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European Standard (Telecommunications series)

**Digital Enhanced Cordless Telecommunications (DECT);
Global System for Mobile communications (GSM);
DECT/GSM integration based on dual-mode terminals**



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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Project Digital Enhanced Cordless Telecommunications (DECT), and is now submitted for the Public Enquiry Phase of the ETSI standards Two-step Approval Procedure.

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

1 Scope

The present document specifies the additional requirements to the existing Global System for Mobile communications (GSM) and Digital Enhanced Cordless Telecommunication (DECT) standards needed for DECT/GSM Dual Mode Terminals (DMTs) that can be switched manually between DECT and GSM mode and/or can perform background scanning and switch automatically between GSM and DECT modes and/or can have both GSM and DECT modes activated at the same time.

For the DECT side, the DECT/GSM Interworking Profile (IWP) is not considered.

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] ETS 300 434-2: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); DECT/ISDN interworking for end system configuration; Part 2: Access profile".
- [2] EN 300 444: "Digital Enhanced Cordless Telecommunications (DECT); Generic Access Profile (GAP)".
- [3] ETS 300 511: "European digital cellular telecommunications system (Phase 2); Man-Machine Interface (MMI) of the Mobile Station (MS) (GSM 02.30)".
- [4] ETS 300 607-1: "Digital cellular telecommunications system (Phase 2); Mobile Station (MS) conformance specification; Part 1: Conformance specification (GSM 11.10-1 version 4.22.0)".
- [5] EN 300 824: "Digital Enhanced Cordless Telecommunications (DECT); Cordless Terminal Mobility (CTM); CTM Access Profile (CAP)".
- [6] ETR 341: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT/GSM Interworking Profile; Profile overview".
- [7] TR 101 072: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile Communications (GSM); DECT/GSM integration based on dual-mode terminals".
- [8] EN 300 175-1: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 1: Overview".
- [9] EN 300 175-2: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 2: Physical layer (PHL)".
- [10] EN 300 175-3: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 3: Medium Access Control (MAC) layer".
- [11] EN 300 175-4: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 4: Data Link Control (DLC) layer".
- [12] EN 300 175-5: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 5: Network (NWK) layer".

- [13] EN 300 175-6: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 6: Identities and addressing".
- [14] EN 300 175-7: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 7: Security features".
- [15] EN 300 175-8: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 8: Speech coding and transmission".
- [16] TBR 6: "Radio Equipment and Systems (RES); Digital Enhanced Cordless Telecommunications (DECT); General terminal attachment requirements".
- [17] TBR 10: "Radio Equipment and Systems (RES); Digital Enhanced Cordless Telecommunications (DECT); General terminal attachment requirements: Telephony applications".
- [18] TBR 19: "European digital cellular telecommunications system (Phase 2); Attachment requirements for Global System for Mobile communications (GSM) mobile stations; Access".
- [19] TBR 20: "European digital cellular telecommunications system (Phase 2); Attachment requirements for Global System for Mobile communications (GSM) mobile stations; Telephony".
- [20] TBR 22: "Radio Equipment and Systems (RES); Attachment requirements for terminal equipment for Digital Enhanced Cordless Telecommunications (DECT); Generic Access Profile (GAP) applications".
- [21] TBR 31: "Digital cellular telecommunications system (Phase 2); Attachment requirements for mobile stations in the DCS 1 800 band and additional GSM 900 band; Telephony".
- [22] TBR 32: "Digital cellular telecommunications system (Phase 2); Attachment requirements for mobile stations in the DCS 1 800 band and additional GSM 900 band; Access".
- [23] TBR 40: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); Attachment requirements for terminal equipment for DECT/ISDN interworking profile applications".
- [24] ITU-T Recommendation G.111: "Loudness ratings (LRs) in an international connection".
- [25] EN 301 439: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); Attachment requirements for DECT/GSM dual-mode terminal equipment".
- [26] TR 101 176: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT/GSM advanced integration of DECT/GSM dual-mode terminal equipment".

3 Definitions and abbreviations

3.1 Definitions

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

active communication: a state, where a communication link has been established between the DMT and a fixed part in either GSM or DECT mode.

active mode: GSM or DECT mode after being selected and switch on procedures for that mode being performed.

automatic switched operation: the DMT is in either GSM or DECT mode and switches automatically between these modes when it loses current coverage or finds preferred coverage.

background scanning: the process whereby a DMT in manually or automatically switched operation attempts to identify the existence of stable networks in the mode other than the one it is in to which the terminal has access rights.

dual mode terminal: a terminal comprising both GSM and DECT parts.

GSM coverage: the sum of all GSM Public Land Mobile Network (PLMN) coverages where the DMT has at least limited service.

GSM: in the present document, the GSM part of a DMT can be GSM 900, Digital Cellular System 1800 (DCS 1800) or GSM/DCS dual band.

manually switched operation: the DMT is in either GSM or DECT mode and switches between these modes only after interaction with the user.

mode selection: a DMT based procedure, whereby operating mode, GSM or DECT, is chosen.

mode: a DMT has two modes, GSM and DECT. In GSM mode the DMT behaves as a GSM Mobile Station (MS) and in DECT mode the DMT behaves as a DECT Portable Part (PP).

parallel operation: the DMT has both GSM and DECT modes activated at the same time. It is capable of being location registered both to a DECT FP and a GSM PLMN at the same time and is capable of at least receiving simultaneously in both GSM and DECT modes.

preferred mode: either DECT or GSM is set to be the preferred mode. The DMT in automatic switched operation automatically switches to the preferred mode when it finds a suitable network in that mode and the DMT in parallel operation uses the preferred mode for outgoing calls.

3.2 Abbreviations

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

ARI	Access Rights Identity
CAP	CTM Access Profile
CTM	Cordless Terminal Mobility
DCS	Digital Cellular System
DECT	Digital Enhanced Cordless Telecommunications
DMT	Dual Mode Terminal
GAP	Generic Access Profile
GSM	Global System for Mobile communication
IAP	ISDN Access Profile
IMSI	International Mobile Subscriber Identity
IWP	Interworking Profile
MS	Mobile Station
PARK	Portable Access Rights Key
PIN	Personal Identification Number
PLMN	Public Land Mobile Network

PP	Portable Part
SIM	Subscriber Identity Module
LSTR	Listeners Sidetone Ratio
RLR	Receiving Loudness Rating
SLR	Sending Loudness Rating

4 General on DECT/GSM DMTs

4.1 DECT and GSM modes

A DMT is a terminal comprising both GSM and DECT parts, see TR 101 072 [7] and TR 101 176 [26]. The DMT is in either GSM or DECT mode or it can have both modes activated at the same time. In each mode, the DMT shall operate as the corresponding single mode terminal and shall fully comply with the relevant standards for that single mode terminal (for GSM see references in ETS 300 607-1 [4]; for DECT see EN 300 175 parts 1 to 8 [8] to [15] and EN 300 444 [2], EN 300 824 [5] or ETS 300 434-2 [1]), unless specified in the present document.

The DMT shall give an indication to the user of the mode(s) currently in use.

When one mode is being activated the DMT shall operate like a single mode terminal that is switching on. When one mode is being deactivated the DMT shall operate like a single mode terminal that is switching off.

Location registration within each mode shall be performed according to the relevant standards for single-mode terminals (for GSM see references in ETS 300 607-1 [4]; for DECT see EN 300 175 parts 1 to 8 [8] to [15] and EN 300 444 [2], EN 300 824 [5] or ETS 300 434-2 [1]) and the behaviour when switching modes is the same as when one single-mode terminal is switched-off and the second is switched-on:

- when deactivating one mode, the applicable behaviour shall be the one specified in the relevant standards for the switch off (e.g. detach procedure, if applicable), for GSM see references in ETS 300 607-1 [4]; for DECT see EN 300 175 parts 1 to 8 [8] to [15] and EN 300 444 [2], EN 300 824 [5] or ETS 300 434-2 [1];
- when activating one mode, the applicable behaviour shall be the one specified in the relevant standards for the switch on (e.g. attach procedure, if applicable), for GSM see references in ETS 300 607-1 [4]; for DECT see EN 300 175 parts 1 to 8 [8] to [15] and EN 300 444 [2], EN 300 824 [5] or ETS 300 434-2 [1].

4.2 Dual mode operation

The following ways of operation are possible for a DMT:

- **Manually switched operation** (the DMT behaves as a GSM MS or as a DECT PP):
 - GSM-only mode;
 - DECT-only mode.
- **Automatically switched operation** (the DMT behaves as a GSM MS or as a DECT PP and can switch automatically between GSM and DECT modes):
 - old mode is switched off before new mode is switched on.
- **Parallel operation** (both DECT and GSM modes are activated and the DMT is location registered both in a GSM PLMN and with a DECT FP):
 - active communication is only possible in one mode at the time; or
 - active communication is possible in both modes at the same time.

Manually switched operation shall always be implemented in a DMT. In addition, automatically switched operation and/or parallel operation can be implemented.

NOTE: Here, and in the following, referring to manually switched operation means both GSM-only and DECT-only while referring to parallel operation means either single active mode or double active modes.

It shall be possible for the user to select any of the implemented ways of operation. When changing way of operation, the relevant DECT and GSM switch-on and switch-off procedures shall be performed if necessary.

The DMT should use the last way of operation, as the default way of operation, at every switch-on.

4.2.1 General on manually switched operation

When in manually switched operation, the DMT can only be switched manually between GSM mode and DECT mode. The decision of the user to switch mode may be based on the result of a background scan.

4.2.1.1 GSM-only mode

After a manual switch to GSM mode, the DMT shall behave as a GSM MS.

4.2.1.2 DECT-only mode

After a manual switch to DECT mode, the DMT shall behave as a DECT PP.

4.2.2 General on automatically switched operation

In automatically switched operation the DMT is registered in only one network at the time using either DECT or GSM mode. The DMT switches automatically between GSM and DECT mode either due to loss of coverage / service or because preferred coverage has been identified (during background scanning) in the mode other than the one it is currently in. The frequency of mode switching based on background scanning is restricted.

When in automatically switched operation, the DMT can be switched manually between GSM mode and DECT mode only by changing to manually switched operation.

When switching mode, the DMT switches the first mode off before the second mode is switched on.

The requirements on the active mode shall be met also when the DMT is background scanning for coverage in the other mode.

4.2.3 General on parallel operation

In parallel operation the DMT is normally registered in two networks at the time using both DECT and GSM mode. The DMT shall not switch between GSM and DECT modes unless it can meet the requirements on automatically switched operation. In case of loss of coverage in one mode, the DMT shall operate according to the idle mode procedures for that mode.

When in parallel operation, the DMT can be forced into DECT or GSM mode only by changing to manually switched operation.

4.2.3.1 Single active mode

In parallel operation with a single active mode the DMT shall simultaneously meet idle mode requirements of both DECT and GSM. When the DMT is in active communication in one mode, it shall not transmit in the other mode and shall behave as if it was out of coverage in that mode.

NOTE: E.g. when the DMT is active in a GSM call, it does not respond to DECT pagers.

The normal requirements which apply to a GSM MS shall apply to the DMT also when the DECT receiver is active. The normal requirements which apply to a DECT PP shall apply to the DMT also when the GSM receiver is active.

4.2.3.2 Double active modes

When in parallel operation with double active modes, the DMT behaves simultaneously both as a GSM MS and a DECT PP except for cases where some physical units (e.g. microphone and loudspeaker) are shared.

The DMT shall simultaneously meet idle mode and active mode requirements of both DECT and GSM. When the DMT is in active communication in one mode, it can transmit in the other mode and shall be capable of handling simultaneous communication in both modes.

The normal requirements which apply to a GSM MS shall apply to the DMT also when the DECT transceiver is active. The normal requirements which apply to a DECT PP shall apply to the DMT also when the GSM transceiver is active.

If parallel operation with double active modes is implemented then functionality to handle a second incoming call should be implemented.

4.3 Service access

A DMT with valid International Mobile Subscriber Identity (IMSI) and/or Access Rights Identity / Portable Access Rights Key (ARI/PARK) pairs may access service in the areas authorized by the entitlement of the subscriptions.

NOTE 1: DECT ARI class D is not covered in the present document.

Entry of the Personal Identification Number (PIN) shall be done according to GSM 02.30 (ETS 300 511 [3]) at switch on of the DMT with a Subscriber Identity Module (SIM) in or at insertion of the SIM when the DMT is switched on. At the time of entering the PIN the DMT may be in DECT or GSM mode.

NOTE 2: In GSM mode a SIM card is mandatory except for emergency calls. In DECT mode SIM access is needed, e.g. for the SIM phone book.

Switching of modes may be done without entering the PIN again. Unblocking PIN or PIN2 need not be supported in DECT mode.

4.4 DECT profiles

If the voice telephony service is implemented in the DECT part of the DMT it shall be based on at least one of the DECT profiles: Generic Access Profile (GAP) (EN 300 444 [2]); Cordless Terminal Mobility (CTM) Access Profile (CAP) (EN 300 824 [5]) or ISDN Access Profile (IAP) (ETS 300 434-2 [1]).

The DECT/GSM IWP (ETR 341 [6]) is not covered by the present document. Scenarios for DMTs with DECT/GSM IWP are given in TR 101 176 [26].

5 Requirements on manually switched operation

When in manually switched operation, the DMT is in either GSM or DECT mode. When in either mode, the DMT shall operate as the corresponding single mode terminal and shall fully comply with the relevant standards for that single mode terminal (for GSM see references in ETS 300 607-1 [4]; for DECT see EN 300 175 parts 1 to 8 [8] to [15] and EN 300 444 [2], EN 300 824 [5] or ETS 300 434-2 [1]).

5.1 Manual mode selection

When in manually switched operation the user shall be given the opportunity to change the chosen mode at any time except when in active communication. Background scanning may be implemented, e.g. to give notification to the user on the availability of other networks. A background scan may be initiated manually or automatically. If background scanning is implemented then it shall be implemented according to subclause 6.2.2.2.

When the DMT switches mode it shall operate as two single mode terminals where the first is switched off before the second is switched on, i.e. it shall deactivate the first mode before activating the second mode. When one mode is activated the DMT shall operate like a single mode terminal that is switched on. When one mode is deactivated the DMT shall operate like a single mode terminal that is switched off.

5.2 Procedures

5.2.1 At switch-on

If the DMT was in manually switched operation when switched-off it shall go active (at switch-on) in the same mode it was active in when switched-off.

5.2.2 User re-selection of mode

The user may, at any time when not in active communication, initiate re-selection of mode. When the re-selection of mode is initiated, the DMT could initiate a background scan if implemented but can go directly to the other mode. If a suitable network is identified during the background scan, the user can initiate a switch to the other mode.

6 Requirements on automatically switched operation

This clause covers the requirements on DMTs with the automatic switched operation implemented, i.e. DMTs where only one mode (DECT or GSM) is activated at the time.

6.1 General

The DMT is in either GSM or DECT mode. When in either mode, the DMT shall operate as the corresponding single mode terminal (except that it may perform background scanning) and shall fully comply with the relevant standards for that single mode terminal (for GSM see references in ETS 300 607-1 [4]; for DECT see EN 300 175 parts 1 to 8 [8] to [15] and EN 300 444 [2], EN 300 824 [5] or ETS 300 434-2 [1]), unless specified in this subclause.

When one mode is activated the DMT shall operate like a single mode terminal that is switched on. When one mode is deactivated the DMT shall operate like a single mode terminal that is switched off. When the DMT switches mode, it shall deactivate the first before activating the second, and shall operate as two single mode terminals where the first is switched off before the second is switched on.

Switching between the two modes is done automatically by the terminal. The DMT shall not switch mode when in active communication. Automatically switching of mode can be based on background scanning or loss of coverage. In the case the automatic switching of modes is based on background scanning there are requirements to prevent switching too frequently, see subclause 6.2.2.4.

If the DMT loses the coverage of the network currently in use, an established communication will be terminated. If the user then wants to continue, another mode and/or network providing service has to be selected and a new communication has to be established.

NOTE: Seamless handover of an active communication between GSM and DECT modes is thus not supported.

6.2 Mode selection

6.2.1 General requirements

In addition to automatically switched operation also manually switched operation shall be implemented, i.e. it shall be possible for the user to set the DMT into either DECT-only or GSM-only mode.

NOTE: Network controlled mode selection is not considered in the present document.

The user shall be given the opportunity to change between manually switched operation and automatically switched operation at any time when the DMT is not in active communication.

When in automatically switched operation, either GSM or DECT shall be considered as the preferred mode. If background scanning for both DECT and GSM is implemented then the user shall be given the opportunity to change the preferred mode at any time when the DMT is not in active communication. If background scanning is implemented for only one mode (DECT or GSM) then by default that mode is the preferred mode.

6.2.2 Procedures

6.2.2.1 At switch-on

If the DMT with a valid SIM inserted was in automatically switched operation when switched-off, it shall go active (at switch-on) in the preferred mode.

If the DMT with no or invalid SIM inserted was in automatically switched operation when switched-off, it shall go active (at switch-on) in DECT mode.

NOTE: Requirements on entering of PIN at switch-on is given in clause 4.

6.2.2.2 Background scanning

The purpose of the background scanning procedure is to check the possibility to get into normal service under stable coverage conditions in the mode other than the one it is currently in. Background scanning is done without leaving the currently active mode. It is a procedure consisting of three steps:

- 1) searching for coverage in the not active mode;
- 2) identifying the presence of a network found in step 1 to which the DMT has access rights as far as the broadcast information allows this;

As the requirements of the mode the terminal is currently active in needs to be kept, the terminal may read some broadcast information during the background scan, but shall not set up an active communication in the other mode;

NOTE 1: There are exceptional cases where it may not be possible for the DMT to identify valid access rights, e.g. active communication may be needed to confirm that full GSM service is available.

- 3) checking the stability of coverage.

In case the terminal has access rights, according to step 2, to one of the networks found in step 1, it should check the stability of the coverage of this network.

NOTE 2: One criteria for stability could be the field strength measured by the terminal during a certain time interval.

In order to save battery power, the whole procedure may be a periodic process.

The switching of modes is not part of the background scanning. Switching of modes may be the result of a background scan if the network found is stable according to step 3. Switching of modes may be performed automatically as a result of a background scan, or manually following user notification of the result of a background scan.

6.2.2.3 Mode switching

The automatic switch between DECT and GSM modes in the DMT can be initiated:

- based on loss of coverage;
- based on the result of a background scan identifying coverage in the mode other than the one it is currently in.

When the DMT switches mode, the first mode shall be deactivated before the second mode is activated.

6.2.2.4 Automatic mode selection

When the in automatically switched operation the DMT selects automatically GSM or DECT mode with respect to the preferred mode defined by the user. In the case of a change of the mode, the DMT behaves like a GSM or DECT phone at power up or down.

The switching cycle between non-preferred and preferred modes is illustrated in figure 1. As a result of loss of coverage of the network in the current mode, the terminal shall switch to the other mode. The switch due to loss of coverage need not be immediate. When in non-preferred mode, the terminal may perform automatic mode selection as a result of a successful background scan for networks the preferred mode.

Thus three cycles are found in the automatic mode selection procedure. One cycle for loss of coverage, one for background scanning where no preferred networks are found, and one for background scanning, which results in change of mode.

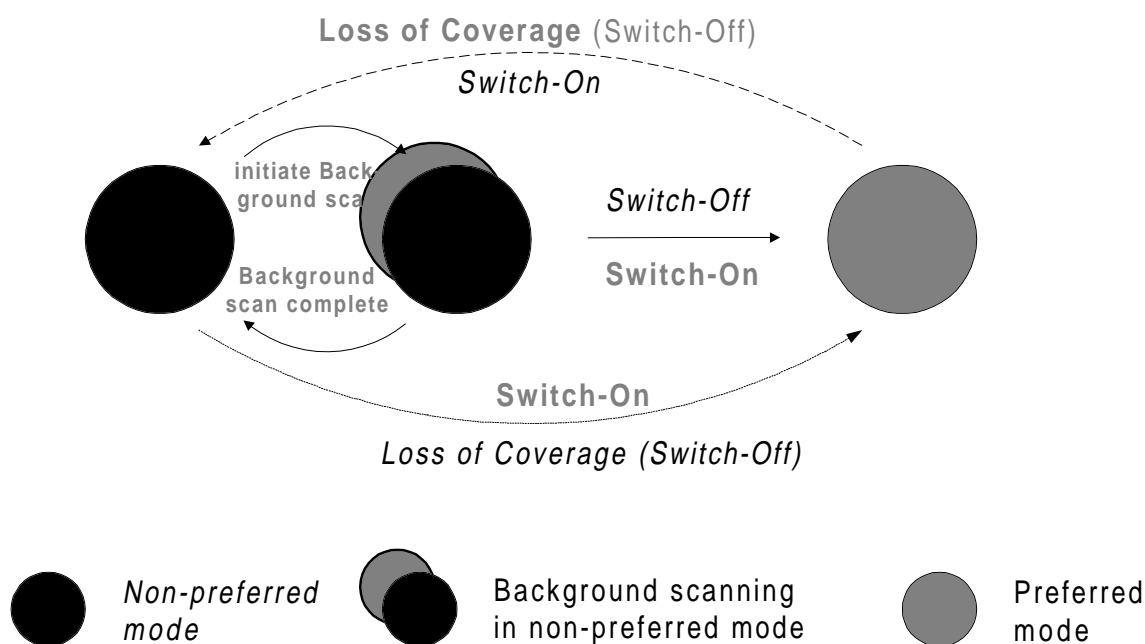


Figure 1: Mode selection cycles

The requirements given in subclauses 6.2.2.4.1 to 6.2.2.4.3 shall be supported.

6.2.2.4.1 Preferred use of GSM networks

The DMT need not perform any background scan for DECT networks as long as it is in GSM mode and normal GSM service is available. In the case of a loss of GSM coverage, the DMT shall switch to DECT mode.

While the DMT is in DECT mode, it may perform background scanning for GSM networks. If a suitable GSM network is detected, the DMT shall switch to GSM mode. In the case of a loss of DECT coverage, the DMT shall switch to GSM mode.

In the case where only GSM limited service is available, the DMT shall perform background scanning for DECT networks. If a suitable DECT network is identified, the DMT shall switch to DECT mode.

6.2.2.4.2 Preferred use of DECT networks

The DMT need not perform any background scan for GSM networks as long as it is in DECT mode and normal DECT service is available. In the case of a loss of DECT coverage the DMT shall switch to GSM mode.

While the DMT is in GSM mode and normal or limited service is available, the DMT shall perform background scanning for DECT. If a DECT network, to which the DMT has access rights, is detected, the DMT shall switch to DECT mode. In the case of a loss of GSM coverage, the DMT shall switch to DECT mode.

6.2.2.4.3 Protection against excessive signalling

To avoid excessive signalling load in the networks by frequent switching between the two modes as result of background scanning, the following timer shall be implemented in the DMT.

The DMT may switch from the non-preferred to the preferred mode as a result of background scanning. The DMT may then switch back to the non-preferred mode as a result of lack of coverage in the preferred mode. The DMT shall not automatically change from the non-preferred mode to the preferred mode as a result of background scanning more than DMT-N100 times every DMT-T100, i.e. point A shall not be passed more than DMT-N100 times every DMT-T100. This requirement shall apply irrespective of why the DMT switched from the preferred mode to the non preferred mode.

In case the user invokes re-selection of mode within DMT-T100, the timer shall be stopped and reset.

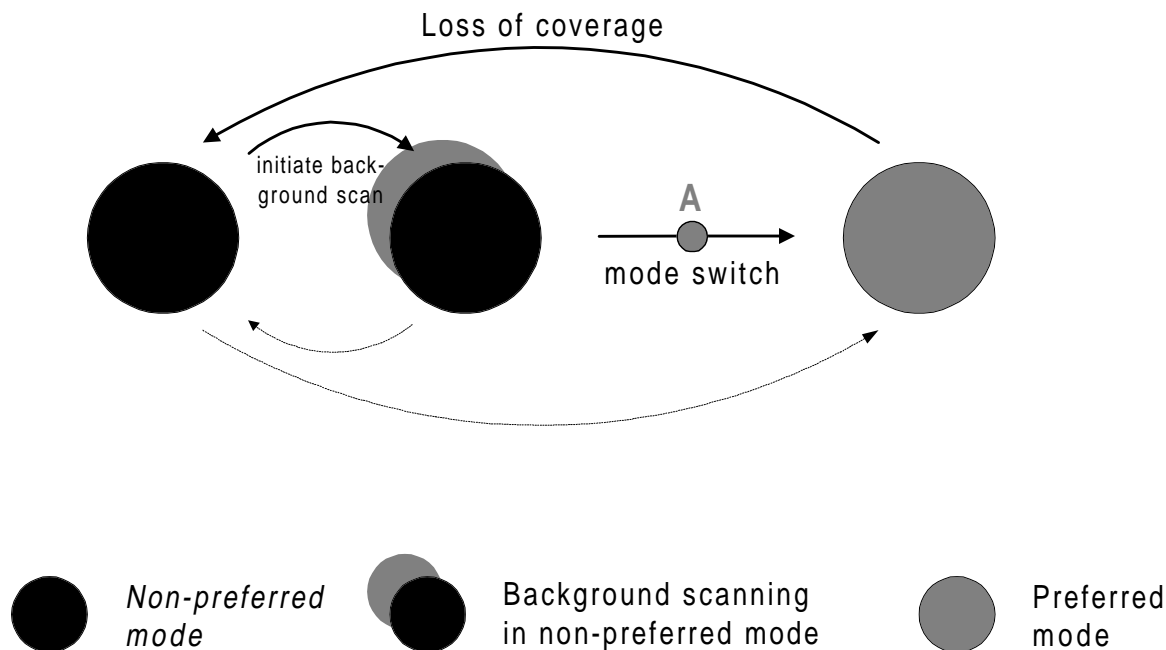


Figure 2: Background scanning cycle

NOTE 1: It is advantageous for the DMT to wait for stable coverage before switching modes in order to not be restricted from further switching by the above timer too often.

NOTE 2: There is no limit on the frequency with which a DMT may switch mode due to loss of coverage. However frequent switching may lead to excessive battery drain.

6.2.2.5 User re-selection of mode

At any time except when in active communication, the user shall be able to force the DMT into GSM or DECT mode by changing to manually switched operation.

When the DMT is in automatically switched operation the user may, at any time when not in active communication, initiate re-selection of mode.

If the DMT is in the preferred mode when the re-selection of mode is initiated, it shall remain in that mode.

If the DMT is in the non-preferred mode when the re-selection of mode is initiated, it should initiate background scanning but can go directly to the preferred mode. If a suitable network is identified during the background scan, the DMT shall switch to the preferred mode.

7 Requirements on parallel operation

This clause covers the requirements on DMTs with parallel operation implemented, i.e. DMTs operating with both modes (DECT and GSM) activated at the time.

7.1 Parallel mode DMT

A DMT which simultaneously at least receives in both DECT and GSM modes, and is simultaneously registered to both a DECT FT and a GSM base station at the same time, is a parallel mode DMT (a DMT in parallel operation). Such a DMT shall comply with the requirements detailed below. A DMT in parallel operation shall comply with all of the idle mode requirements for both DECT and GSM.

7.2 Mode selection

In addition to parallel operation also manually switched operation shall be implemented, i.e. it shall be possible for the user to set the DMT into either DECT-only or GSM-only mode.

When in parallel operation, either GSM or DECT shall be considered as the preferred mode. The user should be given the opportunity to change the preferred mode at any time when the DMT is not in active communication. If both automatically switched operation and parallel operation are implemented, the same mode (DECT or GSM) shall be considered as preferred in both cases.

When making an outgoing call, the DMT shall use the preferred mode, unless otherwise specified by the user.

NOTE: In parallel operation it should be possible for the user to select on per call basis which mode to use for outgoing call set-up.

7.3 Power on and initial registration

When the DMT is powered on in an area where there is coverage from a suitable DECT FP and a suitable GSM network, it should perform the complete power on and initial location registration procedures for each mode in sequence. If the DMT is not capable of simultaneous transmission on both modes, the complete power on and location registration procedures shall be performed on the preferred mode, before commencing the same procedures on the non-preferred mode. This is in order to avoid overlapping mobility management procedures on both modes.

7.4 Procedure while in parallel idle modes

When both parts (DECT and GSM) of the DMT is in idle mode, the DMT:

- shall meet both DECT and GSM idle mode requirements;
- shall be capable of being registered on both a DECT FT and GSM network;
- shall be capable of receiving a paging message in either mode; and
- shall respond to the first paging it receives, regardless of the mode in which it is received.

7.5 Procedures while in active communication in one mode

When in active communication in one mode (DECT or GSM), the DMT:

- shall not leave parallel operation;
- shall meet the idle mode requirements of the other mode.

The active communication may be an outgoing call, it may be a terminal initiated MM procedure, or it may be responding to a paging from the network, which in turn may be an incoming call, or a network initiated MM procedure.

If the DMT is incapable of responding to any paging messages in the other mode (GSM or DECT) while in active communication in one mode, then it shall behave as though out of coverage in the other mode.

If the DMT is capable of responding to paging messages in the other mode (GSM or DECT) while in active communication in one mode, then it shall not do so unless it is capable of handling parallel active communications.

7.5.1 Procedure while in active communication in DECT mode

When the DMT is paged in the DECT mode, or when the DMT initiates an active communication in DECT mode, it shall not perform the detach procedure in the GSM mode. It shall respond to the DECT paging within the time required by the DECT standards.

If the GSM network requires periodic location updating on the GSM mode, the T3212 timer in the GSM part of the DMT shall be kept running during the DECT active communication. If this timer times out before the DECT communication is finished, then as soon as the DECT communication is finished, a location update shall be performed in the GSM mode.

When in active communication in the DECT mode, if the DMT is paged in GSM mode, and the DMT has detected this paging and is incapable of responding to it, then as soon as the DECT active communication has finished, the DMT shall perform a location update in the GSM mode.

NOTE: If this paging was due to an incoming SMS message, then it is likely that the SMS would be sent again following the location update. If the paging was due to an incoming call, and the user had call divert to voice mailbox activated on no reply, then it is likely that an SMS message would have been sent to the user to notify him of a message in his mailbox (in which case there would have been 2 sets of pagings), and he would receive this SMS following the location update.

7.5.2 Procedure while in active communication in GSM mode

When the DMT is paged in the GSM mode, or when the DMT initiates an active communication in GSM mode, and the DMT implements the CAP profile on the DECT mode, it shall not perform the detach procedure in the DECT mode. It shall respond to the GSM paging within the time required by the GSM standards.

If the DECT CAP FP requires periodic location registration on the DECT mode, when the DMT implements the DECT CAP profile, the corresponding timer in the DECT PP part of the DMT shall be kept running during the GSM active communication. If this timer times out before the GSM communication is finished, then as soon as the GSM communication is finished, a location registration shall be performed in the DECT mode.

7.6 Procedure while in active communication in both GSM and DECT modes

If the DMT supports non-call related active communication simultaneously in both modes, the DMT shall meet the idle mode requirements of one mode even when it is in active communication in the other mode.

If the DMT supports call related active communication simultaneously in both modes:

- during active communication in one mode the DMT shall be able to receive and either accept or reject an incoming call in the other mode, i.e. pagings for a second call shall not be ignored;
- it should be possible to initiate a call in one mode while being in active communication in the other mode;
- the DMT shall meet the active mode requirements of one mode even when it is in active communication in the other mode.

NOTE: A second incoming call, in the other mode than the one which the DMT is active in, could be handled using a terminal based call completion (call waiting / call hold) feature. This would enable simultaneous handling of one DECT call and one GSM call in a way similar to how two mobile calls are handled in the GSM part of then DMT or two PSTN calls are handled in the DECT part of the DMT. When active in a DECT call while receiving a page for a GSM call, the DMT could also use the GSM USUB feature to reject the call.

When the DMT is in active communication in both GSM mode and DECT mode simultaneously, it shall not radiate more power than one active GSM MS and one active DECT PP placed in the same geographical position would.

7.7 Loss of coverage

When the DMT loses coverage in either DECT or GSM mode, it shall remain in parallel operation. The DMT shall behave like a normal GSM MS in order to find suitable GSM coverage or like a DECT PP performing background scanning or active unlocked state scanning in order to find suitable DECT coverage again. The loss of coverage in one mode shall not affect the operation of the other mode; it shall not produce any extra signalling load on the other mode.

Annex A (normative): Testing of DECT/GSM DMTs

The general principle adopted for the standardization of DMTs can also be applied when testing, in particular type approval testing, is concerned. DMTs should operate as single mode DECT or GSM terminals when in the DECT or GSM mode respectively, and therefore they should be tested, wherever possible, as single mode DECT or GSM terminals, using the existing DECT and GSM test specifications. In particular, all of the essential requirements applicable to single mode DECT or GSM terminals, as identified in their TBRs, (TBR 6 [16], TBR 10 [17], TBR 22 [20], and where applicable, TBR 40 [23], for DECT, and TBR 19 [18], TBR 20 [19], TBR 31 [21] and TBR 32 [22] for GSM) shall be applicable to DMTs.

Some initial explorations on testing were conducted during the production of TR 101 072 [7]. Since then, during development of EN 301 439 [25], more detailed investigations were conducted, which, for the most part, upheld the initial considerations, and indeed removed some of the initial concerns expressed. Testing and type approval aspects of DMTs in parallel operation are contained in TR 101 176 [26].

Instead of repeating the information contained within clauses 6 and 9 of TR 101 072 [7], this clause will identify some issues which merit highlighting. Also, no details of the technical analysis performed is contained here.

A.1 Radio testing

In general, as a result of the analysis of the test cases contained within TBR 6 [16], TBR 19 [18] and TBR 31 [21], it was concluded that all of the tests in these TBRs shall be applied separately. Most tests can be applied while the DMT is manually switched to the mode being tested, i.e. while background scanning is not in operation.

The first issue which requires highlighting is the difference in temperature range between DECT and GSM for those tests which need to be performed under extreme conditions. TBR 6 [16] specifies an extreme temperature range of 0° to +40°, while TBR 19 [18] and TBR 31 [21] specify -10° to +55° for DCS 1800 and small mobile stations, and -20° to +55° for other terminals, such as normal mobile stations. Certain GSM tests are required to be performed under vibration conditions, which is not the case for DECT. While there is no question of TBR 6 [16] tests being performed under the extreme conditions identified in the GSM test specifications, nevertheless, in reality the DMT as a unit will need to function under these extreme conditions.

There are no requirements related to the performance of background scanning for GSM or DECT, other than the fact that it shall not interfere with the operation of the currently active mode. There is no test to protect background scanning from any kind of interfering sources from the active mode (blocking, spurious emission, intermodulation, etc.). Furthermore, the impact of DCS1800 transmitting interference within DECT receiver bandwidth is resolved by an appropriate DECT protection, to be left open to manufacturers.

The basic receiver performance requirements of the active mode shall be tested when the other mode is performing background scanning. This is required to verify that the operation of background scanning does not interfere with the performance of the active mode. This only applies in the case where a DMT is capable of performing background scanning in one mode while in active communication in the other, because these tests require the terminal to be in active communication. In the case of performing these tests for GSM terminals, it is considered sufficient to perform the tests for the full rate codec while background scanning for DECT (if supported) is in operation, and to perform the tests for the half rate and enhanced full rate codecs when the DMT is manually switched to GSM mode. In order to perform these DECT and GSM tests in the required mode, all DECT and GSM test modes, such as loopback, shall be supported while performing background scanning.

Spurious emissions tests required special investigation, as it was initially assumed that some combination of the DECT and GSM requirements would need to be applied to the DMT while it is performing background scanning. However, when it was realized how technically difficult it would be to combine the existing DECT and GSM tests, three options on how to proceed were elaborated.

- Option 1: The DMT shall fulfil the existing GSM requirements when manually set to GSM mode (no background scanning for DECT) and shall fulfil the existing DECT requirements when manually set to DECT mode (no background scanning for GSM). There shall be no spurious emissions tests applied while background scanning is being performed (whether for DECT or for GSM).

- Option 2: The DMT shall fulfil the existing GSM requirements when GSM mode is the active (but non-preferred) mode and background scanning for DECT is being performed. The DMT shall fulfil the existing DECT requirements when DECT mode is the active (but non-preferred) mode and background scanning for GSM is being performed. No need in this case to fulfil requirements of option 1 in addition. No allowance is made for any possible spurious emissions as a result of the background scanning.
- Option 3: Same test conditions as in option 2 but the value of the accepted levels of spurious emissions is modified to include contributions also from the receiver of the mode that is performing background scanning. (The value of the new accepted levels may be up to the sum of the currently allowed values for DECT and GSM.) In addition to this, the requirements of option 1 shall also be met.

The requirements in option 1 are preferred. There is considered to be a low risk, for example, of the DECT part or receiver of the DMT producing higher emissions while performing background scanning than it would when manually switched to DECT. Option 2 is considered as unnecessarily severe, in that it does not take into account any typical spurious emissions from a second receiver performing background scanning. Option 3 requires the definition of appropriate conversion factors between DECT and GSM standards in order to produce a combined test, as there are differences in measurement bandwidth, etc. Also, for option 3, if such a test were to be defined, with allowed limits equal to the sum of the current DECT and GSM limits, the protection offered would not be any better than that provided by option 1, and if a lower limit were to be chosen, this would require unjustifiable investigation and delay for agreement, with regard to the real risk.

A.2 Acoustic testing

In general, the results of the comparison elaborated in TR 101 072 [7] clause 9 were upheld, in that it was concluded that the DECT and GSM TBR 10 [17], TBR 20 [19] and TBR 32 [22] shall be applied separately, while the DMT is manually switched to the mode being tested (background scanning not in operation).

No effort has been made to combine the acoustic requirements or tests for DECT and for GSM, therefore in applying their respective TBRs separately, there will be duplication of tests. This is necessary to enable rapid production of EN 301 439 [25] without modification of existing test procedures.

In many cases, GSM requirements are more stringent than DECT, therefore it may be necessary to design DMTs from the outset to meet certain GSM requirements. This does not impact the separate application of the DECT and GSM TBRs.

Listener's Sidetone Ratio (LSTR): TBR 32 [22] and TBR 20 [19] refer to LSTR as a special test situation (no test, manufacturer's declaration required). The computational models are identical though the assumption of a leakage correction implemented within the GSM/DCS1800 test cases is to be further checked within the relevant reference documents. For GSM/DCS1800 and DECT respectively, the requirements are LSTR greater or equal than 15 dB and 10 dB (at nominal Receiving Loudness Rating (RLR) and Sending Loudness Rating (SLR) settings). The DECT standard allows a lower limit of 15 dB if noise rejection capability is implemented.

NOTE: GSM is more stringent to cope with noisy environment.

As suggested within TBR 10 [17], an alternative measurement based on the weighted average D factor leads to D to be greater than or equal to -5 dB (or 0 dB if noise rejection capability). The D factor governs the transducers and acoustics terminal capability to discriminate ambient noise against speech. It is defined as the ratio of terminal sensitivity to ambient noise against sensitivity to speech. This basic discriminating ability is of primary importance for GSM handsets when used in hostile PLMN environment. Moreover we note the terminal casing, an issue for a dual mode technology like DMT, has a straight impact on this figure. On that respect, GSM 03.50, phase 2 recommends *but not requires* that the sending path is designed so that the value of D, defined in ITU-T Recommendation G.111 [24], should not be less than 2 dB, while GSM phase 2+ defines a lower limit (0 = SFDELSM) and recommends +3 dB for the Single Figure DELSM (SFDELSM). This small divergence together with the lack of a method aiming at quantifying the D figure for GSM handset should be highlighted.

A.3 Protocol testing

In TR 101 072 [7], it was considered that it may be necessary to permit degradation in the performance of a DMT, in particular with reference to receiving paging messages in one mode while performing background scanning in the other. It was also considered necessary to specify performance requirements relating to background scanning.

In the present document, the only requirement relating to background scanning is that it does not interfere with the operation of active mode of the DMT. For this reason, the protocol tests contained within TBR 22 [20], TBR 19 [18], TBR 31 [21] and TBR 40 [23], if applicable, shall be performed while the DMT is active in one mode and performing background scanning in the other. No degradation of performance of a DMT is permitted with respect to receipt of paging messages.

Extra tests are required to verify that the DMT does not place an excessive signalling load on a network by switching modes too frequently as a result of background scanning and to verify the correct behaviour of the DMT in parallel operation.

A.4 EMC testing

As a result of the investigation of the relevant Harmonized Standards for EMC for DECT and for GSM, it was found that there are no differences between the requirements for DECT and for GSM. Therefore, the EMC tests for DECT and for GSM shall be applied separately.

The EMC emissions tests for DECT and for GSM shall be applied while background scanning is being performed for the other mode (GSM and DECT respectively). The EMC immunity tests shall be applied when the DMT is manually switched to the mode being tested (no background scanning in operation).

Annex B (normative): Timers and constants

B.1 Timers

DMT-T100 = 8 minutes: time window for maximum DMT-N100 Non-preferred / Preferred mode complete loop.

B.2 Constants

DMT-N100 = 2: maximum number of Non-preferred / Preferred mode complete loop in DMT-T100.

History

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