



SLOVENSKI STANDARD  
PSIST TR 101 176:2000  
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Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT/GSM advanced integration of DECT/GSM dual-mode terminal equipment

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Ta slovenski standard je istoveten z: **TR 101 176 Version 1.1.1**

**ICS:**

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33.070.50	Globalni sistem za mobilno telekomunikacijo (GSM)	Global System for Mobile Communication (GSM)

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# TR 101 176 V1.1.1 (1998-04)

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*Technical Report*

## **Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); Advanced integration of DECT/GSM dual-mode terminal equipment**

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***European Telecommunications Standards Institute***

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**Reference**

DTR/DECT-010096 (aw000ics.PDF)

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**Keywords**

DECT, GSM, network, radio, terminal

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## Foreword

This Technical Report (TR) has been produced by ETSI Project Digital Enhanced Cordless Telecommunications (DECT).

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## Introduction

The primary objective of the present document is to examine the advanced technical issues relating to dual-mode (combined DECT/GSM) terminals in order to provide a basis for future work in this area. The present document proposes what could be standardized in order to establish type approval procedures for advanced dual-mode terminals that goes beyond the existing type approval procedures for DECT and GSM terminals.

The main contents of this report is:

- Radio, network and service aspects of dual-mode terminals that can be registered in two networks, and maybe be in active communication, at the same time via both DECT and GSM radio interfaces. Special focus is put on the reception of SMS in DECT mode and handover between DECT and GSM modes.
- DECT/GSM dual-mode operation where the terminal connects to the same network (GSM PLMN) in both modes using only a single subscription.

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## 1 Scope

To investigate radio and network aspects and clarifying the possibilities, problems and needs for new standardization related to advanced dual-mode terminals for DECT and GSM. The present document will identify the needed contents of the necessary standards that will form the basis for the second edition of Harmonized Standard EN 301 439 [18], i.e. dual-mode terminals that cannot be type approved according to existing TBRs and Harmonized Standards and that may operate in both modes at the same time or using only a single subscription. Basic dual-mode terminals, i.e. terminals consisting of one DECT part and one GSM part and that can be type approved according to existing TBRs and Harmonized Standards, were considered in another ETR (TR 101 072 [16]). The same consideration should be made for dual-mode terminals and infrastructure for DECT/DCS1800 as well as dual-mode/dual-band terminals DECT/GSM/DCS1800. The term GSM is considered to cover all the frequency bands, and combinations of frequency bands, allowed for GSM type equipments, i.e. P-GSM, E-GSM, R-GSM, DCS1800 or dual-band GSM/DCS.

NOTE: A terminal comprising multiple GSM parts operating on different frequency bands is considered as a dual-band terminal. A terminal comprising both DECT and GSM parts is referred to as a dual-mode terminal.

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## 2 References

References may be made to:

- a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or
- b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or
- c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or
- d) publications without mention of a specific version, in which case the latest version applies.

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] EN 300 175-1: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 1: Overview".
- [2] EN 300 175-2: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 2: Physical layer (PHL)".
- [3] EN 300 175-3: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 3: Medium Access Control (MAC) layer".
- [4] EN 300 175-4: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 4: Data Link Control (DLC) layer".
- [5] EN 300 175-5: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 5: Network (NWK) layer".
- [6] EN 300 175-6: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 6: Identities and addressing".
- [7] EN 300 175-7: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 7: Security features".
- [8] EN 300 175-8: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 8: Speech coding and transmission".



- [9] ETS 300 370: "Digital Enhanced Cordless Telecommunications / Global System for Mobile communications (DECT/GSM) inter-working profile; Access and mapping (Protocol/procedure description for 3,1 kHz speech service)".
- [10] ETR 341: "Digital Enhanced Cordless Telecommunications / Global System for Mobile communications (DECT/GSM) Interworking Profile (IWP); Profile overview".
- [11] ETS 300 787: "Digital Enhanced Cordless Telecommunications / Global System for Mobile communications (DECT/GSM); Integrated Services Digital Network; DECT access to GSM via ISDN; General description of service requirements".
- [12] EN 300 444: "Digital Enhanced Cordless Telecommunications (DECT); Generic Access Profile (GAP)".
- [13] ETS 300 824: "Digital Enhanced Cordless Telecommunications (DECT); Cordless Terminal Mobility (CTM); CTM Access Profile (CAP)".
- [14] 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".
- [15] ETR 185: "Digital European Cordless Telecommunications (DECT); Data Services Profile (DSP); Profile overview".
- [16] TR 101 072: "Digital Enhanced Cordless Telecommunications/Global System for Mobile Communications (DECT/GSM); Integration based on dual-mode terminals".
- [17] EN 301 242: "Digital Enhanced Cordless Telecommunication (DECT); Global System for Mobile communications (GSM); DECT/GSM integration based on dual-mode terminals".
- [18] EN 301 439: "Digital European Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); Attachment requirements for DECT/GSM Dual-Mode Terminal (DMT) equipment".
- [19] ETR 350: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms (GSM 01.04 version 5.0.1)".
- [20] GTS GSM 03.09: "Digital cellular telecommunications system (Phase 2+); Handover procedures (GSM 03.09 version 5.1.0)".
- [21] ETS 300 930: "Digital cellular telecommunications system (Phase 2+); Functions related to Mobile Station (MS) in idle mode and group receive mode (GSM 03.22 version 5.2.1)".
- [22] ETR 366: "Digital cellular telecommunications system (Phase 2+); Multiband operation of GSM/DCS 1800 by a single operator (GSM 03.26 version 5.1.0)".
- [23] ETS 300 940: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface; Layer 3 specification (GSM 04.08 version 5.6.3)".
- [24] ETS 300 921: "Digital cellular telecommunications system; Service accessibility (GSM 02.11 version 5.0.1)".
- [25] TBR 6: "Digital Enhanced Cordless Telecommunications (DECT); General terminal attachment requirements".
- [26] TBR 10: "Digital Enhanced Cordless Telecommunications (DECT); General terminal attachment requirements; Telephony applications".
- [27] TBR 19: "European digital cellular telecommunications system (Phase 2); Attachment requirements for Global System for Mobile communications (GSM) mobile stations; Access".
- [28] TBR 20: "European digital cellular telecommunications system (Phase 2); Attachment requirements for Global System for Mobile communications (GSM) mobile stations; Telephony".

- [29] TBR 22: "Digital Enhanced Cordless Telecommunications (DECT); Attachment requirements for terminal equipment for DECT; Generic Access Profile (GAP) applications".
- [30] TBR 31: "Digital cellular telecommunications system (Phase 2); Attachment requirements for mobile stations in the DCS 1 800 band and additional GSM 900 band; Access".
- [31] TBR 32: "Digital cellular telecommunications system (Phase 2); Attachment requirements for mobile stations in the DCS 1 800 band and additional GSM 900 band; Telephony".
- [32] TBR 36: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT access to GSM Public Land Mobile Network (PLMNs) for 3.1 kHz speech applications".
- [33] EN 301 440: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); Attachment requirements for terminal equipment for DECT/ISDN interworking profile applications".

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## 3 Definitions, symbols 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.

NOTE 1: When the DMT is in active communication in a mode, it has left the idle state of that mode.

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

NOTE 2: For GIP/GSM DMTs, registration is not performed in both modes.

**background scanning:** The process whereby a basic DMT 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.

**basic dual-mode terminal:** A DMT that can only be in one mode at the time and that can be switched either manually or automatically between modes. The basic DMT is always in one mode.

**cell (DECT):** The domain served by a single antenna(e) system (including a leaky feeder) of one fixed part.

NOTE 3: A cell may include more than one source of radiated Radio Frequency (RF) energy (i.e. more than one radio end point).

**call (DECT):** All of the layer 3 processes involved in one layer 3 peer-to-peer association.

**dual-band terminal:** A terminal comprising multiple GSM parts operating on different frequency bands. For example a terminal comprising of GSM and DCS1800 parts.

**Dual-Mode Mobile Station (DMS):** A GIP/GSM DMT that operates using only a GSM subscription.

**Dual-Mode Terminal (DMT):** A terminal comprising both DECT and GSM parts.

**Fixed Part (DECT Fixed Part) (FP):** A physical grouping that contains all of the elements in the DECT network between the local network and the DECT air interface.

**GAP/GSM DMT:** A dual-mode terminal where the DECT part is compliant with any DECT profile(s) except the DECT/GSM InterWorking Profile.

**GIP/GSM DMT:** A dual-mode terminal where the DECT part is at least compliant with the DECT/GSM InterWorking Profile.

**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.

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

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

NOTE 4: Mode selection only applies for type 2 DMTs, type 3, 4, and 5 DMTs operate in both modes.

**mode:** A basic DMT is in either of the 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).

NOTE 5: More advanced DMTs can be active in both modes. The grade of service available in the two modes depend on the terminal type.

**Portable Part (PP) (DECT Portable Part):** A physical grouping that contains all elements between the user and the DECT air interface. PP is a generic term that may describe one or several physical pieces.

**PLMN selection:** A GSM procedure defined in [21] where the DMT identifies and selects the PLMN to which it may register.

NOTE 6: For GIP/GSM DMTs, both radio interfaces may be involved in the PLMN selection.

**Radio Fixed Part (RFP):** One physical sub-group of a fixed part that contains all the radio end points (one or more) that are connected to a single system of antennas.

NOTE 7: Specific GSM abbreviations may be found in ETR 350 [19]. Specific DECT definitions and abbreviations are found in EN 300 175-1 [1].

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## 3.2 Abbreviations

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

ARI	Access Rights Identifier
CAP	CTM Access Profile
CTM	Cordless Terminal Mobility
DAM	DECT Authentication Module
DECT	Digital Enhanced Cordless Telecommunications
DMS	Dual-Mode Mobile Station
DMT	Dual-Mode Terminal
ETR	ETSI Technical Report
ETS	European Telecommunication Standard
ETSI	European Telecommunications Standards Institute
FP	Fixed Part
FT	Fixed Termination
GAP	Generic Access Profile
GIP	DECT/GSM Interworking Profile
IMEI	International Mobile Equipment Identity
IPEI	International Portable Equipment Identity
IPUI	International Portable User Identity
ISDN	Integrated Services Digital Network
LAI	Local Area Identifier
LE	Local Exchange
MMI	Man Machine Interface
MSC	Mobile Switching Centre
PABX	Private Automatic Bransch Exchange
PBX	Private Bransch Exchange
PLMN	Public Land Mobile Network
PP	Portable Part
PSTN	Public Switched Telephone Network
PT	Portable Termination

RES	Radio Equipment and Systems
RFP	Radio Fixed Part
SIM	Subscriber Identity Module
SMS	Short Message Service
TBR	Technical Basis for Regulation

## 4 Reference configurations and scenarios

### 4.1 Terminal Configurations

A Dual-Mode Terminal (DMT) for DECT and GSM is considered to be a terminal with one GSM part and one DECT part that is controlled by a common Interworking Unit which also controls one common MMI (keypad, display and menu functions). A reference configuration for dual-mode terminals is shown in figure 1.

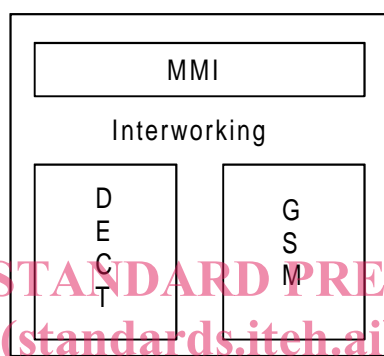


Figure 1: Reference configuration for DMT

Some parts in the terminal, such as microphone and loudspeaker, could be reused by both the GSM and DECT parts or could be implemented in two ways. Integration of the RF parts is also foreseen. The exact functionality of the interworking function will depend on the terminal configuration.

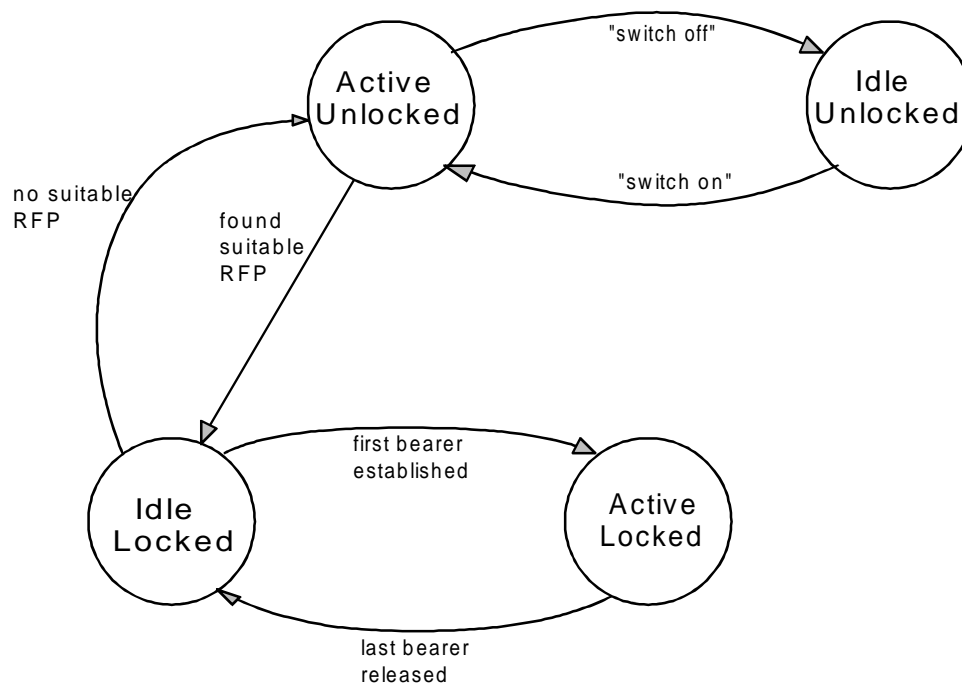
#### 4.1.1 Terminal states

A DMT can operate in two modes: DECT and/or GSM. In each mode the terminal can be in different states of operations at a lower layer (MAC layer for DECT and RR layer for GSM).

##### 4.1.1.1 DECT Terminal states

The DECT mode of a DMT behaves as a DECT Portable Part (PP). A PP can exist in one of the following MAC layer states (see EN 300 175-3 [3], subclause 4.3.1).

- 1) **Active\_Locked:** where the PP is synchronized to at least one RFP transmission and has one or more connections in progress.
- 2) **Idle\_Locked:** where the PP is synchronized to at least one RFP transmission. It is able to make or receive connections, but has no connections in progress.
- 3) **Active\_Unlocked:** where the PP is not synchronized to any RFP transmissions, and is unable to make or receive connections. The PP makes occasional attempts to detect a suitable RFP and enter the Idle\_Locked state.
- 4) **Idle\_Unlocked:** the PP is not synchronized to any RFP and does not attempt to detect RFPs.



**Figure 2: DECT mode state diagram (see EN 300 175-3 [3])**

The DECT idle unlocked state corresponds to the GSM idle state.

NOTE: Compared to the GSM case, a DECT PP can go to the switched off state via the active state (e.g. in the GIP and CAP cases) but also directly from the idle state (as e.g. in the GAP case).