Advice of charging - End of call
- Call Forwarding (Busy, No Reply and Unconditional)
- Hold
- Call Waiting
- Completion of Call to Busy Subscriber
- Connected Line Identification Presentation
- Freephone
- Malicious Caller Identification

Quite the majority of the services are charged either on provision only or on provision and again when they are used. Interestingly there are sometimes quite different approaches depending on the services. For example all service providers offer CLIP on a provision only basis, however CLIR, the necessary complementary service, is sometimes offered free and sometimes charged on provision. No PSTN provider offered the other two identification services COLP and COLR.

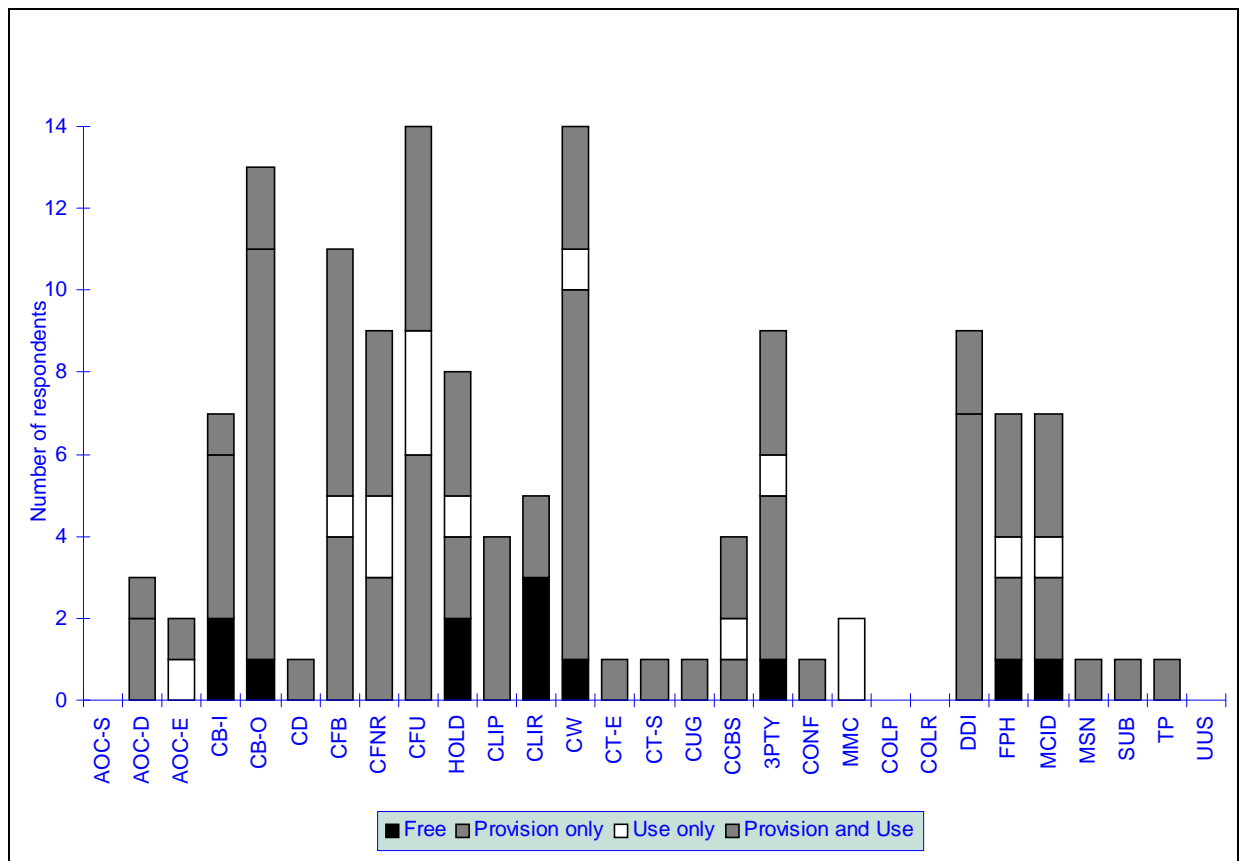


Figure 3: How charges are made for each service - PSTN

4.1.1.3 What MMI do they provide?

Most of the key questions asked related to the format of the man-machine interface the service users were provided with. This was broken down into two sets of questions on the detail of the format of the command dialogue (stimulus protocol) used, and the type of feedback provided to support both normal operation and a range of possible error conditions.

4.1.1.3.1 Command dialogue format

Table 2 shows the collated results from the 18 PSTN operators.

Table 2: Command dialogue implemented by European PSTN operators

Function	Command	% Using
Switch on (basic)	*SC#	100 %
Switch on with data	*SC*SI#	100 %
Switch off (basic)	#SC#	100 %
Switch off erases data stored	-	67 %
Check status/data	*#SC#	83 %
Store data only	*SC*SI*0#	6 % (1 operator)
Switch on using stored data	*SC#	6 % (1 operator)
Switch off and Erase data	#SC*0# (CEPT proposed #SC*1#)	6 % (1 operator)
Where:	SC = Service Code, e.g. 21 for Call Forward Unconditional, and SI = Supplementary Information, e.g. a subscriber number	

All 18 used the same simple command structure defined by CEPT [1] for Switching On, Switching On with Data and for Switching Off. The majority (67 %) also confirmed that whenever the user switched off a service (e.g. Call Forwarding) which has data stored they also erase the data. This is at variance to the CEPT recommendation which was structured to leave the data stored and to enable the user to reuse this data element on a subsequent activation. For example, with a full CEPT implementation the following commands should be available for Call Forwarding - Unconditional:

- Register and Activate *21*Directory Number# or *21*Directory Number*1#
- Deactivate #21# or #21*0#
- Activate again *21#
- Deactivate and Erase #21*1#
- Register and Not Activate *21*Directory Number*0#
- Interrogate, Status Check *#21#
- Interrogate, Data Check *#21*Directory Number#
- Interrogate, Data Request *#21*1#

For most European PSTN operators the commands they would provide for the CFU service are:

- Register and Activate *21*Directory Number#
- Deactivate and Erase #21#
- Interrogate *#21#

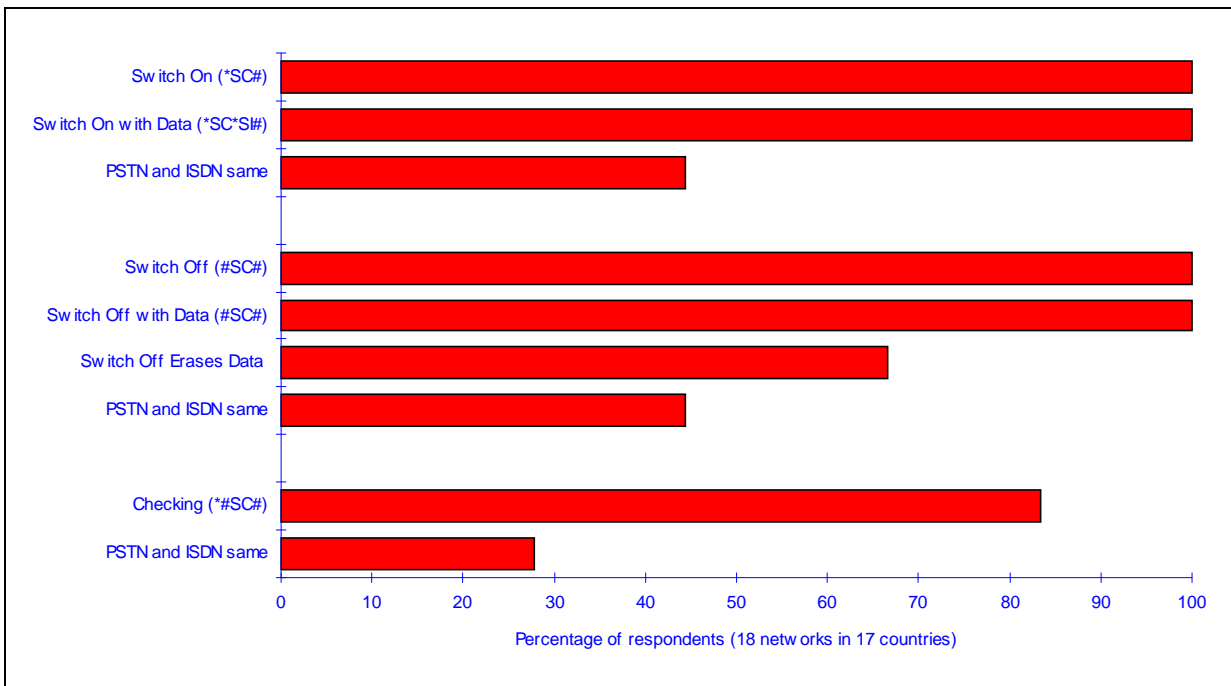


Figure 4: Reported use of basic stimulus commands within PSTNs

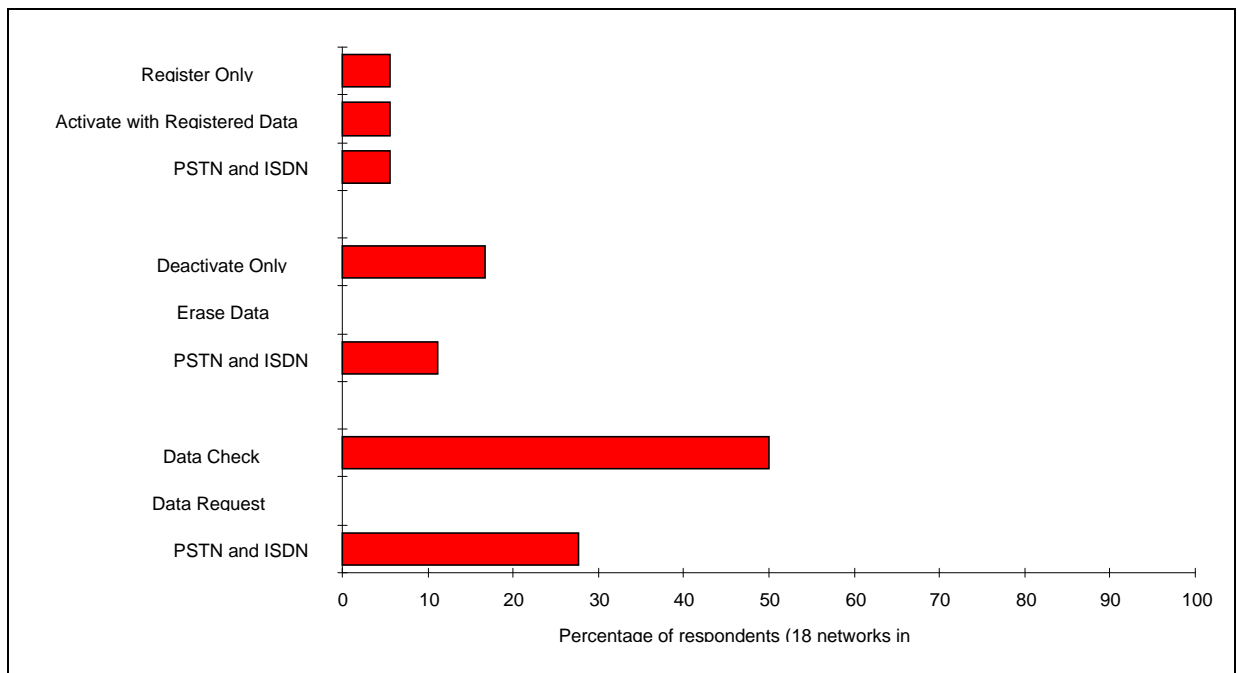


Figure 5: Reported use of complex stimulus commands in PSTNs

Table 2 and figures 4 and 5 confirm that in effect, 17 out of the 18 had implemented cut down versions of the CEPT recommendations [1]. Only one operator reported a facility to store data without switching on, and even their erase command differed from CEPT's proposal.

4.1.1.3.2 Type of feedback

The type of feedback offered was explored in the two final questions (9 and 10). Question 10 asked the respondents to give more detail on the type and content of the feedback they offered in normal successful operation of the services. Figure 6 shows that five service providers (28 %) relied solely on tones to inform the user of the success or otherwise of any service command entered. At the other end of the scale, there are four who state they rely only on announcements. Which leaves the larger group (44 %) using a mixture of tones and announcements. More interesting are the numbers of different tones and announcements used by any one provider. Figure 6 goes on to show that six (33 %) claim they use only one or two tones and of these, two also use only one or two announcements, which means that four (22 %) use only the two tones. At the other extreme, there is just one operator which uses in excess of 20 announcements.

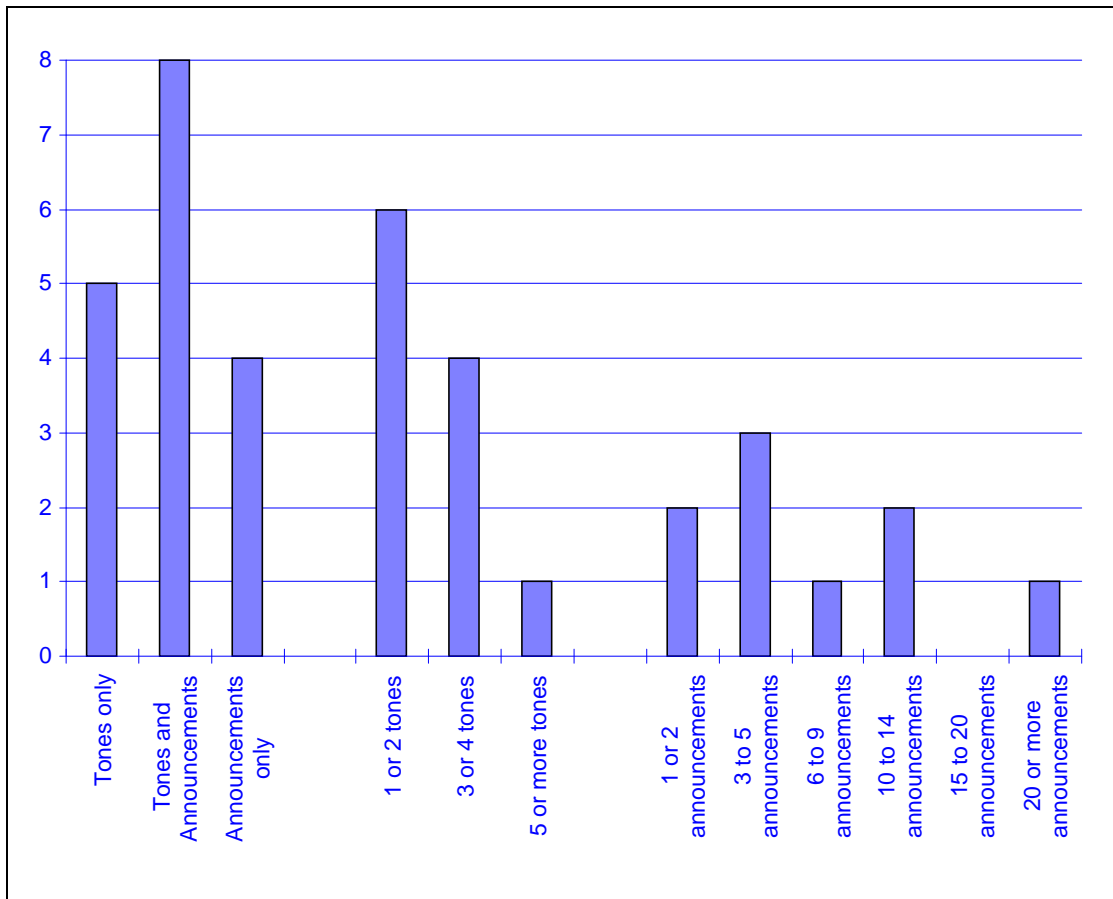


Figure 6: Analysis of the type and format of feedback given to correctly dialed service commands - PSTNs - Question 10

Clearly the majority of service providers are only offering their users the absolute minimum feedback, e.g. using less than 4 tones and/or announcements. One example of the problems this minimum level can cause may suffice. In the CFU service, in response to a correct call forwarding command, if the user is only given a positive indication (whether by confirmation tone, ringing tone, positive indication tone, or by confirmatory announcement "Your command has been executed"), they have no way of knowing whether they are sending calls to the right number or not. The user may be pleased they get no more calls, but somebody may be getting calls they do not want and somebody else may be expecting calls they never get. Equally if a service code error is made but the rest of the command is correct e.g. 67 rather than 61, the user will have invoked an unintended service. With simply a positive indication feedback policy a user can only assume a legitimate command was received by the provider. Whether it will do what the user intended will have to be deduced in due course. If at the same time the party receiving the forwarded calls cannot call the party who set up the call forwarding, because their call is always diverted back to themselves - i.e. a loop is created -, then the service becomes close to unusable. Unfortunately, at least one operator has such a situation.

One place where good feedback may be expected is when the service provider can detect an error. Question 9 explored this further by presenting a set of specific error conditions and asking for the feedback that would be presented. Figure 7 shows the type of feedback offered (a range of different tones vs. voice announcements) within European PSTNs for a range of code scheme error conditions. At best, of the 16 operators completing this question, only about 50 % offered any form of voice announcement. Perhaps of even greater concern was that there was no consistency of meaning that could be assigned to the way tones were used to inform the user of error states. For example: in response to using the wrong prefix (e.g. `#*43#` instead of `*#43#`), a user might have got: a Busy Tone, a Negative Information Tone, a Special Information Tone or a Voice Announcement, depending on his service provider.

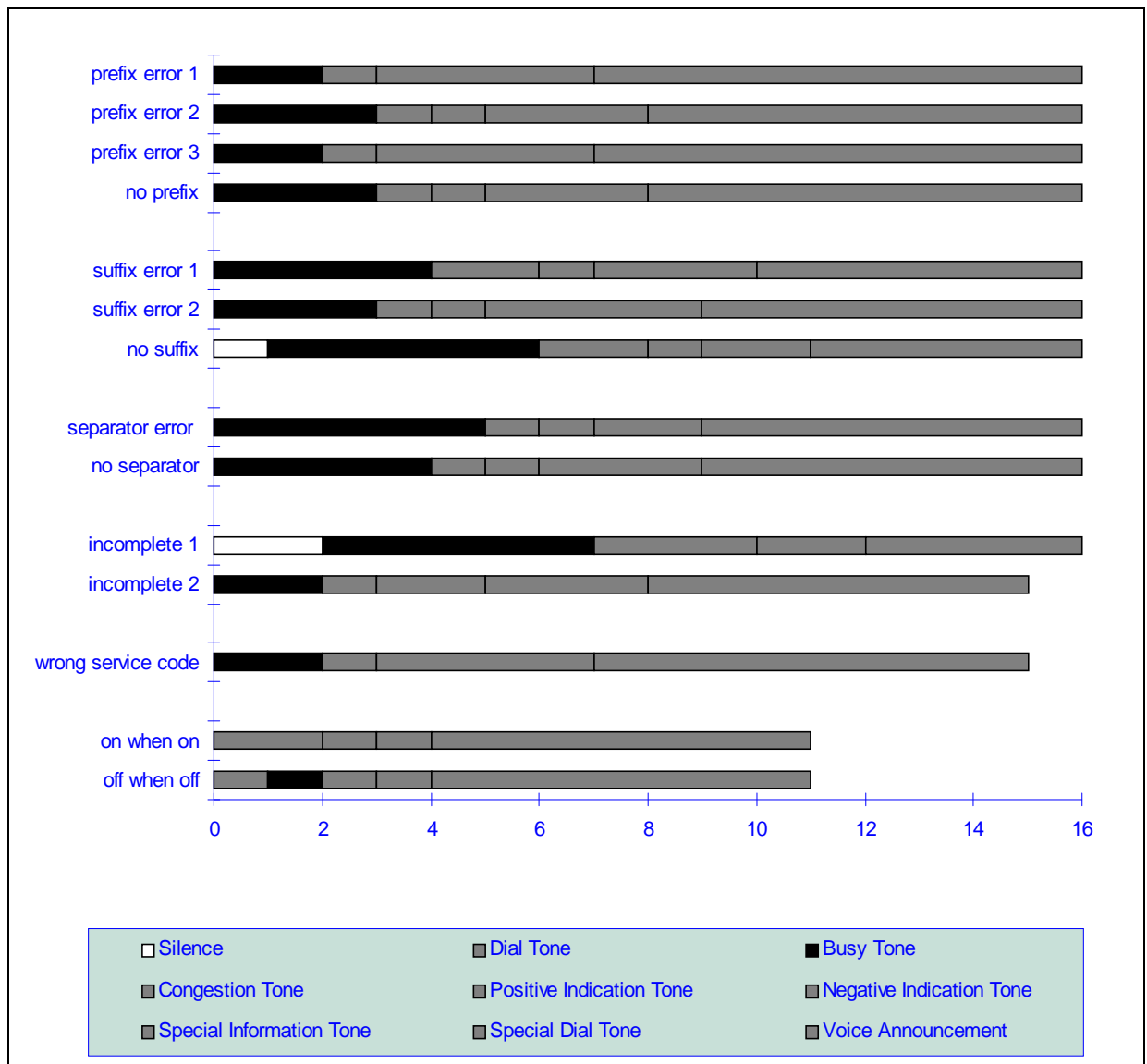


Figure 7: Responses to dialling errors in supplementary service control commands - PSTNs - Question 9

4.1.2 ISDN services

4.1.2.1 Who provides what in ISDN?

Table C4 (annex C) presents the recorded year of implementation for each supplementary service for each of the responding PSTN networks/countries. The total number of services reported by each respondent is shown in figure 8.

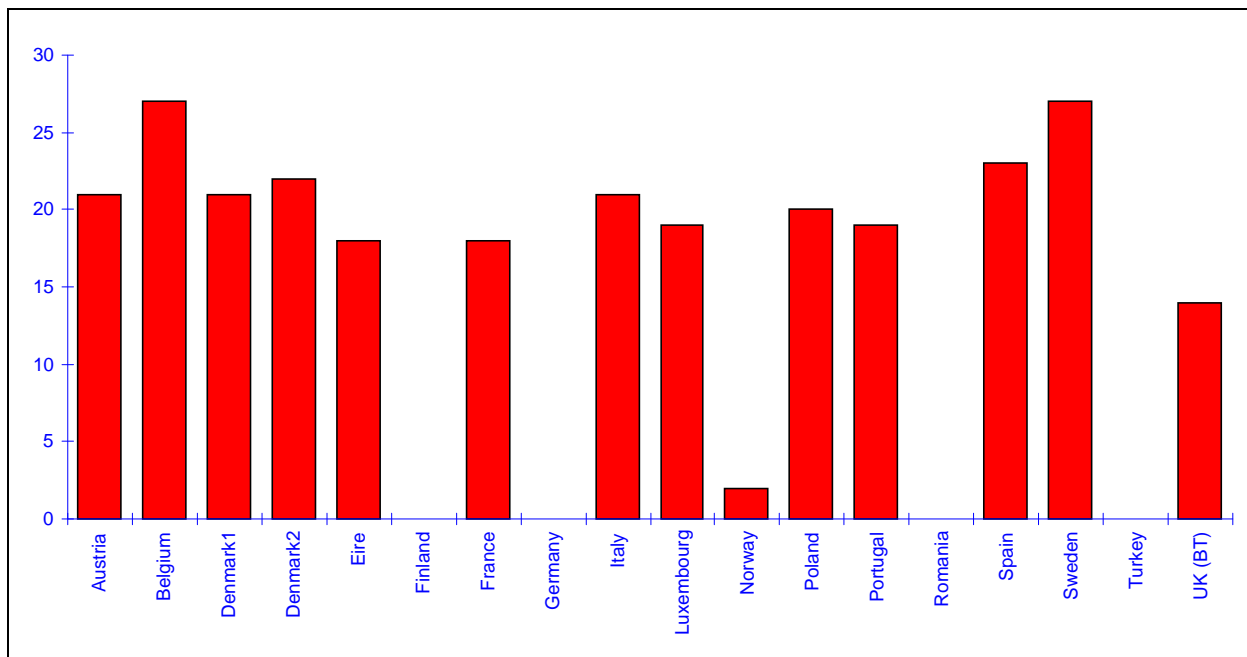


Figure 8: Number of reported services for each respondent - ISDN

Figure 9 shows the number of respondents offering each of the ISDN services under investigation and the mean year of its implementation. The main difference to the PSTN is that because so many more providers are offering so many more services, it is easier to say which services are *not* offered by over half the respondents; these include:

- Call Barring - Incoming
- Call Transfer - Explicit
- Call Transfer - Simple
- Completion of Call to Busy Subscriber
- Conference - Add on
- Conference - Meet Me
- Freephone

The mean year for most of these services is of course that much later than within the PSTN (1992 - 1994 rather than 1984 - 1988).

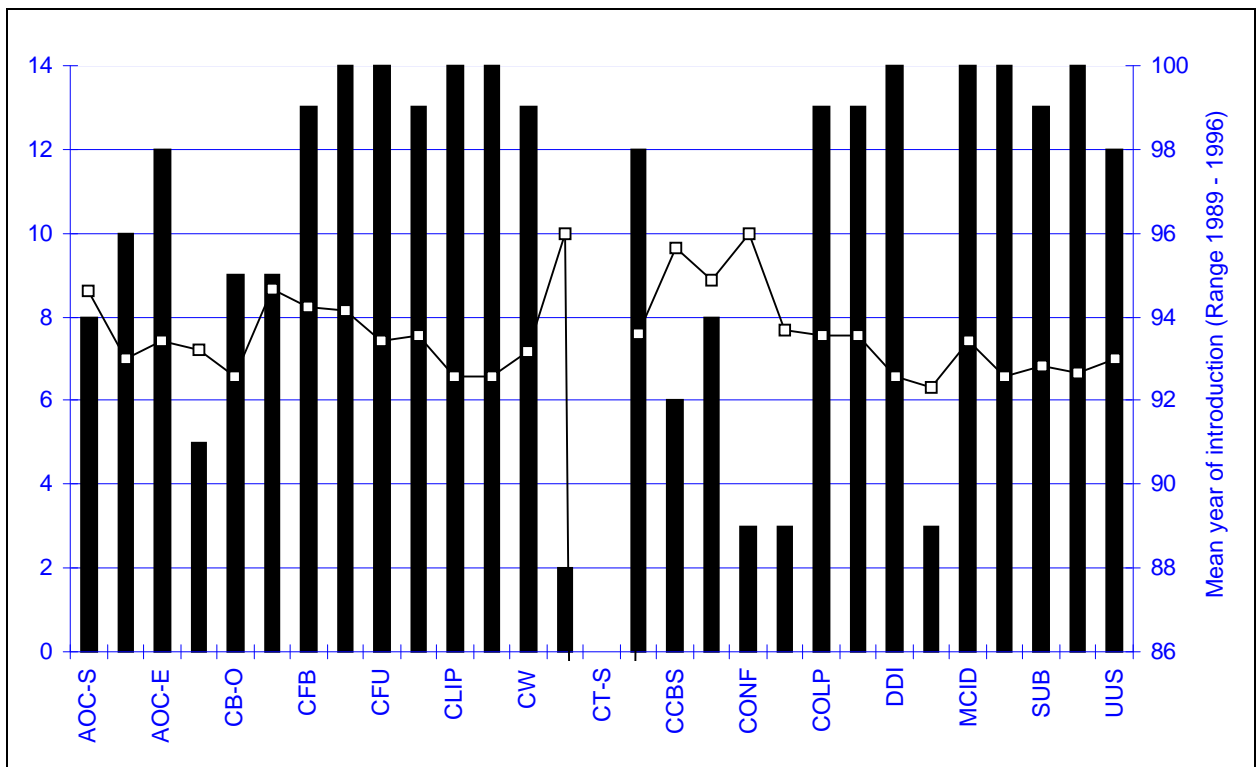


Figure 9: Number of respondents offering each service and mean year of implementation - ISDNs

4.1.2.2 How do ISDN networks charge for different services?

As within the PSTN, there is little consistency in charging policy between service providers for the different services. Figure 10 shows the number of respondents for each charging option. Comparison with the PSTN (figure 3) shows that many more providers are offering more services free, particularly CLIP and TP, almost all prefer the charging on provision option, except for the CF services where quite a number charge both for provision and for use.

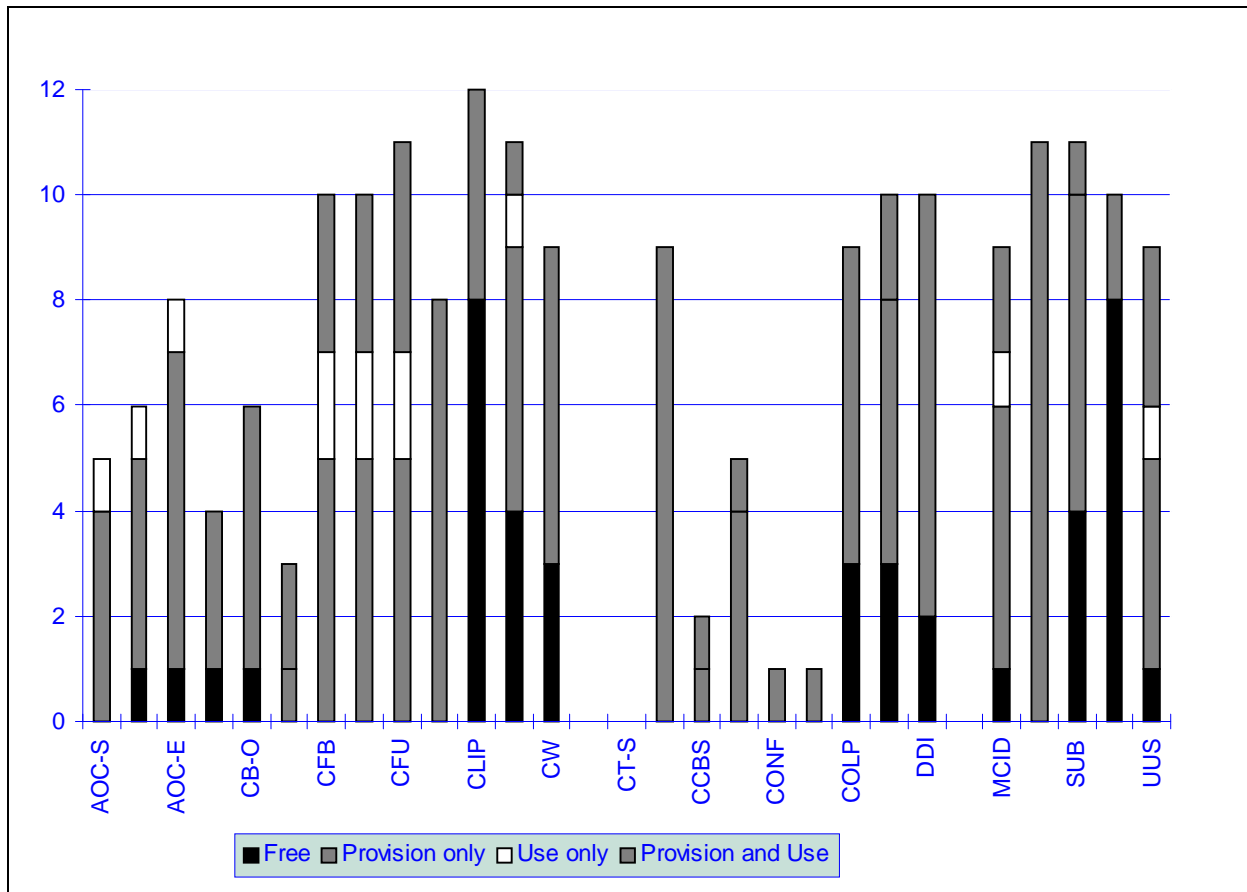


Figure 10: How charges are made for each services - ISDNs

4.1.2.3 What MMI do they provide for ISDN?

What MMI is, is a key question for ISDN providers. The recommendations and standards all expect the providers and terminals to make use of functional rather than stimulus signalling, but the respondents show something of a dichotomy. Between 25 % and 50 % stated that the MMI for various control commands is the same for ISDN as it is for PSTN (see figures 4 and 5, subclause 4.1.1.3.1). What is more, 8 providers (about 50 % of those offering ISDN) reported on their use of supplementary service codes with ISDN services (see table C6, annex C), and only very few respondents clearly stated that service codes or a stimulus protocol style MMI was not applicable to the ISDN services.

Of the 7 providers who gave an indication of the type of feedback they provided, 1 stated it only provided tones, 1 stated that it was determined by DSS1, and 5 stated they provided visual announcements. Of these five, 1 provider listed 4 announcements and another 9 announcements. Unfortunately these data are insufficient to draw conclusions.

4.1.3 PSTN and ISDN use of service codes?

From the responses given to the first question in the fixed network questionnaire, it is possible to make a comparison between the reported use of service codes within the two networks. Table 3 lists the recommended CEPT codes and then tables the number of respondents who are compliant with this list in both the PSTN and the ISDN. It also tables the service codes used by those respondents who report using non-compliant service codes. Thus, the CEPT code for the service AOC-S is "461"; there are no providers of this service within the PSTN who use this code - the one provider who offers this service in the PSTN uses the code "40" - whereas the one provider who offers the service in the ISDN is compliant i.e. uses the code "461". Where there are alternative codes recommended by CEPT, the number of respondents compliant with each are recorded in parentheses. It is also possible that one provider may use more than one code perhaps to enable different aspects of the service (see the service CB-O in the table).

Table 3: Comparison of CEPT recommendations versus reported PSTN and ISDN supplementary service code usage

	CEPT Standard	PSTN Compliant	PSTN Non-Standard	ISDN Compliant	ISDN Non-Standard
AOC-S	461	0	40	1	
AOC-D	462, 463	0	40	1	23, SO?
AOC-E	464	0	40 (x3), 17, 1717	2	24, SO?
CB-I	35	1	SO?, 26 (x2), 261		SO?
CB-O	33, 331, 332, 34	9 (33 x 6) (34 x 5)	SO?	3 (33 x 3) (34 x 1)	17, SO?
CD	66		21	2	
CFB	67	8	31, 60, 68	4	31, 671
CFNR	61, 62, 63	8 (61 x 8) (62 x 1)	28	4	28, 611
CFU	21, 22	14 (21 x 14) (22 x 1)	27	8 (21 x 8) (22 x 0)	211
HOLD	94, SO1, SO2	0	SO?, 43	1	11, SO?
CLIP	30	0	1470	1	SO?
CLIR	31	2	141	2	30, SO?
CW	43, SO0, SO1	12	41	4	25, SO?
CT-E	96, SO4	0			
CT-S	97	0	SO4		
CUG	01,	1		4	SO?
CCBS	37, SO5	1	SO5	3	SO5
3PTY	SO3	4	70	1	95
CONF	70, 71	1	SO?	1	
MMC	72	0	160	1	
COLP	76	0		2	SO?
COLR	77	0		2	SO?
DDI			53		53, SO?
FPH			SO?, 020		020,
MCID	39	2	SO9, 19, SO39	4	32, SO?
MSN					SO?
SUB	89	0		1	SO?
TP	79	0		1	SO?
UUS	36	0		1	SO?

From the review offered by table 3 it is perhaps surprising that there seem to be fewer non-compliant alternatives in the ISDN than there are in the PSTN. The full data of the service codes used by each respondent are given in tables C3 (PSTN) and C6 (ISDN) (see annex C). These confirm that if service codes are to be harmonized across Europe there may be some significant opposition.

4.1.4 Mobile networks

Unfortunately, due to a very low response rate the data received from the mobile networks cannot be analysed in the same way as for fixed networks. Only five respondents presented any data for these networks, and of these the only question answered reasonably completely was question 1 which considered the year of introduction for each of the services under review, the service codes used and the charging policy. These data are tabled separately in annex C for the analogue and digital mobile networks.

The only tentative conclusions that are possible from these tables are:

- Digital GSM implementations are much more consistent in their use of service codes than the analogue mobile networks;
- There is no consistency in charging policy for services in either analogue or digital networks.

5 Survey of users in centrex and PBX environments

5.1 Introduction

This clause describes a limited survey carried out in Norway of selected supplementary services then currently available in the PSTN. The survey took the form of a questionnaire which was circulated to three groups of telephone users. The results here are compiled from two of the three proposed groups.

5.2 The questionnaire

The questionnaire was designed to find out what users knew about supplementary services, how easy they found access to services, how often they used them, and their views on any feedback provided in the service.

Only three supplementary services were presented for comment, as these had been the subject of the previous experimental evaluations carried out [6, 7 & 8]. Subjects replying to the questionnaire were invited to add other services with which they may be familiar. The services included in the questionnaire were:

- Call forwarding
- Call barring
- Conference call

The questionnaire contained eight questions. These covered the following topics:

- Type of phone and network connected;
- Frequency of use of listed services;
- Source of information about supplementary services;
- Ease of use of services (This question had a section for each service, employing a rating scale 0 - 10, where 0 is very difficult and 10 is very easy);
- Feedback provided by the network for the selected services and where in the dialogue it is presented;
- Usefulness of the feedback (Rated as above 0 - 10).

Participants were also invited to add general or specific extra comments about services and their use of them.

A copy of the complete questionnaire is included in annex B.

5.3 Subjects

Three groups of subjects were originally chosen for this survey.

Group 1 consisted of 14 subjects, selected at Norwegian Telecom's Research Institute (now Telenor Research). The participants were all research scientists and engineers, working in the general field of telecommunications, but not necessarily concerned with services. The PBX installation in Telenor Research was a centrex, supplied by Televerket (now Telenor), the Norwegian PSTN network provider.

Group 2 consisted of 18 subjects, at the University of Oslo's Institute of Psychology. A standard PBX was installed, from the private communications business of Telenor. The subjects were almost all staff, self-selected from 55 possible posted in the staff mailbox system.

Group 3 was to have consisted of an equivalent number (or more) of the general public in the Sandefjord area. However, the results from the two groups surveyed suggested that little additional information would be gained, apart from simply increasing the numbers in the sample. This is discussed later.

Group 1 was presented with the questionnaire as shown in the annex B, in its English version. All subjects were fully conversant with English, commonly used in technical reports, specifications, etc. Group 2 was given a version translated into Norwegian, using the accepted translations of the supplementary service names. The preamble was simplified for Group 2, and a rating scale from 0 - 5 was employed, instead of 0 - 10.

5.4 Results

With such small numbers, no statistical inferences may be drawn, so that the results are discussed mainly in terms of the proportions of subjects responding to each question. The ratings scales have, where appropriate, been averaged. The results have not been extrapolated to percentages, neither should they be taken to be representative of the general user population.

5.4.1 Group 1 - Telenor Research

5.4.1.1 General

All 14 subjects had use of a 12 key push-button telephone served by a centrex PBX, operating through the local digital switch (Alcatel System 12[®]).

No record was made of subjects' age, sex, educational attainments, or any other rating of ability.

A user guide describing the supplementary services, their availability and instructions for use, prepared by Telenor, was issued within Telenor Research. All subjects, except two, obtained their information about the services from this source, the remaining two had services of special interest explained to them by someone else (but see later).

5.4.1.2 Frequency of use

All 14 subjects used one or more of the three services under investigation.

Call Forwarding (CF) was used by 13 of the 14 subjects; four of them daily, eight weekly and one monthly or less.

Call Barring (CB) was not used by any subject, although some did rate the procedure, presumably from the user guide. Some subjects were in doubt whether the service was on offer.

Call Waiting (CW) was used by 3 of the 14 subjects, two using it daily and one monthly.

Conferencing (CONF) was used by 4 of the 14, all on a monthly basis.

In addition to these three services, Voice-mail as provided by the centrex was used by one subject daily, and weekly by another. Completion of Call to Busy Subscriber (CCBS) was used by one subject weekly.

A particular combination was mentioned by one subject, which was to use his radio pager for deflected calls. A clear indication that the CF service was very useful.

5.4.1.3 Ease of use

Each supplementary service was rated on the scale 0 = very difficult, to 10 = very easy. The mean scores are given in the table below.

Table 4: Mean ratings for ease of use

	CF	CB	CW	CONF
Mean score	6,4	5,5	5,4	3,5
Subjects replying to question	14	5	8	8

The higher the mean score, the easier the subjects felt the service was to use. Thus, for CF, 9/14 scored 5 and better. Finding the service easy to use correlates well with the higher periodic usage. CB, on the other hand, not used by any subject, was rated difficult, presumably just on the description alone. Both CW and CONF were rated as more difficult by half the subjects, on the basis of mainly weekly, i.e. infrequent, use.

5.4.1.4 Specific difficulties in use

The mean rating scores are given in each table, followed by a brief discussion. Where ratings of 0 - 5 indicate difficulty, and 6 - 10 relative ease.

Table 5: Difficulties with Call Forwarding - CF

Question	Mean score	Number of subjects
Remembering service is available	8,5	14
Remembering the service code	5,4	13
Remembering to switch on	5,4	14
Remembering to switch off	4,5	14
Remembering how to switch off	6,2	13
Remembering the number to forward to	7,7	11

All subjects felt it easy to remember the service code, with the regular daily users scoring higher than the mean. Half the subjects had difficulty in remembering the service code itself (21), and the procedure to switch on the service, but remembering to switch it off afterwards (i.e. return phone to normal), in the absence of any feedback until one picks up the phone, was more difficult.

Table 6: Difficulties with Call Barring - CB

Question	Mean score	Number of subjects.
Remembering which service	2,4	5
Remembering the service code	3,4	5
Remembering the dialogue	3,0	5
Remembering to switch off	2,8	5
Other		

These data are for a service none of the subjects actually used, so presumably the ratings are based on a reading of the service description and instructions for use in the user guide. All scores suggest that the subjects believed the service would be difficult to use.

Table 7: Difficulties with Call Waiting - CW

Question	Mean score	Number of subjects
Remembering the service is available	5,9	8
Remembering the dialogue	4,9	7

Two subjects were unaware that the service was available at all. One used help from the PBX operator. Half of the subjects responding, however, were easily able to remember the availability, some scoring 10, two scoring 0. It is assumed that they had difficulties remembering the details of the dialogue - how to hold call in progress and speak to new caller, etc. No other specific problems were noted.

Conference Calls - CONF

Without being specific in their answers, it is assumed that subjects made three party calls, but frequency of use was too low for anyone to be likely to become familiar with the procedures.

Table 8: Difficulties with Conference Calls - CONF

Question	Mean score	Number of subjects
Remembering the service is available	6,7	7
Remembering the service code	4,0	7
Remembering the dialogue	3,3	7
Remembering the procedure	3,0	7
Remembering the terminating procedure	7,3	7

Nearly all subjects found it easy to remember the service was available, but had difficulty in remembering the service code and even greater difficulty in remembering the procedural dialogue for calling each party in turn. The termination procedure for each party, on the other hand, appeared to cause less difficulty. One subject made a specific point about this latter question.

5.4.1.5 Feedback

The table shows the feedback given in the particular environment at Telenor Research. It is not necessarily the same in the public network.

Table 9: Type of feedback provided with each service within Telenor

Service	Feedback						
	tone	voice	display	before	during	after	none
CF	x					x	
CB	x				x		
CW	x				x		
CONF	x				x		

Two of the subjects seemed confused about feedback, giving different answers to the others for the same service. This may be because the feedback tone itself is inadequate as a prompt.

All subjects rated the feedback as being very helpful, in spite of the argument above. Clearly feedback is an important issue in use of services, and is much appreciated when it is present.

5.4.1.6 General comments

About half the subjects made some comments at the end of the questionnaire. They included such things as:

- "...(feedback) message gives error but not what it is."
- "...potentially useful. Made no effort to learn procedures. Uses Voice-mail plus pager."
- "...poor interface. Difficult to remember services. Useful when used daily."
- "...generally difficult to use."
- "...do not know the services (call barring)."

5.4.2 Group 2 - University in Oslo

5.4.2.1 General

Eighteen members of staff, including some senior research students, answered the questionnaire in its Norwegian translation. 55 questionnaires were distributed to all staff mailboxes in the Institute of Psychology with a return of 32 %.

All subjects had use of a 12 key push-button telephone connected to a PBX supplied by Telenor. No record was made of subjects personal details.

Telenor provided a single A4 page guide to supplementary services, and all subjects obtained their knowledge of services available from this source. Interestingly, although the actual procedures for controlling the services is well presented, very little information is given in terms of what the service can do for the user - just a single word title, e.g. *Medflytting* is Call Forward.

5.4.2.2 Frequency of use

Only five subjects out of the 18 had apparently ever made use of the supplementary services on offer.

Call Forwarding (CF) was used by one subject on a daily basis, one weekly and three monthly.

Call Barring (CB) was used by the daily user of CF, but only once a month, together with one other. This subject also used a Wake-up facility, but since this did not appear to be available at the university, it is assumed he used it at home.

5.4.2.3 Ease of use

The only two subjects rating ease of use for Call Forwarding appeared to find it moderately easy, again confirming the familiarity theme, but one also added that he always deflected to the same number.

Subjects appeared to be confused also about feedback, but generally agreed that they found it useful.

The only appropriate general comment was from a subject who preferred to use the telephone as often as possible as *"...an old-fashioned telephone."*

5.4.2.4 Discussion re Group 2

The extremely disappointing result from this group can be interpreted in two ways. One is that the subjects genuinely had no use for, or interest in, supplementary services. This interpretation is supported by the extremely poor information made available to potential users.

The other, less charitable, view of the results is that the subjects had no interest in filling in questionnaires about such a topic.

5.5 Comparing usage between the two groups

The question of how usable are the current implementations can only be addressed by comparing the users from the two different environments. User group 1 were all research scientists and engineers working at a telecommunications research centre: the services were provided by centrex. User group 2 were also research scientists, this time within a non-technical university department, where the services were provided by PBX. The target services (Call Forward, Call Barring, Call Waiting and Conference) were accessed and controlled in a similar way in both groups. Table 10 compares the reported frequency of use. Quite obviously being telephony aware and/or technically oriented has impact on usage.

Table 10: Reported frequency of use of 4 services between two subject groups

	Group 1: Telephone aware (14 Ss)			Group 2 Less aware (18 Ss)			total
	Daily	Weekly	Monthly	Daily	Weekly	Monthly	
Call Forward	28 %	57 %	7 %	6 %	6 %	17 %	56 %
Call Barring						6 %	3 %
Call Waiting	14 %		7 %				9 %
Conference			28 %				12 %

Group 1 were also asked to elucidate on specific difficulties in relation to each service. Table 11 shows their reported level of difficulty for each service on the scale 0 - 10 (very difficult to very easy). Note that not all questions were asked for each service.

Table 11: Areas of reported difficulties with centrex services

Remembering...	CFU	CB	CW	CONF
...the service is available	8,5	2,4	5,9	6,7
...the service code	5,4	3,4	-	4,0
...to switch on	5,4	3,0	4,9	3,3
...to switch off	4,5	2,8	-	-
...how to switch on	6,2	-	-	3,0
...how to switch off	-	-	-	7,3
...other numbers needed (subscriber, PIN, etc.)	7,7	-	-	-

The problems areas (mean rating scores of less than 6, emboldened in table 11) for these users at least were remembering the code and remembering to switch the service on and off. In this respect even these telephone-aware users seem to be little different to many other groups that have been reported previously.

5.6 Discussion and conclusions

Although comparatively few subjects took part in this survey, the picture they tell is reasonably coherent and the results are what might be expected, considering the general feeling about supplementary services and the results from the other reported experiments [10, 13 & 14].

It is disappointing that the University Group, who might be expected to be both receptive to new technology and analytical in their comments, provided so little data.

The clear conclusion is that familiarity with a service allows frequent use and consequently easy recall and execution of procedures. The key to that familiarity seems to lie in the quality of information available about supplementary services given by the service provider. Almost universally, the user guides are inadequate. They do not present a service in a way that allows a potential user to identify his likely need, neither do they explain procedures in a satisfactory way.

The second weakness seems to be in the services themselves, where inadequate care has been taken to provide the sort of feedback necessary to reinforce a user's knowledge about a service. Typically, no error correction help is given, even with or after a fault message. Neither has the feedback mode been developed to be appropriate to the service or the needs of the user. Finally, no help or demonstration service appears to be available, on or off-line, to reinforce the information contained in the user guide.

Annex A: Public-network-based supplementary services questionnaires

A.1 Introductory letter

ETSI Project Team 50 has been tasked to work towards the definition of: "a Harmonized Minimum MMI for the Access and Control of Telecommunications Services". One of the project's aims is to set a framework to raise the usability and uptake of network based supplementary services.

This questionnaire is designed to elicit up-to-date information about, how European Network Operators have implemented supplementary services within their fixed networks, PSTN and ISDN. In particular, we need to know:

- what supplementary services are, or will be, implemented, in each network;
- what commands are used to enable the user to access and control the services; and
- what types of feedback is given to the end-users?

Please answer all the questions as completely as you can and return the questionnaire, preferably by fax, at the latest by 31st March 1994 to the PT50 Leader at Espace Beethoven, ETSI HQ, F-06921 SOPHIA ANTIPOLIS, France.

Thank you in advance for your help.

A.2 The fixed network questionnaire

GENERAL

1 Do your existing fixed networks (PSTN and/or ISDN) support any Supplementary Services (e.g. Call Waiting, Call Forwarding, Etc..)?

Yes Please go to question 2

No Please go to the last question

2 What Supplementary Services do you, or will you, support in your fixed networks?

- Please note in the table below:

the year of introduction, or planned introduction
 the Service Codes or Switching Orders you use
 and how you charge the subscriber ?

- Please indicate:

F = The service is free;
P = Charge for provision, use is free;
U = Provision is free, charge for use (i.e. per call);
PU = Charge for provision and charge for use;

for each network PSTN or ISDN.

	PSTN			ISDN		
	Year of Introduction	Service Code	When charged	Year of Introduction	Service Code	When charged
Advice of Charge, Call Set-up						
Advice of Charge, During Call						
Advice of Charge, End of Call						
Call Barring, Incoming Calls						
Call Barring, Outgoing Calls						
Call Deflection						
Call Forwarding Busy						
Call Forwarding No Reply						
Call Forwarding Unconditional						
Call Hold						

	PSTN			ISDN		
	Year of Introduction	Service Code	When charged	Year of Introduction	Service Code	When charged
Calling Line Identification Presentation						
Calling Line Identification Restriction						
Call Waiting						
Call Transfer, Explicit						
Call Transfer, Simple						
Closed User Group						
Completion of Call to Busy Subscriber						
Conference Call , 3-Party						
Conference Call , Add On						
Conference Call , Meet Me						
Connected Line Identification Presentation						
Connected Line Identification Restriction						
Direct Dialling In						
Freephone						
Malicious Call Identification						
Multiple Subscriber Number						
Sub-Addressing						
Terminal Portability						
User User Signalling						

BASIC STIMULUS COMMANDS

Questions 3 to 5 ask about the basic set of stimulus commands the user may use to access and control a supplementary service, e.g. Switch On, Switch Off and, Check Status.

3 What is the command used to switch on a service (i.e. activate)?

3a To switch on Call Waiting, is it *43#?

Yes No if No, please write the full command used

.....

3b To switch on Call Forwarding to Telephone No.112233, is it *21*112233#?

Yes No if No, please write the full command used

.....

3c Is the Switch On command the same for both fixed networks, PSTN and ISDN?

Yes No if No, please clarify

.....

4 What is the command used to switch off a service (i.e. de-activate)?

4a To switch off Call Waiting is it #43#?

Yes No if No, please write the full command used

.....

4b To switch off Call Forwarding to Telephone No.112233, is it #21#?

Yes No if No, please write the full command used

.....

4c When the end-user switches off a service which uses stored data, like Call Forwarding, is the data automatically erased at the same time?

Yes No

4d Is the Switch Off command the same for both fixed networks, PSTN and ISDN?

Yes No if No, please clarify

.....

5 What is the command used to check the status of a service (i.e. interrogate)?

5a To check the status of Call Waiting, is it *#43#?

Yes

No if No, please write the full command used

.....

5b Is the Status Check command the same for both fixed networks, PSTN and ISDN?

Yes

No if No, please clarify

.....

COMPLEX STIMULUS COMMANDS

Questions 6, 7 and 8 relate to more complex stimulus commands that the networks may support.

6 Is there a separate command which will allow end-users to store data without switching on the service (i.e. register only)?

Yes Please go to questions 6a and 6b

No Please go to question 7

6a What is the command used to store the number 112233 as a Call Forwarding number for future use, is it *21*112233*0#?

Yes No if No, please write the full command used

.....

6b It the end-user can store data without switching on a service, is there a separate command which can allow users to switch on (i.e. activate) a service which uses data previously stored?

To switch on Call Forwarding to the previously stored number 112233, is it *21#?

Yes No if No, please write the full command used

.....

6c Where it is supported, is the command for storing data without switching on (i.e. register only), the same for both fixed networks?

Yes No if No, please clarify

.....

7 Is there a separate command which will allow users to switch off a service without erasing the stored data (i.e. de-activate only)?

Yes Please go to questions 7a and 7b

No Please go to question 8

7a What is the command used to switch off Call Forwarding to Telephone no. 112233, without erasing the data, is it #21#?

Yes No if No, please write the full command used

.....

7b If the end-user can switch off a service without erasing stored data; is there a separate command which will allow users to erase data (Erase) from a service which has had data previously stored?

To erase any data stored for Call Forwarding, is it #21*1#?

Yes No if No, please write the full command used

.....

7c Where it is supported, is the command for switching off a service without erasing stored data (i.e. de-activate only), the same for both fixed networks?

Yes No if No, please clarify

.....

8 Does the Status Check (i.e. interrogate) command allow the end-user to ask for specific information?

Yes Please go to questions 8a and 8b

No Please go to question 9

8a Can the end-user request a data-check, i.e. to compare any stored data with data included in the keyed command?

Is the data check command *#21*112233#?

Yes No if No, please write the full command used

.....

8b Can the end-user send a data-request, i.e. ask the network to inform them of the content of any data stored?

Is the data request command *#21*1#?

Yes No if No, please write the full command used

.....

8c Where they are supported, are the command for checking stored data (i.e. data check/request), the same for both fixed networks?

Yes No if No, please clarify

.....

ERROR PROTECTION

Question 9 relates to the error protection strategy provided by the network to support incorrectly entered stimulus commands and/or data.

9 What feedback does the end-user get in the following circumstances:

9a When the end-user gives the wrong prefix or omits it altogether?

#*43#

****43#**

##43#

43#

9b When the end-user gives the wrong suffix or omits it altogether?

43

***#43*#**

***43**

9c When the end-user gives the wrong separator or omits it altogether?

***21*#112233#**

***21112233#**

9d When the end-user gives an incomplete command string?

***21*123**

***21#** (if no data is currently stored)

9e When the end-user gives the wrong Service Code, i.e. one not subscribed to or one not yet assigned?

***85#**

9f When the end-user gives a correct command string but in the wrong circumstances?

***43#** (when Call Waiting is already ON)

#43# (when Call Waiting is already OFF)

9g Is the error protection strategy the same for both fixed networks?

Yes

No

if No, please clarify

.....

A.3 The mobile network questionnaire

GENERAL

1 Do your existing mobile networks (TACS and/or GSM) support any Supplementary Services (e.g. Call Waiting, Call Forwarding, Etc..)?

Yes Please go to question 2

No Please go to the last question

2 What Supplementary Services do you, or will you, support in your mobile networks?

- Please note in the table below:

the year of introduction, or planned introduction
 the Service Codes or Switching Orders you use
 and how you charge the subscriber ?

- Please indicate:

- F** = The service is free;
- P** = Charge for provision, use is free;
- U** = Provision is free, charge for use (i.e. per call);
- PU** = Charge for provision and charge for use;

for each network TACS or GSM.

	TACS/ETACS/NMT			GSM		
	Year of Introduction	Service Code	When charged	Year of Introduction	Service Code	When charged
Advice of Charge, Call Set-up						
Advice of Charge, During Call						
Advice of Charge, End of Call						
Call Barring, Incoming Calls						
Call Barring, Outgoing Calls						
Call Deflection						
Call Forwarding Busy						
Call Forwarding No Reply						
Call Forwarding Unconditional						
Call Hold						

	TACS/ETACS/NMT			GSM		
	Year of Introduction	Service Code	When charged	Year of Introduction	Service Code	When charged
Calling Line Identification Presentation						
Calling Line Identification Restriction						
Call Waiting						
Call Transfer, Explicit						
Call Transfer, Simple						
Closed User Group						
Completion of Call to Busy Subscriber						
Conference Call, 3-Party						
Conference Call, Add On						
Conference Call, Meet Me						
Connected Line Identification Presentation						
Connected Line Identification Restriction						
Direct Dialling In						
Freephone						
Malicious Call Identification						
Multiple Subscriber Number						
Sub-Addressing						
Terminal Portability						
User User Signalling						

BASIC STIMULUS COMMANDS

Questions 3 to 5 ask about the basic set of stimulus commands the user may use to access and control a supplementary service, e.g. Switch On, Switch Off and, Check Status.

3 What is the command used to switch on a service (i.e. activate)?

3a To switch on Call Waiting, is it *43#?

Yes No if No, please write the full command used

.....

3b To switch on Call Forwarding to Telephone No.112233, is it *21*112233#?

Yes No if No, please write the full command used

.....

3c Is the Switch On command the same for both mobile networks, TACS and GSM?

Yes No if No, please clarify

.....

4 What is the command used to switch off a service (i.e. de-activate)?

4a To switch off Call Waiting is it #43#?

Yes No if No, please write the full command used

.....

4b To switch off Call Forwarding to Telephone No.112233, is it #21#?

Yes No if No, please write the full command used

.....

4c When the end-user switches off a service which uses stored data, like Call Forwarding, is the data automatically erased at the same time ?

Yes No

4d Is the Switch Off command the same for both mobile networks, TACS and GSM?

Yes No if No, please clarify

.....

5 What is the command used to check the status of a service (i.e. interrogate)?

5a To check the status of Call Waiting, is it *#43#?

Yes

No

if No, please write the full command used

.....

5b Is the Status Check command the same for both mobile networks, TACS and GSM?

Yes

No

if No, please clarify

.....

COMPLEX STIMULUS COMMANDS

Questions 6, 7 and 8 relate to more complex stimulus commands that the networks may support.

6 Is there a separate command which will allow end-users to store data without switching on the service (i.e. register only)?

Yes Please go to questions 6a and 6b

No Please go to question 7

6a What is the command used to store the number 112233 as a Call Forwarding number for future use, is it **21*112233#?

Yes No if No, please write the full command used

.....

6b If the end-user can store data without switching on a service, is there a separate command which can allow users to switch on (i.e. activate) a service which uses data previously stored?

To switch on Call Forwarding to the previously stored number 112233, is it *21#?

Yes No if No, please write the full command used

.....

6c Where it is supported, is the command for storing data without switching on (i.e. register only), the same for both mobile networks?

Yes No if No, please clarify

.....

7 Is there a separate command which will allow users to switch off a service without erasing the stored data (i.e. de-activate only)?

Yes Please go to questions 7a and 7b

No Please go to question 8

7a What is the command used to switch off Call Forwarding to Telephone no. 112233, without erasing the data, is it #21#?

Yes No if No, please write the full command used

.....

7b If the end-user can switch off a service without erasing stored data; is there a separate command which will allow users to erase data (Erase) from a service which has had data previously stored?

To erase any data stored for Call Forwarding, is it ##21#?

Yes No if No, please write the full command used

.....

7c Where it is supported, is the command for switching off a service without erasing stored data (i.e. de-activate only), the same for both mobile networks?

Yes No if No, please clarify

.....

8 Does the Status Check (i.e. interrogate) command allow the end-user to ask for specific information?

Yes Please go to questions 8a and 8b

No Please go to question 9

8a Can the end-user request a data-check, i.e. to compare any stored data with data included in the keyed command?

Is the data check command *#21*112233#?

Yes No if No, please write the full command used

.....

8b Can the end-user send a data-request, i.e. ask the network to inform them of the content of any data stored?

Is the data request command *#21*1#?

Yes No if No, please write the full command used

.....

8c Where they are supported, are the command for checking stored data (i.e. data check/request), the same for both mobile networks?

Yes No if No, please clarify

.....

ERROR PROTECTION

Question 9 relates to the error protection strategy provided by the network to support incorrectly entered stimulus commands and/or data.

9 What feedback does the end-user get in the following circumstances:

9a When the end-user gives the wrong prefix or omits it altogether?

#*43#

****43#**

##43#

43#

9b When the end-user gives the wrong suffix or omits it altogether?

43

***#43*#**

***43**

9c When the end-user gives the wrong separator or omits it altogether?

***21*#112233#**

***21112233#**

9d When the end-user gives an incomplete command string?

***21*123**

***21#** (if no data is currently stored)

9e When the end-user gives the wrong Service Code, i.e. one not subscribed to or one not yet assigned?

***85#**

9f When the end-user gives a correct command string but in the wrong circumstances?

***43#** (when Call Waiting is already ON)

#43# (when Call Waiting is already OFF)

9g Is the error protection strategy the same for both mobile networks?

Yes

No

if No, please clarify

.....

Annex B: Centrex and PBX supplementary services questionnaire

Supplementary services - User survey

Man Machine Technology is currently working for ETSI (European Telecommunications Standards Institute) in a Project Team which has been tasked to work towards a definition of "A Harmonized Minimum MMI for Access and Control of Telecommunications Services". The Project team is considering the user and technology requirements of many different services, including the PSTN, ISDN, GSM supplementary services and UPT, VPN and phone based interfaces for stored voice services, home banking, teleaction, etc.

This questionnaire is designed to find out how easy users find it to access any supplementary services available on your phone, both at home and at work. However, if you mainly use services at work (e.g. CENTREX services at TELENOR RESEARCH), then concentrate your replies on these. We are particularly interested in the commands used to access and control services such as Call forwarding, Call waiting, Call barring (if available) and Conference calls, and in what feedback is given to the end user.

Please answer all the questions as completely as you can and return it as soon as possible.

1 What type of phone do you use regularly?

	at home	at work
Rotary dial	___	___
12 key push button	___	___
Mobile - analogue	___	___
Mobile - digital (GSM)	___	___
Please state model if known.....		
Direct line	___	___
PABX, CENTREX, etc.	___	___

2 How many times approximately do you use these Supplementary Services in the periods listed below:

	never	daily	weekly	monthly	service code
Call forwarding	___	___	___	___	
Call barring	___	___	___	___	
Call waiting	___	___	___	___	
Conference call	___	___	___	___	
Other services, please specify					
.....	___	___	___	___	
.....	___	___	___	___	
.....	___	___	___	___	

3 Where did you get information and instructions about the supplementary service availability?

Telephone directory or "house directory"	___
"Hjemmets lille telefon guide" (little red/blue book)	___
Someone explained it to you	___
Other, please specify	_____

4 How easy is it to use these services? Please rate each on a scale 0 to 10, where 0 is "very difficult" and 10 is "very easy"

- Call forwarding _____
- Call barring _____
- Call waiting _____
- Conference call _____

5 What particular difficulties did you have? Please rate each on a scale 0 to 10, as above, 0 is "very difficult" and "10 is very easy".

5.1 Call forwarding

- Remembering the service is available _____
- Remembering the service code number _____
- Remembering how to switch on _____
- Remembering to switch service off _____
- Remembering how to switch off _____
- Remembering to key in the number to forward to _____
- Other, please specify in detail if possible _____

.....
Please write the full command to switch on/activate and forward to Tlf.12 34 56 78

5.2 Call barring

- Remembering which service to use _____
- Remembering the service code _____
- Remembering the dialogue, (i.e. the sequence of numbers/use of * and #) _____
- Remembering to switch the service on/off _____
- Other, please specify in detail if possible _____

.....
Please write the full command to switch on and bar calls on Tlf.78 56 34 12

5.3 Call waiting

- Remembering the service is available _____
- Remembering how to hold your call, speak to caller 1 or caller 2, etc. _____
- Other, please specify in detail if possible _____

5.4 Conference call

- Remembering the service is available (name/description of service) _____
- Remembering the service code _____
- Remembering the dialogue,(i.e. sequence of numbers, *, #, etc.) _____
- Remembering how to call up each party in turn _____
- Remembering how to terminate any party _____
- Other, please specify in detail if possible _____

6 What kind of feedback is available during setting up, using or terminating a service?

	tones	voice	display
Call forwarding	___	___	___
Call barring	___	___	___
Call waiting	___	___	___
Conference call	___	___	___

7 When is feedback given in a call?

	before	during	after	not at all
Call forwarding	___	___	___	___
Call barring	___	___	___	___
Call waiting	___	___	___	___
Conference call	___	___	___	___

8 How useful did you find the feedback? Use the 0 to 10 scale as before, 0 is "very difficult" and 10 is "very easy".

Call forwarding	___
Call barring	___
Call waiting	___
Conference call	___

Use this space to write any other comments about the use of supplementary services

.....

.....

.....

.....

Annex C: Supplementary service tables by network type

C.1 PSTNs

C.1.1 Recorded year of implementation

Table C1: PSTN services recorded year of implementation

PSTN	Austria	Belgium	Denmark1	Denmark2	Eire	Finland	France	Germany
AOC-S								
AOC-D	1948							
AOC-E								
CB-I	1986	1994	1986					
CB-O	1986	1990	1986	1985			1996	1993
CD								
CFB		1994	1986	1985			1996	1993
CFNR		1994	1986	1985			1996	1993
CFU	1986	1990	1986	1985	1989		1993	1993
HOLD	1986		1986	1985			1993	
CLIP				1994			1996	
CLIR		1994		1994			1991	
CW	1986	1994	1986	1985	1989		1993	1993
CT-E								
CT-S								
CUG								
CCBS				1996				
3PTY			1986	1985	1989		1993	1993
CONF								
MMC			1993	1985				
COLP								
COLR								
DDI	1948	1990		1985	1992			
FPH	1988	1990	1986	1985				
MCID	1948	1990	1986	1985	1984		1993	
MSN	1986							
SUB				1985				
TP	1986							
UUS								
TOTAL	11	10	11	15	5	0	10	6

Table C1: PSTN services recorded year of implementation... continued

PSTN	Italy	Luxembourg	Norway	Poland	Portugal	Romania
AOC-S						
AOC-D						
AOC-E	1990					
CB-I		1993	1980	1994		
CB-O	1990	1993	1980	1994	1994	1994
CD						
CFB		1993	1984	1994		1994
CFNR		1993	1984	1994		1994
CFU	1990	1993	1980	1994	1994	1994
HOLD	1990			1994	1994	
CLIP	1996					
CLIR	1996		1993			
CW	1990	1993	1991	1994	1994	1994
CT-E						
CT-S						
CUG						
CCBS	1996		1991			
3PTY	1990		1993	1994	1994	
CONF			1986			
MMC						
COLP						
COLR						
DDI		1980	1970		1990	1994
FPH			1984	1994		1994
MCID	1986	1980		1994		1994
MSN						
SUB						
TP		1980				
UUS						
TOTAL	10	9	12	10	6	8

Table C1: PSTN services recorded year of implementation... concluded

PSTN	Spain	Sweden	Turkey	UK (BT)
AOC-S				1984
AOC-D			1987	1984
AOC-E			1987	1984
CB-I	pre 1994		1987	1984
CB-O	pre 1994	1980	1987	1984
CD			1987	
CFB	pre 1994	1983	1987	1984
CFNR	pre 1994	1983		1984
CFU	pre 1994	1980		1984
HOLD		1983	1987	
CLIP		1994		1994
CLIR		1994		1994
CW	pre 1994	1983	1987	1984
CT-E			1987	
CT-S		1985		
CUG		1987	1987	
CCBS		1986	1987	
3PTY	pre 1994	1983	1987	1984
CONF	pre 1994		1987	
MMC				
COLP				
COLR				
DDI	pre 1994	1980	1990	
FPH		1985	1989	
MCID		1980	1970	1995
MSN				
SUB				
TP				
UUS				
TOTAL	9	15	16	13

C.1.2 Charging practices

Table C2: Reported charging practice for each service - PSTNs

PSTN	Free	Provision only, Use is free	Use only, Provision is free	Provision and Use	Total
AOC-S					0
AOC-D		2		1	3
AOC-E			1	1	2
CB-I	2	4		1	7
CB-O	1	10		2	13
CD				1	1
CFB		4	1	6	11
CFNR		3	2	4	9
CFU		6	3	5	14
HOLD	2	2	1	3	8
CLIP		4			4
CLIR	3	2			5
CW	1	9	1	3	14
CT-E				1	1
CT-S				1	1
CUG				1	1
CCBS		1	1	2	4
3PTY	1	4	1	3	9
CONF				1	1
MMC			2		2
COLP					0
COLR					0
DDI		7		2	9
FPH	1	2	1	3	7
MCID	1	2	1	3	7
MSN		1			1
SUB		1			1
TP		1			1
UUS					0

Table C3: Reported use of supplementary service codes for each PSTN service... continued

PSTN	Italy	Luxembourg	Norway	Poland	Portugal	Romania
AOC-S						
AOC-D						
AOC-E	40, 1717	17				
CB-I				SO?		
CB-O	33			SO?	34	33
CD						
CFB		31	67	67		21
CFNR		28	61	61		21
CFU	21	21	21	21	21	21
HOLD				SO?	43	
CLIP						
CLIR						
CW	43	43		43	43	43
CT-E						
CT-S						
CUG						
CCBS						
3PTY	SO3			SO?	70	
CONF			70			
MMC						
COLP						
COLR						
DDI						
FPH				SO?		
MCID	SO9, 19			39		
MSN						
SUB						
TP						
UUS						

Table C3: Reported use of supplementary service codes for each PSTN service... concluded

PSTN	Spain	Sweden	Turkey	UK (BT)
AOC-S				40
AOC-D				40
AOC-E			40	40
CB-I	26		26	261
CB-O	33	33, 34	33	34
CD			21	
CFB	67	67, 68	60	67
CFNR	61	61, 62		61
CFU	21	21, 22		21
HOLD		SO1, SO2		
CLIP				1470
CLIR		31		141
CW	43	43, SO0, 1, 2	43	43
CT-E				
CT-S		SO4		
CUG		01,		
CCBS		SO5, 37		
3PTY	SO?	SO3		SO3
CONF	SO?			
MMC				
COLP				
COLR				
DDI	53		53	
FPH		020,	800	
MCID		SO (R)39		
MSN				
SUB				
TP				
UUS				

C.2 ISDN fixed networks

C.2.1 Recorded year of implementation

Table C4: ISDN services recorded year of implementation

ISDN	Austria	Belgium	Denmark1	Denmark2	Eire	Finland	France	Germany
AOC-S	1994	pre 1994	1995	1996				
AOC-D	1994	pre 1994					1989	1993
AOC-E	1994	pre 1994	1995	1996			1989	1993
CB-I	1993	1994						
CB-O	1993	pre 1994		1992			1989	
CD		1996	1995	1996	1995		1989	1994
CFB	1994	1994	1995	1996	1995			1993
CFNR	1994	1994	1995	1996	1995		1993	1993
CFU	1994	pre 1994	1995	1996	1995		1989	1993
HOLD	1994	pre 1994	1994	1994	1995		1989	1993
CLIP	1993	pre 1994	1993	1992	1994		1989	1993
CLIR	1993	pre 1994	1993	1992	1994		1989	1993
CW	1994	pre 1994	1993	1992	1995		1989	1993
CT-E		1996						
CT-S								
CUG	1994	pre 1994	1994	1993	1995			1993
CCBS		1996	1995	1996				
3PTY		1996	1995	1996	1995			1994
CONF		1996						
MMC		1996					1989	
COLP	1994	pre 1994	1994	1994	1995			1993
COLR	1994	pre 1994	1994	1994	1995			1993
DDI	1993	pre 1994	1993	1992	1994		1989	1993
FPH							1989	
MCID	1994	pre 1994	1995	1996	1995		1989	1993
MSN	1993	pre 1994	1993	1992	1994		1989	1993
SUB	1994	pre 1994	1993	1992	1994		1989	1993
TP	1994	pre 1994	1993	1992	1994		1989	1993
UUS	1994	pre 1994	1993	1992	1994		1989	1993
TOTAL	21	27	21	22	18	0	18	

Table C4: ISDN services recorded year of implementation... continued

ISDN	Italy	Luxembourg	Norway	Poland	Portugal	Romania
AOC-S			1994		1994	
AOC-D	1992	1994		1994	1992	
AOC-E	1992		1994	1994	1992	
CB-I		1994		1994		
CB-O	1992	1994		1994		
CD	1996					
CFB	1996	1994		1994	1992	
CFNR	1996	1994		1994	1992	
CFU	1992	1994		1994	1992	
HOLD	1992	1994		1994	1994	
CLIP	1992	1994		1994	1992	
CLIR	1992	1994		1994	1992	
CW	1992	1994		1994	1992	
CT-E						
CT-S						
CUG	1992	1994		1994	1992	
CCBS	1996					
3PTY	1992					
CONF	1996					
MMC						
COLP	1992	1994		1994	1994	
COLR	1992	1994		1994	1994	
DDI	1992	1994		1994	1992	
FPH						
MCID	1992	1994		1994	1992	
MSN	1992	1994		1994	1992	
SUB		1994		1994	1992	
TP	1992	1994		1994	1992	
UUS		1994		1994	1992	
TOTAL	21	19	2	20	19	0

Table C4: ISDN services recorded year of implementation... concluded

ISDN	Spain	Sweden	Turkey	UK (BT) ISDN2
AOC-S	1995	1996		
AOC-D	1995	1994		
AOC-E	1995	1994		
CB-I				1991
CB-O		1995		1991
CD	1995	1996		
CFB	1995	1996		1991
CFNR	1995	1996		1991
CFU	1995	1995		1991
HOLD	1995	1995		
CLIP	1993	1993		1991
CLIR	1993	1993		1991
CW	1995	1995		
CT-E		1996		
CT-S				
CUG	1995	1994		
CCBS	1995	1996		
3PTY	1995	1996		
CONF		1996		
MMC		1996		
COLP	1993	1995		1991
COLR	1993	1995		1991
DDI	1993	1993		1991
FPH	1995	1993		
MCID	1995	1993		1993
MSN	1993	1993		1991
SUB	1995	1993		1991
TP	1993	1993		1991
UUS	1995	1993		
TOTAL	23	27	0	14

C.2.2 Charging practices

Table C5: Reported charging practice for each service - ISDN Fixed Networks

ISDN	Free	Provision only, Use is free	Use only, Provision is free	Provision and Use	Total
AOC-S		4	1		5
AOC-D	1	4	1		6
AOC-E	1	6	1		8
CB-I	1	3			4
CB-O	1	5			6
CD		1		2	3
CFB		5	2	3	10
CFNR		5	2	3	10
CFU		5	2	4	11
HOLD		8			8
CLIP	8	4			12
CLIR	4	5	1	1	11
CW	3	6			9
CT-E					0
CT-S					0
CUG		9			9
CCBS		1		1	2
3PTY		4		1	5
CONF				1	1
MMC				1	1
COLP	3	6			9
COLR	3	5		2	10
DDI	2	8			10
FPH					0
MCID	1	5	1	2	9
MSN		11			11
SUB	4	6		1	11
TP	8	2			10
UUS	1	4	1	3	9

Table C6: Reported use of supplementary service codes for each ISDN service...continued

ISDN	Italy	Luxembourg	Norway	Poland	Portugal	Romania
AOC-S						
AOC-D				SO?		
AOC-E				SO?		
CB-I				SO?		
CB-O	33	17		SO?		
CD						
CFB		31		671	67	
CFNR		28		611	61	
CFU	21	21		211	21	
HOLD				SO?		
CLIP				SO?		
CLIR				SO?		
CW	43	43		SO?		
CT-E						
CT-S						
CUG				SO?		
CCBS						
3PTY	SO3					
CONF						
MMC						
COLP				SO?		
COLR				SO?		
DDI				SO?		
FPH						
MCID				SO?	39	
MSN				SO?		
SUB				SO?		
TP				SO?		
UUS				SO?		

Table C6: Reported use of supplementary service codes for each ISDN service...concluded

ISDN	Spain	Sweden	Turkey	UK (BT)
AOC-S		461		
AOC-D		463		
AOC-E		464		n.a.
CB-I				n.a.
CB-O		33		n.a.
CD		66		
CFB		67		n.a.
CFNR		61		n.a.
CFU	21	21		n.a.
HOLD	11	94		
CLIP				n.a.
CLIR		31		n.a.
CW		43		
CT-E		96		
CT-S				
CUG	01,	01,		
CCBS		SO5, 37		
3PTY		95		
CONF		71		
MMC		72		
COLP		76		n.a.
COLR		77		n.a.
DDI	53			n.a.
FPH		020,		
MCID	39	39		n.a.
MSN				n.a.
SUB		89		n.a.
TP		79		n.a.
UUS		36		

C.3 Analogue mobile networks - NMT, TACS, ETACS

C.3.1 Recorded year of implementation

Table C7: Analogue mobile services recorded year of implementation

	Turkey [NMT]	Italy [E/TACS]	UK (Cellnet) [E/TACS]
AOC-S			1985
AOC-D			1985
AOC-E			1985
CB-I	1986	1993	1985
CB-O	1986	1993	1985
CD	1986		1985
CFB	1986	1993	1985
CFNR	1986	1993	1985
CFU	1986	1993	1985
HOLD			1985
CLIP			
CLIR			
CW		1993	1985
CT-E			
CT-S			
CUG			
CCBS			
3PTY			1985
CONF			
MMC			
COLP			
COLR			
DDI			
FPH			
MCID			
MSN			
SUB			
TP			
UUS			No date given
TOTAL	6	6	12

C.3.2 Charging practices

Table C8: Reported charging practice for each service - Analogue mobile networks

	Turkey [NMT]	Italy [E/TACS]	UK (Cellnet) [E/TACS]
AOC-S			P
AOC-D			P
AOC-E			P
CB-I	PU	U	F
CB-O	PU	F	F
CD	PU		U
CFB	PU	U	U
CFNR	PU	U	U
CFU	PU	U	U
HOLD			F
CLIP			
CLIR			
CW		U	F
CT-E			
CT-S			
CUG			
CCBS			
3PTY			U
CONF			
MMC			
COLP			
COLR			
DDI			
FPH			
MCID			
MSN			
SUB			
TP			
UUS			

C.3.3 Service code usage

Table C9: Reported use of supplementary service codes for each analogue mobile service

	Turkey [NMT]	Italy [E/TACS]	UK (Cellnet) [E/TACS]
AOC-S			Not reported
AOC-D			Not reported
AOC-E			Not reported
CB-I	35	Not reported	Not reported
CB-O	33	00,	Not reported
CD	21		Not reported
CFB	64	21	Not reported
CFNR	61	21	Not reported
CFU	62	21	Not reported
HOLD			Not reported
CLIP			
CLIR			
CW		43	Not reported
CT-E			
CT-S			
CUG			
CCBS			
3PTY			Not reported
CONF			
MMC			
COLP			
COLR			
DDI			
FPH			
MCID			
MSN			
SUB			
TP			
UUS			

C.4 Digital mobile networks - GSM

C.4.1 Recorded year of implementation

Table C10: Digital mobile services recorded year of implementation

	Italy	Luxembourg	Sweden (Comviq)
AOC-S			
AOC-D			
AOC-E			
CB-I	1994	1993	
CB-O	1994	1993	
CD			
CFB	1994	1993	1992
CFNR	1994	1993	1992
CFU	1994	1993	1992
HOLD	1994	1994	1994
CLIP		1994	1994
CLIR			1994
CW	1994	1994	1994
CT-E			
CT-S			1994
CUG			
CCBS			
3PTY			1993
CONF			
MMC			
COLP			
COLR			
DDI			
FPH			
MCID			
MSN			1994
SUB			
TP			
UUS			
TOTAL	7	8	10

C.4.2 Charging practices

Table C11: Reported charging practice for each service - Digital mobile networks

	Italy	Luxembourg	Sweden (Comviq)
AOC-S			
AOC-D			
AOC-E			
CB-I	Not reported	F	
CB-O	Not reported	F	
CD			
CFB	Not reported	F	F
CFNR	Not reported	F	F
CFU	Not reported	F	F
HOLD		Not reported	F
CLIP		Not reported	P
CLIR			P
CW	Not reported	Not reported	P
CT-E			
CT-S			P
CUG			
CCBS			
3PTY			P
CONF			
MMC			
COLP			
COLR			
DDI			
FPH			
MCID			
MSN			F
SUB			
TP			
UUS			

C.4.3 Service code usage

Table C12: Reported use of supplementary service codes for each digital mobile service

	Italy	Luxembourg	Sweden (Comviq)
AOC-S			
AOC-D			
AOC-E			
CB-I	35	35	
CB-O	33	33	
CD			
CFB	67	67	67
CFNR	61	61	61
CFU	21	21	21
HOLD		Not reported	Not reported
CLIP		Not reported	Not reported
CLIR			31
CW	43	Not reported	Not reported
CT-E			
CT-S			Not reported
CUG			
CCBS			
3PTY			Not reported
CONF			
MMC			
COLP			
COLR			
DDI			
FPH			
MCID			
MSN			Not reported
SUB			
TP			
UUS			

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