

Public Switched Telephone Network (PSTN); Analogue ringing signals



Reference

DTR/ATA-005074 (ayc00ics.PDF)

Keywords

PSTN, analogue, signalling

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Foreword

This Technical Report (TR) has been produced by the ETSI Project Analogue Terminals and Access (ATA).

Introduction

Many network operators are now in the process of introducing new ringing signals on their public switched telephone networks in order to support supplementary services through analogue interfaces such as:

- Multiple subscriber numbering, this service is used to allow more than one telephone number to be assigned to a line. It has applications in homes where different family members would each be assigned their own number, or in the case of people operating a business from home where one number could be published for business calls and one for personal calls. The cadence used to indicate call arrival would also indicate the number called.
- Selective alerting, this service would allow the user to programme a list of numbers in the public switch, incoming calls to the user originating from one of these numbers would be indicated by the ringing pattern used to deliver the call. This service has applications in home and business use.
- Call Completion Busy Subscriber, call completion no reply, these services also have applications in home and business use. Once the user has activated the service, the network will monitor the busy or unavailable subscriber until it becomes available when the user is alerted to indicate that the call can be completed.
- Centrex, this service has applications for the most part in business use where the PBX function is located within the public switch. Calls originating from within the centrex group are delivered using a different cadence to that used to deliver calls originating outside the group.

It is important that designers of terminal equipment be made aware of these signals in order to design their terminals to correctly respond to them. The type of response will obviously depend on the terminal type, terminals with an acoustic alerting device would alert for all ringing types. Terminals with an automatic answer feature may be programmable to detect different cadences but would not normally answer to the ringing signal used for CCBS.

The information contained in this report has been compiled from responses to questionnaires sent out to network operators, ETS 300 001 Ed 4 [2], subclause 1.7.9 and also from documents listed in Bibliography.

1 Scope

The present document identifies ringing signals used by various network operators on analogue interfaces of Public Switched Telephone Networks both for delivery of normal calls and also distinctive ringing signals used to support supplementary services.

The present document deals with the time, cadence and waveform characteristics of the ringing signals uses in different countries.

The present document is useful to terminal equipment intended for analogue connection to the public switched telephone networks and could be used as a complement of information to TBR 21 [1], subclause 4.5. This is a study that aims to compliment the information included in ETS 300 001 [2], subclause 1.7.9 considering the present development of European Telecommunications.

The present document is applicable to the analogue interface of the Public Switched Telephone Network.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, subsequent revisions do apply.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] TBR 21: "Terminal Equipment (TE); Attachment requirements for pan-European approval for connection to the analogue Public Switched Telephone Networks (PSTNs) of TE (excluding TE supporting the voice telephony service) in which network addressing, if provided, is by means of Dual Tone Multi Frequency (DTMF) signalling".

[2] ETS 300 001 Edition 4: "Attachments to Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following definitions apply:

normal ringing: the ringing pattern sent by a network to indicate normal delivery of an incoming call to the TE.

distinctive ringing: special ringing patterns sent by the network to convey information to the TE about the called number, the calling number or the status of an automatic call request.

multiple subscriber number: a supplementary service which provides the called NTP with a distinctive ringing signal for each directory number associated with that NTP.

Call Completion Busy Subscriber: a supplementary service where if a call attempt fails due to the called party being busy, the network monitors the called party until it is available and then alerts the original caller.

Call Completion No Reply: a supplementary service where if a call attempt fails due to the called party not answering, the network monitors the called party until it is available and then alerts the original caller.

selective alerting: a supplementary service where a list of numbers is associated with a particular ringing cadence thereby giving the called party an indication of who the caller is.

centrex out of group call: TEs on a centrex service alert using different ringing signals to indicate if the call has been originated from within or outside the centrex group.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

CCBS	Call Completion Busy Subscriber
CCNR	Call Completion No Reply
Hz	Hertz
ms	milli second
MSN	Multiple Subscriber Numbering.
NTP	Network Termination Point
TE	Terminal Equipment

4 Technical characteristics

4.1 Normal ringing

In the case of normal call delivery the ringing signals given in table 1 are used.

Table 1: Normal ringing

Country	Frequency [Hz]	Waveform	Cadence [ms]	Network Operator
Austria	40 - 55	Not reported	1 000 ± 200 on 5 000 ± 1 000 off	Austria Telekom
Belgium	23 - 27	Not reported	1 000 on 3 000 off	
Cyprus	23,5 - 26,5	Not reported	1 500 on 3 000 off	
Czech Republic	22 - 55	Not reported	1 000 ± 100 on 4 000 ± 400 off	
Czech Republic	25	Sine	1 000 ± 100 on 4 000 ± 400 off	DATTEL a.s.
Czech Republic	25	Sine	300 on 300 off 1 000 off (Non Repeating)	DATTEL a.s.
Denmark	25	Sine	750± 150 on 7 500± 1 500 off	Tele Denmark
Finland	22 - 28	Not reported	1 000 on 4 000 off	Finnet Group
Finland	25	Sine	1 000 ± 100 on 4 000 - 5 000 off	Finnet Group
France	48 - 52	Not reported	1 500 ± 150 on 3 500 ± 350 off	France Telecom
Germany	23 - 28	Sine	First Ringing Pulse 250 - 6 500 on, followed by 3 500 - 5 500 off 790 - 1 100 on	Deutsche Telekom
Greece	16 - 50	Not reported	1 000 on 4 000 off	
Hungary	25	Not reported	1 250 on 3 750 off	
Iceland	22 - 28	Not reported	1 200 on 4 700 off	

Country	Frequency [Hz]	Waveform	Cadence [ms]	Network Operator
Ireland	25	Sine	400 on 200 off 400 on 2 000 off	Telecom Eireann
Italy	23 - 25	Not reported	1 000 ± 100 on 4 000 ± 100 off	Telecom Italia
Luxembourg	25	Not reported	1 000 ± 100 on 4 000 ± 400 off or 1 000 ± 100 on 5 000 ± 500 off	
Netherlands	23 - 27	Not reported	1 000 ± 250 on 4 000 ± 500 off	
Norway	23 - 27	Sine or Square	800 - 1 100 on 2 800 - 4 700 off	Telenor
Portugal	15 - 30	Not Reported	1 000 ± 200 on 5 000 ± 1 000 off	
Slovakia	25 - 27	Not Reported	1 000 on 4 000 off	
Spain	20 - 30	Not Reported	1 500 on 3 000 off	Telefonica
Sweden	23 - 27	Sine	1 000 ± 100 on 5 000 ± 500 off	Telia
Switzerland	22 - 27	Sine	1 000 ± 200 on 4 000 + 200, - 500 off	Swisscom
UK	25	Not Reported	400 on 200 off 400 on 2 000 off	British Telecom
UK	25	Not Reported	400 on 200 off 400 on 2 000 off	Cable & Wireless
UK	25	Sine	1 500 on 500 off 500 on 500 off 500 on 2 500 off or 1 500 on 500 off 1 500 on 2 500 off	Atlantic Telecom
NOTE 1: All cadences are repeated unless otherwise stated.				
NOTE 2: Some networks have an initial single ringing burst which is different from the cadences given above.				

Taking the figures in table 1 the normal ringing cadences can be divided as described in the following sub-clauses.

4.1.1 Single long burst of ringing followed by single long pause

The ringing on time may be between 750 ms and 1 750 ms and the pause time between 3 000 ms and 6 000 ms.

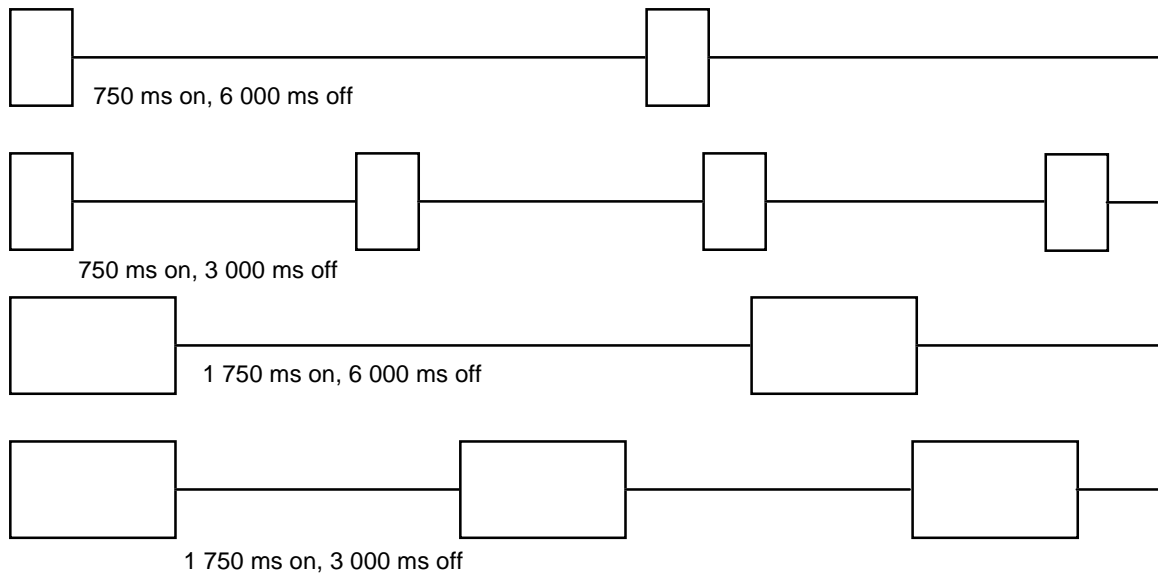


Figure 1

Figure 1 shows 4 cadences all of which would need to be detected by a terminal in order to support normal ringing signals in Austria, Belgium, Czech Republic, Cyprus, Greece, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Luxembourg, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden and Switzerland.

4.1.2 Single long burst of ringing followed by single very long pause

Denmark uses a ringing cadence which also consists of 1 long ringing burst followed by a long pause but cannot be covered in figure 1 as the OFF time is significantly longer. The cadences shown in figure 2 would need to be detected in order to support normal ringing signals in Denmark.

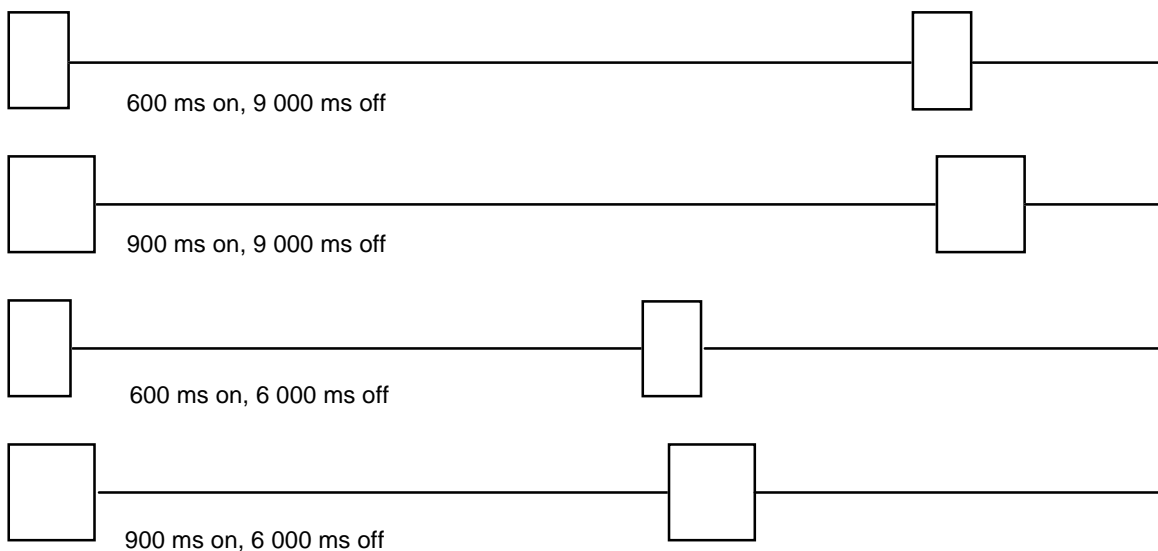


Figure 2

4.1.3 Two short bursts followed by single short pause

Another possible signal is to have two short ringing bursts of 400 ms interrupted by 200 ms followed by a 2 000 ms pause.

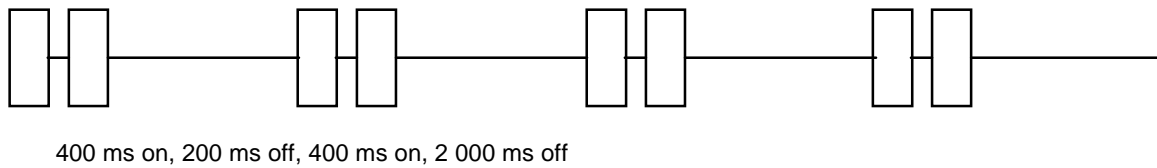


Figure 3

Figure 3 shows the cadence which would need to be detected in order to support normal ringing in Ireland and the UK.

4.1.4 Other ringing signals used for normal call delivery.

In the UK there are some network operators who use different normal ringing cadences to the traditional one described in figure 3. Atlantic Telecom use two ringing cadences, one ringing cadence for residential customers and one for business customers. They are represented in figure 4.

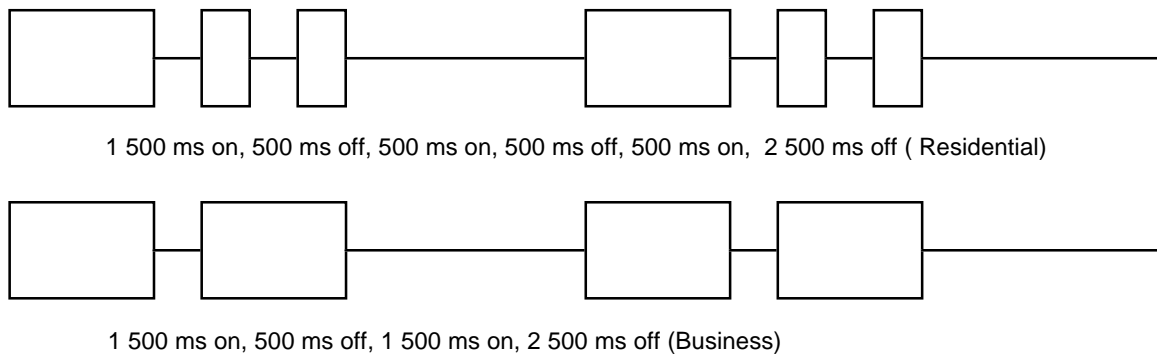


Figure 4

4.2 Initial ringing pulse

The initial ringing pulses in an alerting signal are different in many cases from the steady state cadence which follows, this may be due to the call set-up method of the network switch or to ring pulse alerting which is used on many networks in calling line identification presentation.

These initial ringing pulses are not considered in further detail in this report because their characteristics cannot be very well defined and it was considered not to influence primarily the TE design. The existence of these non-cyclic signals should be considered.

4.3 Distinctive ringing signals

Distinctive ringing signals used to provide supplementary services are described in table 2. In some cases these ringing patterns are not intended to activate ring detectors in terminals with automatic answer function. Some of the supplementary services which would use distinctive ringing are multiple subscriber number, call completion busy subscriber and selective alerting.

Table 2: Distinctive ringing

Country	Frequency [Hz]	Purpose	Automatic Answer Terminals	Cadence [ms]	Network Operator
Belgium	23,75 - 26,75	Not reported	Not reported	1 000 ± 100 on 1 000 ± 100 off	
Czech Republic	25	Centrex	No answer	400 on 200 off 400 on 3 000 off	DATTEL a.s.
Czech Republic	25	CCBS	Answer	400 on 200 off 400 on 200 off 400 on 2 400 off	DATTEL a.s.
Czech Republic	25	Not reported	Answer	1 000 on 1 000 off	DATTEL a.s.
Denmark	25	Not reported	Not reported	300 ± 30 on 1 200 ± 120 off	Tele Denmark
Denmark	25	Not reported	Not reported	500 on 700 off	Tele Denmark
Finland	25	MSN	No Answer	300 on 4 000 off	Finnet Group
Finland	25	MSN	No Answer	300 on 300 off 300 on 4 000 off	Finnet Group
Finland	25	MSN	No Answer	300 on 300 off 300 on 300 off 300 on 4 000 off	Finnet Group
Finland	25	CCBS	No Answer	300 on 300 off 2 000 - 5 000 on 4 000 off	Finnet Group
France	48 - 52	Not reported	No Answer	750 on 1 500 off	France Telecom
France	48 - 52	CCBS	No Answer	2 000 on 1 000 off	France Telecom
Italy	24 - 26	CCBS	Not reported	400 ± 50 on 200 ± 50 off 400 ± 50 on 200 ± 50 off 800 ± 100 on 4 000 ± 100 off	Telecom Italia
Norway	23 - 27	CCBS	No Answer	300 ± 30 on 300 ± 30 off	Telenor
Norway	23 - 27	CCBS	No Answer	200 ± 20 on 200 ± 20 off 400 ± 40 on 200 ± 20 off	Telenor
Norway	23 - 27	Centrex	Answer	200± 20 on 200 ± 20 off 400 ± 40 on 4 200 ± 420 off	Telenor
Norway	23 - 27	Centrex	Answer	300 ± 30 on 400 ± 40 ms off 300 ± 30 on 4 000 ± 400 off	Telenor
Switzerland	22 - 28	Centrex	Answer	330 ± 40 on 330 ± 40 off 330 ± 40 on 4 000 ± 400 off	Swisscom

Country	Frequency [Hz]	Purpose	Automatic Answer Terminals	Cadence [ms]	Network Operator
Switzerland	22 - 28	CCBS	No Answer	400 ± 40 on 400 ± 40 off 400 ± 40 on 400 ± 40 off 400 ± 40 on 3 000 ± 400 off	Swisscom
Switzerland	22 - 28	Alarm ring	No Answer	Continuous	Swisscom
Sweden	23 - 27	CCBS	No Answer	300 ± 30 on 400 ± 40 off repeated for 30 seconds	Telia
Sweden	23 - 27	Centrex	Answer	330 ± 33 on 330 ± 33 off 330 ± 33 on 5 000 ± 500 off	Telia
UK	20 - 26	MSN	Not reported	1 000 on 2 000 off	British Telecom
UK	20 - 26	CCBS	Not reported	250 on 250 off 250 on 250 off 250 on 1 750 off	British Telecom
UK	20 - 26	Not allocated	Not reported	400 on 800 off	British Telecom
UK	20 - 26	Not allocated	Not reported	2 000 on 4 000 off	British Telecom
UK	25	MSN	Not reported	1 500 on 4 500 off	Atlantic Telecom
UK	25	MSN	Not reported	1 500 on 500 off 500 on 3 500 off	Atlantic Telecom
UK	25	MSN	Not reported	1 500 on 500 off 500 on 500 off 1 000 on 2 000 off	Atlantic Telecom
UK	25	MSN	Not reported	1 000 on 500 off 1 000 on 3 500 off	Atlantic Telecom
UK	25	MSN	Not reported	500 on 500 off 500 on 500 off 1 000 on 3 000 off	Atlantic Telecom
UK	25	MSN	Not reported	500 on 500 off 1 000 on 500 off 500 on 3 000 off	Atlantic Telecom
UK	25	Centrex	Answer	1 000 on 2 000 off	Cable & Wireless

NOTE 1: All cadences are repeated unless otherwise stated.
NOTE 2: Some networks have an initial single ringing burst which is different from the cadences given above.

4.3.1 Analysis of distinctive ringing cadences

From table 2 it can be seen that a number of network operators are using similar ringing cadences for different purposes. In order to classify these cadences it is necessary to assign values for the duration of long and short ringing pulses and pauses. It is recognized that the ratio of ring pulse time to pause time is an extra factor which is also important in the case of human perception of alerting patterns.

Table 3: Timing

Period	Minimum Duration (ms)	Maximum Duration (ms)
Short Ring Pulse	180	550
Short Pause	180	1 200
Long Ring Pulse	750	2 000
Long Pause	1 500	5 000

4.3.2 Ringing cadence types used by more than one operator

Taking the figures in table 3, many of the distinctive ringing signals in table 2 can be classified as in tables 4 to 10.

4.3.2.1 Long ring pulse, long pause

Table 4: Long ring pulse, long pause

Country	Frequency [Hz]	Purpose	Automatic Answer Terminals	Cadence [ms]	Network Operator
France	48 - 52	Not reported	No Answer	750 on 1 500 off	France Telecom
UK	25	Not reported	Not reported	1 500 on 4 500 off	Atlantic Telecom
UK	20 - 26	MSN	Not reported	1 000 on 2 000 off	British Telecom
UK	20 - 26	Not Allocated	Not reported	2 000 on 4 000 off	British Telecom
UK	25	Centrex	Answer	1 000 on 2 000 off	Cable & Wireless

This cadence type is in the timing range for the cadences used for normal ringing in the case of most continental European countries. In the case of France the normal ringing cadence has a nominal value of 1 500 ms on, 3 500 ms off.

4.3.2.2 Short ring pulse, short pause, short ring pulse, long pause

Table 5: Short ring pulse, short pause, short ring pulse, long pause

Country	Frequency [Hz]	Purpose	Automatic Answer Terminals	Cadence [ms]	Network Operator
Czech Republic	25	Centrex	No answer	400 on 200 off 400 on 3 000 off	DATTEL a.s.
Finland	25	MSN	No Answer	300 on 300 off 300 on 4 000 off	Finnet Group
Norway	23 - 27	Centrex	Answer	200± 20 on 200 ± 20 off 400 ± 40 on 4 200 ± 420 off	Telenor
Norway	23 - 27	Centrex	Answer	300 ± 30 on 400 ± 40 ms off 300 ± 30 on 4 000 ± 400 off	Telenor
Switzerland	22 - 28	Centrex	Answer	330 ± 40 on 330 ± 40 off 330 ± 40 on 4 000 ± 400 off	Swisscom
Sweden	23 - 27	Centrex	Answer	330 ± 33 on 330 ± 33 off 330 ± 33 on 5 000 ± 500 off	Telia

These cadences are similar to the normal ringing cadence used in Ireland and in the UK apart from the long pause which is longer here.

4.3.2.3 Long ring pulse, short pause

Table 6: Long ring pulse, short pause

Country	Frequency [Hz]	Purpose	Automatic Answer Terminals	Cadence [ms]	Network Operator
Belgium	23,75 - 26,75	Not reported	Not reported	1 000 ± 100 on 1 000 ± 100 off	
Czech Republic	25	Not reported	Answer	1 000 on 1 000 off	DATTEL a.s.
France	48 - 52	CCBS	No Answer	2 000 on 1 000 off	France Telecom

4.3.2.4 Short ring pulse, short pause

Table 7: Short ring pulse, short pause

Country	Frequency [Hz]	Purpose	Automatic Answer Terminals	Cadence [ms]	Network Operator
Denmark	25	Not reported	Not reported	500 ± 50 on 700 ± 70 off	Tele Denmark
Denmark	25	Not reported	Not reported	300 ± 30 on 1 200 ± 120 off	Tele Denmark
Norway	23 - 27	CCBS	No Answer	300 ± 30 on 300 ± 30 off	Telenor
Norway	23 - 27	CCBS	No Answer	200 ± 20 on 200 ± 20 off 400 ± 40 on 200 ± 20 off	Telenor
Sweden	23 - 27	CCBS	No Answer	300 ± 30 on 400 ± 40 off repeated for 30 seconds	Telia
UK	20 - 26	Not Allocated	Not reported	400 on 800 off	British Telecom

4.3.2.5 Short ring pulse, short pause, long ring pulse, long pause

Table 8: Short ring pulse, short pause, long ring pulse, long pause

Country	Frequency [Hz]	Purpose	Automatic Answer Terminals	Cadence [ms]	Network Operator
Finland	25	CCBS	No Answer	300 on 300 off 2 000 - 5 000 on 4 000 off	Finnnet Group
UK	25	Not reported	Not reported	500 on 500 off 1 500 on 2 500 off	Atlantic Telecom

4.3.2.6 Three short ring pulses followed by a long pause

Table 9: Three short ring pulses followed by a long pause

Country	Frequency [Hz]	Purpose	Automatic Answer Terminals	Cadence [ms]	Network Operator
Czech Republic	25	CCBS	Answer	400 on 200 off 400 on 200 off 400 on 2 400 off	DATTEL a.s.
Finland	25	MSN	No Answer	300 on 300 off 300 on 300 off 300 on 4 000 off	Finnet Group
Switzerland	22 - 28	CCBS	No Answer	400 ± 40 on 400 ± 40 off 400 ± 40 on 400 ± 40 off 400 ± 40 on 3 000 ± 400 off	Swisscom
UK	20 - 26	CCBS	Not reported	250 on 250 off 250 on 250 off 250 on 1 750 off	British Telecom

4.3.2.7 Two short ring pulses, short pause, followed by long ring pulse, long pause

Table 10: Two short ring pulses, short pause, followed by long ring pulse, long pause

Country	Frequency [Hz]	Purpose	Automatic Answer Terminals	Cadence [ms]	Network Operator
Italy	24 - 26	CCBS	Not reported	400 ± 50 on 200 ± 50 off 400 ± 50 on 200 ± 50 off 800 ± 100 on 4 000 ± 100 off	Telecom Italia
UK	25	MSN	Not reported	500 on 500 off 500 on 500 off 1 000 on 3 000 off	Atlantic Telecom

4.3.3 Ringing signals not used by more than one operator

The following ringing signals could not be accommodated in tables 4 to 10 using the timing criteria given in table 3. They are used by the network operators in the countries indicated in table 11.

Table 11: Ringing signals not used by more than one operator

Country	Frequency [Hz]	Purpose	Automatic Answer Terminals	Cadence [ms]	Network Operator
Switzerland	22 - 28	Alarm ring	No Answer	Continuous	Swisscom
Finland	25	MSN	No Answer	300 on 4 000 off	Finnet Group
UK	25	MSN	Not reported	1 500 on 500 off 500 on 500 off 1 000 on 2 000 off	Atlantic Telecom
UK	25	MSN	Not reported	1 000 on 500 off 1 000 on 3 500 off	Atlantic Telecom
UK	25	MSN	Not reported	500 on 500 off 1 000 on 500 off 500 on 3 000 off	Atlantic Telecom

5 Conclusions

From the information contained in table 2, it is clear that terminals supporting automatic answer would need flexible user programming to allow the user to configure the terminal to respond correctly to the different ringing signals used in their country. Some network operators expect automatic answer terminals not to respond to any of the distinctive ringing cadences, whereas other operators only expect automatic answer terminals not to respond to the cadence used for CCBS. There are 5 different cadence types used for CCBS in 6 countries.

Although many of the distinctive ringing cadences have been classified in tables 4 to 11, in some cases there are cadences in those tables which deviate significantly from others in the same group.

Bibliography

The following material, though not specifically referenced in the body of the present document, gives supporting information.

BT SIN 249 Issue 1: "Call arrival indication from particular supplementary services -distinctive ringing", (Issued by British Telecom).

EN 301 071-1: "Public switched telephone network (PSTN); protocol over the local loop for display services; Server Display and Script Services (SDSS); Part 1: Phase 0", (Annex C).

History

Document history		
V1.1.1	May 1998	Publication