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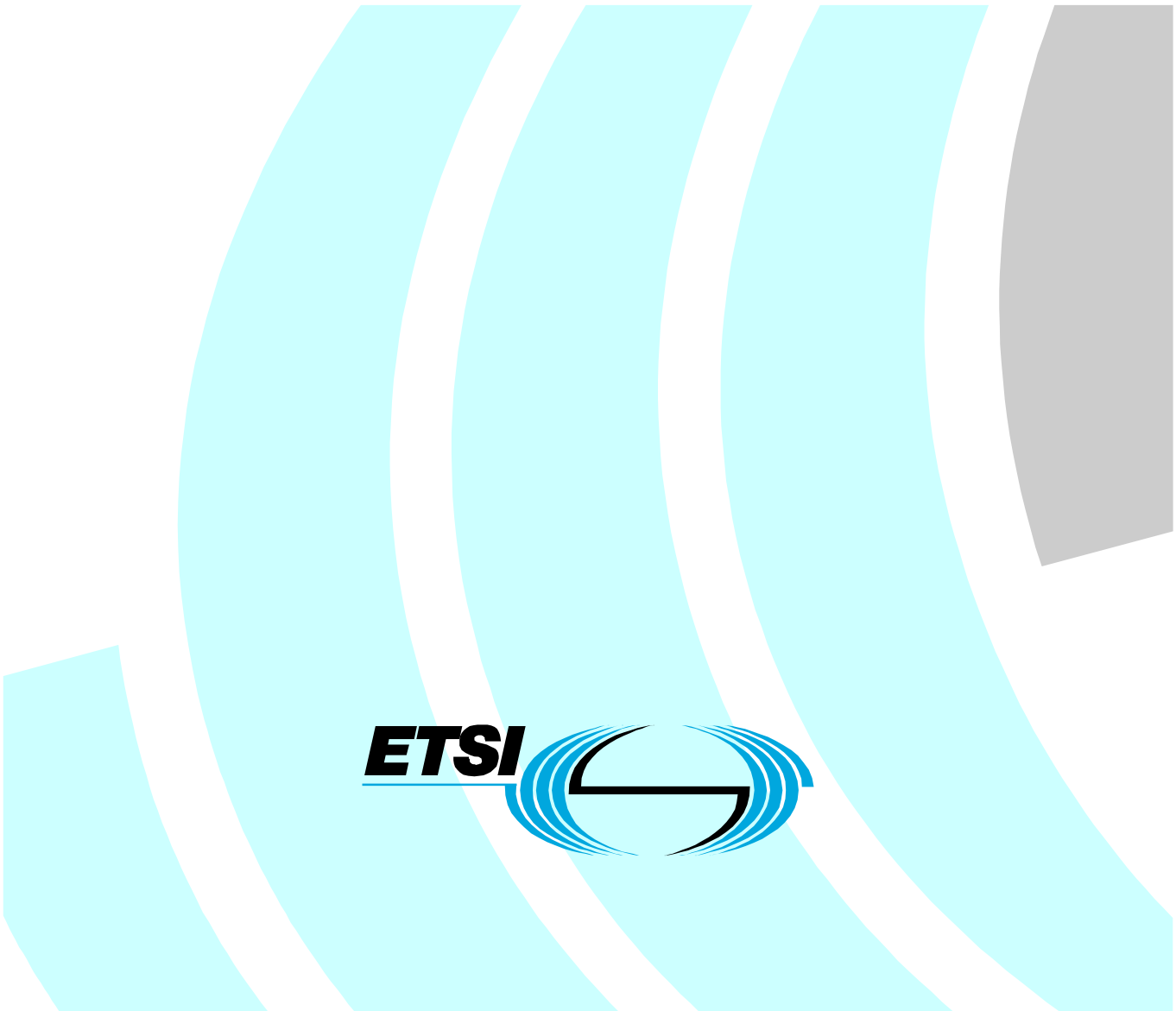
Technical Report

Digital Enhanced Cordless Telecommunications (DECT); A High Level Guide to the DECT Standardization



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Contents

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Foreword

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

The information in the present document is believed to be correct at the time of publication. However, DECT standardization is a rapidly changing area, and it is possible that some of the information contained in the present document may become outdated or incomplete within relatively short time-scales.

Introduction

The aim of the present document is to give the reader a basic understanding of the DECT applications and features and how the ETSI standards for DECT interrelate to the different applications.

In the present document, clause 4 outlines the services and applications addressed by the DECT standards and the concept of DECT being a general radio access technology.

Clause 5 provides a brief overview to the ETSI standardization and introduces some of the other bodies involved in the development of DECT. It also gives an introduction to the DECT-related ETSI publications.

Clause 6 provides details of the basic DECT documents, on which all applications of DECT are built. The aspects covered by each document are briefly described.

Clause 7 describes existing ETSI defined profiles and how they relate to particular applications.

Clauses 8, 9 and 10 cover issues of conformance testing and regulation. Clause 8 explains the distinction between these two closely related topics. Clause 9 describes how conformance to DECT standards is verified. Clause 10 gives information on the regulatory regime for DECT products.

In addition to DECT standards, ETSI Project (EP) DECT has produced several informative documents on DECT. These are published as ETSI Technical Reports (TRs and ETRs). Clause 11 provides a summary of these documents.

Clause 12 outlines some aspects of the market acceptance of DECT.

Clause 13 describes the flexibility for evolutionary developments of the DECT standard.

Annex A provides information on the DECT documents in a summary format.

Annex B provides information about the technical characteristics of DECT. Though not essential background for the present document, there is also a short introduction to the special way, DECT utilizes the radio frequency spectrum. It explains very briefly the Dynamic Channel Selection technique, which makes DECT fundamentally different from traditional cellular systems. Further the frequencies defined by DECT are described.

1 Scope

The present document provides a high level description of the various components of the Digital Enhanced Cordless Telecommunications (DECT) standardization. It is directed to a wide audience, regulators, operators, manufacturers and others, and attempts to provide a basic overview of the DECT standards, without requiring detailed technical knowledge of DECT as a prerequisite.

The present document describes the services and applications for which DECT may be used, and which ETSI publications relate to the different applications. The documents relating to conformance testing and regulation of DECT products are also described.

2 References

For the purposes of this Technical Report (TR) the following references apply:

[1] ETSI EN 300 175-1: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 1: Overview".

[2] ETSI EN 300 175-2: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 2: Physical Layer (PHL)".

[3] ETSI EN 300 175-3: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 3: Medium Access Control (MAC) layer".

[4] ETSI EN 300 175-4: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 4: Data Link Control (DLC) layer".

[5] ETSI EN 300 175-5: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 5: Network (NWK) layer".

[6] ETSI EN 300 175-6: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 6: Identities and addressing".

[7] ETSI EN 300 175-7: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 7: Security features".

[8] ETSI EN 300 175-8: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 8: Speech coding and transmission".

[9] ETSI EN 300 052-1: "Integrated Services Digital Network (ISDN); Multiple Subscriber Number (MSN) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol; Part 1: Protocol specification".

[10] ETSI EN 300 052-2: "Integrated Services Digital Network (ISDN); Multiple Subscriber Number (MSN) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol; Part 2: Protocol Implementation Conformance Statement (PICS) proforma specification".

[11] ETSI EN 300 052-3: "Integrated Services Digital Network (ISDN); Multiple Subscriber Number (MSN) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol; Part 3: Test Suite Structure and Test Purposes (TSS&TP) specification for the user".

[12] ETSI EN 300 052-4: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Multi Subscriber Number (MSN) supplementary service; Part 4: Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT) proforma specification for the user".

[13] ETSI EN 300 052-5: "Integrated Services Digital Network (ISDN); Multiple Subscriber Number (MSN) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol; Part 5: Test Suite Structure and Test Purposes (TSS&TP) specification for the network".

[14] ETSI EN 300 052-6: "Integrated Services Digital Network (ISDN); Multiple Subscriber Number (MSN) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol; Part 6: Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT) proforma specification for the network".

[15] ETSI EN 300 176-1: "Digital Enhanced Cordless Telecommunications (DECT); Test specification; Part 1: Radio".

[16] ETSI EN 300 176-2: "Digital Enhanced Cordless Telecommunications (DECT); Test specification; Part 2: Speech".

[17] ETSI ETS 300 329: "Radio Equipment and Systems (RES); ElectroMagnetic Compatibility (EMC) for Digital Enhanced Cordless Telecommunications (DECT) equipment".

[18] ETSI ETS 300 331: "Digital Enhanced Cordless Telecommunications (DECT); DECT Authentication Module (DAM)".

[19] ETSI EN 300 339: "Electromagnetic compatibility and Radio spectrum Matters (ERM); General ElectroMagnetic Compatibility (EMC) for radio communications equipment".

[20] ETSI EN 300 370: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT/GSM Interworking Profile (IWP); Access and mapping (protocol/procedure description for 3,1 kHz speech service)".

[21] ETSI ETS 300 406: "Methods for Testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".

[22] ETSI EN 300 434-1: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); DECT/ISDN interworking for end system configuration; Part 1: Interworking specification".

[23] ETSI EN 300 434-2: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); DECT/ISDN interworking for end system configuration; Part 2: Access profile".

[24] ETSI EN 300 444: "Digital Enhanced Cordless Telecommunications (DECT); Generic Access Profile (GAP)".

[25] ETSI EN 300 466: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT/GSM Interworking Profile (IWP); General description of service requirements; Functional capabilities and information flows".

[26] ETSI EN 300 474-1: "Digital Enhanced Cordless Telecommunications (DECT); Generic Access Profile (GAP); Profile requirement list and profile specific Implementation Conformance Statement (ICS) proforma; Part 1: Portable radio Termination (PT)".

[27] ETSI EN 300 474-2: "Digital Enhanced Cordless Telecommunications (DECT); Generic Access Profile (GAP); Profile requirement list and profile specific Implementation Conformance Statement (ICS) proforma; Part 2: Fixed radio Termination (FT)".

[28] ETSI EN 300 476-1: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Protocol Implementation Conformance Statement (PICS) proforma; Part 1: Network (NWK) layer - Portable radio Termination (PT)".

[29] ETSI EN 300 476-2: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Protocol Implementation Conformance Statement (PICS) proforma; Part 2: Data Link Control (DLC) layer - Portable radio Termination (PT)".

[30] ETSI EN 300 476-3: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Protocol Implementation Conformance Statement (PICS) proforma; Part 3: Medium Access Control (MAC) layer - Portable radio Termination (PT)".

[31] ETSI EN 300 476-4: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Protocol Implementation Conformance Statement (PICS) proforma; Part 4: Network (NWK) layer - Fixed radio Termination (FT)".

[32] ETSI EN 300 476-5: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Protocol Implementation Conformance Statement (PICS) proforma; Part 5: Data Link Control (DLC) layer - Fixed radio Termination (FT)".

[33] ETSI EN 300 476-6: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Protocol Implementation Conformance Statement (PICS) proforma; Part 6: Medium Access Control (MAC) layer - Fixed radio Termination (FT)".

[34] ETSI EN 300 476-7: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Protocol Implementation Conformance Statement (PICS) proforma; Part 7: Physical layer".

[35] ETSI EN 300 494-1: "Digital Enhanced Cordless Telecommunications (DECT); Generic Access Profile (GAP); Profile Test Specification (PTS); Part 1: Summary".

[36] ETSI EN 300 494-2: "Digital Enhanced Cordless Telecommunications (DECT); Generic Access Profile (GAP); Profile Test Specification (PTS); Part 2: Profile Specific Test Specification (PSTS) - Portable radio Termination (PT)".

[37] ETSI EN 300 494-3: "Digital Enhanced Cordless Telecommunications (DECT); Generic Access Profile (GAP); Profile Test Specification (PTS); Part 3: Profile Specific Test Specification (PSTS) - Fixed radio Termination (FT)".

[38] ETSI EN 300 497-1: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Test Case Library (TCL); Part 1: Test Suite Structure (TSS) and Test Purposes (TP) for Medium Access Control (MAC) layer".

[39] ETSI EN 300 497-2: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Test Case Library (TCL); Part 2: Abstract Test Suite (ATS) for Medium Access Control (MAC) layer - Portable radio Termination (PT)".

[40] ETSI EN 300 497-3: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Test Case Library (TCL); Part 3: Abstract Test Suite (ATS) for Medium Access Control (MAC) layer - Fixed radio Termination (FT)".

[41] ETSI EN 300 497-4: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Test Case Library (TCL); Part 4: Test Suite Structure (TSS) and Test Purposes (TP) - Data Link Control (DLC) layer".

[42] ETSI EN 300 497-5: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Test Case Library (TCL); Part 5: Abstract Test Suite (ATS) - Data Link Control (DLC) layer".

[43] ETSI EN 300 497-6: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Test Case Library (TCL); Part 6: Test Suite Structure (TSS) and Test Purposes (TP) - Network (NWK) layer - Portable radio Termination (PT)".

[44] ETSI EN 300 497-7: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Test Case Library (TCL); Part 7: Abstract Test Suite (ATS) for Network (NWK) layer - Portable radio Termination (PT)".

[45] ETSI EN 300 497-8: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Test Case Library (TCL); Part 8: Test Suite Structure (TSS) and Test Purposes (TP) - Network (NWK) layer - Fixed radio Termination (FT)".

[46] ETSI EN 300 497-9: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Test Case Library (TCL); Part 9: Abstract Test Suite (ATS) for Network (NWK) layer - Fixed radio Termination (FT)".

[47] ETSI ETS 300 499: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT/GSM Interworking Profile (IWP); Mobile services Switching Centre (MSC) - Fixed Part (FP) interconnection".

[48] ETSI ETS 300 702-1: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT/GSM Interworking Profile (IWP); Part 1: Profile Test Specification (PTS) summary".

[49] ETSI ETS 300 702-2: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT/GSM Interworking Profile (IWP); Profile Test Specification (PTS); Profile Specific Test Specification (PSTS); Part 2: Portable radio Termination (PT)".

[50] ETSI ETS 300 702-3: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT/GSM Interworking Profile (IWP); Profile Test Specification (PTS); Profile Specific Test Specification (PSTS); Part 3: Fixed radio Termination (FT)".

[51] ETSI EN 300 703: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT/GSM Interworking Profile (IWP); GSM Phase 2 supplementary services implementation".

[52] ETSI ETS 300 704-1: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT/GSM Interworking Profile (IWP); Profile Implementation Conformance Statement (ICS); Part 1: Portable radio Termination (PT)".

[53] ETSI ETS 300 704-2: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT/GSM Interworking Profile (IWP); Profile Implementation Conformance Statement (ICS); Part 2: Fixed radio Termination (FT)".

[54] ETSI ETS 300 705-1: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); DECT/ISDN interworking for end system configuration; Profile Implementation Conformance Statement (ICS); Part 1: Portable radio Termination (PT)".

[55] ETSI ETS 300 705-2: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); DECT/ISDN interworking for end system configuration; Profile Implementation Conformance Statement (ICS); Part 2: Fixed radio Termination (FT)".

[56] ETSI ETS 300 756: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT/GSM Interworking Profile (IWP); Implementation of bearer services".

[57] ETSI EN 300 757: "Digital Enhanced Cordless Telecommunications (DECT); Low Rate Messaging Service (LRMS) including Short Messaging Service (SMS)".

[58] ETSI ETS 300 758-1: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); DECT/ISDN interworking for end system configuration; Profile Test Specification (PTS); Part 1: Summary".

[59] ETSI ETS 300 758-2: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); DECT/ISDN interworking for end system configuration; Profile Test Specification (PTS); Part 2: Profile Specific Test Specification (PSTS) for Portable radio Termination (PT)".

[60] ETSI ETS 300 758-3: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); DECT/ISDN interworking for end system configuration; Profile Test Specification (PTS); Part 3: Profile Specific Test Specification (PSTS) for Fixed radio Termination (FT)".

[61] ETSI ETS 300 759: "Digital Enhanced Cordless Telecommunications (DECT); DECT Authentication Module (DAM); Test specification for DAM".

[62] ETSI ETS 300 760: "Digital Enhanced Cordless Telecommunications (DECT); DECT Authentication Module (DAM); Implementation Conformance Statement (ICS) proforma specification".

[63] ETSI ETS 300 764: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT/GSM Interworking Profile (IWP); Implementation of short message service, point-to-point and cell broadcast".

[64] ETSI EN 300 765-1: "Digital Enhanced Cordless Telecommunications (DECT); Radio in the Local Loop (RLL) Access Profile (RAP); Part 1: Basic telephony services".

[65] ETSI EN 300 765-2: "Digital Enhanced Cordless Telecommunications (DECT); Radio in the Local Loop (RLL) Access Profile (RAP); Part 2: Advanced telephony services".

[66] ETSI ETS 300 787: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); Integrated Services Digital Network (ISDN); DECT access to GSM via ISDN; General description of service requirements".

[67] ETSI ETS 300 788: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); Integrated Services Digital Network (ISDN); DECT access to GSM via ISDN; Functional capabilities and information flows".

[68] ETSI ETS 300 792: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT/GSM Interworking Profile (IWP); Implementation of facsimile group 3".

[69] ETSI EN 300 822: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); DECT/ISDN interworking for intermediate system configuration; Interworking and profile specification".

[70] ETSI EN 300 824: "Digital Enhanced Cordless Telecommunications (DECT); Cordless Terminal Mobility (CTM); CTM Access Profile (CAP)".

[71] ETSI ETS 300 825: "Digital Enhanced Cordless Telecommunications (DECT); 3 Volt DECT Authentication Module (DAM)".

[72] ETSI EN 301 238: "Digital Enhanced Cordless Telecommunications (DECT); Data Services Profile (DSP); Isochronous data bearer services with roaming mobility (service type D, mobility class 2)".

[73] ETSI EN 301 239: "Digital Enhanced Cordless Telecommunications (DECT); Data Services Profile (DSP); Isochronous data bearer services for closed user groups (service type D, mobility class 1)".

[74] ETSI EN 301 241-1: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); DECT/ISDN interworking for intermediate system configuration; Profile Implementation Conformance Statement (ICS); Part 1: Portable radio Termination (PT)".

[75] ETSI EN 301 241-2: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); DECT/ISDN interworking for intermediate system configuration; Profile Implementation Conformance Statement (ICS); Part 2: Fixed radio Termination (FT)".

[76] ETSI EN 301 242: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT/GSM integration based on dual-mode terminals".

[77] ETSI EN 301 361-1: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); ISDN Mobility protocol Interworking specification Profile (IMIP); Part 1: DECT/ISDN interworking for Cordless Terminal Mobility (CTM) support".

[78] ETSI EN 301 361-2: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); ISDN Mobility protocol Interworking specification Profile (IMIP); Part 2: DECT/ISDN interworking for Global System for Mobile communications (GSM) support".

[79] ETSI EN 301 371-1: "Digital Enhanced Cordless Telecommunications (DECT); Cordless Terminal Mobility (CTM); CTM Access Profile (CAP); Profile Test Specification (PTS); Part 1: Summary".

[80] ETSI EN 301 371-2: "Digital Enhanced Cordless Telecommunications (DECT); Cordless Terminal Mobility (CTM); CTM Access Profile (CAP); Profile Test Specification (PTS); Part 2: Profile Specific Test Specification (PSTS) -Portable radio Termination (PT)".

[81] ETSI EN 301 371-3: "Digital Enhanced Cordless Telecommunications (DECT); Cordless Terminal Mobility (CTM); CTM Access Profile (CAP); Profile Test Specification (PTS); Part 3: Profile Specific Test Specification (PSTS) -Fixed radio Termination (FT)".

[82] ETSI EN 301 439: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); Attachment requirements for DECT/GSM dual-mode terminal equipment".

[83] ETSI EN 301 440: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); Attachment requirements for terminal equipment for DECT/ISDN interworking profile applications".

[84] ETSI EN 301 614-1: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); DECT/ISDN interworking for intermediate system configuration; Part 1: Profile Test Specification (PTS) summary".

[85] ETSI EN 301 614-2: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); DECT/ISDN interworking for intermediate system configuration; Part 2: Profile Specific Test Specification (PSTS) for Portable radio Termination (PT)".

[86] ETSI EN 301 614-3: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); DECT/ISDN interworking for intermediate system configuration; Part 3: Profile Specific Test Specification (PSTS) for Fixed radio Termination (FT)".

[87] ETSI EN 301 649: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS)".

[88] ETSI EN 301 650: "Digital Enhanced Cordless Telecommunications (DECT); DECT Multimedia Access Profile (DMAP) Application Specific Access Profile (ASAP)".

[89] ETSI ETR 041: "Transmission and Multiplexing (TM); Digital European Cordless Telecommunications (DECT); Transmission aspects 3,1 kHz telephony Interworking with other networks".

[90] ETSI ETR 043: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Services and facilities requirements specification".

[91] ETSI ETR 056: "Digital Enhanced Cordless Telecommunications (DECT); System description document".

[92] ETSI ETR 139: "Radio Equipment and Systems (RES); Radio in the Local Loop (RLL)".

[93] ETSI ETR 159: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); Wide area mobility using GSM".

[94] ETSI TR 102 183: "Digital Enhanced Cordless Telecommunications (DECT); Conformance testing on DECT equipment".

[95] ETSI TR 102 185: "Digital Enhanced Cordless Telecommunications (DECT); Data Services Profile (DSP); Profile overview".

[96] ETSI ETR 246: "Digital Enhanced Cordless Telecommunications (DECT); Application of DECT Wireless Relay Stations (WRS)".

[97] ETSI ETR 308: "Digital Enhanced Cordless Telecommunications (DECT); Services, facilities and configurations for DECT in the local loop".

[98] ETSI ETR 341: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT/GSM Interworking Profile (IWP); Profile overview".

[99] ETSI TR 101 072: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT/GSM integration based on dual-mode terminals".

[100] ETSI TR 101 159: "Digital Enhanced Cordless Telecommunications (DECT); Implementing DECT in an arbitrary spectrum allocation".

[101] ETSI TR 101 310: "Digital Enhanced Cordless Telecommunications (DECT); Traffic capacity and spectrum requirements for multi-system and multi-service DECT applications co-existing in a common frequency band".

[102] ETSI TR 101 370: "Digital Enhanced Cordless Telecommunications (DECT); Implementing DECT Fixed Wireless Access (FWA) in an arbitrary spectrum allocation".

[103] Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (Official Journal L139 of 23/5/89 including 92/31/EEC).

[104] Council Directive 91/287/EEC of 3 June 1991 on the frequency band to be designated for the coordinated introduction of digital European cordless telecommunications (DECT) into the Community.

[105] Council Recommendation 91/288/EEC of 3 June 1991 on the coordinated introduction of digital European cordless telecommunications (DECT) into the Community.

[106] ITU-T Recommendation G.726: "40, 32, 24, 16 kbit/s adaptive differential pulse code modulation (ADPCM)".

[107] TRAC Handbook: "Handbook on CTRs".

[108] TRAC Procedure: "Procedure for the Production of CTRs".

[109] ISO/IEC 9646: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework".

[110] ETSI EN 302 096: "Digital Enhanced Cordless Telecommunications (DECT); Cordless Terminal Mobility (CTM); Feature Package 1 (FP1); CTM circuit-switched data profile, 32 kbit/s and 64 kbit/s Unrestricted Digital Information (UDI)".

[111] ETSI EN 300 700: "Digital Enhanced Cordless Telecommunications (DECT); Wireless Relay Station (WRS)".

[112] IEEE 802.3: "Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications".

[113] IEEE 802.5: "Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 5: Token Ring Access Method and Physical Layer Specifications".

[114] ETSI TS 101 679: "Digital Enhanced Cordless Telecommunications (DECT); Broadband Integrated Services Digital Network (B-ISDN); DECT/B-ISDN interworking".

[115] ETSI TBR 036: "Digital Enhanced Cordless Telecommunications (DECT); Global System for Mobile communications (GSM); DECT access to GSM Public Land Mobile Networks (PLMNs) for 3,1 kHz speech applications".

[116] ETSI 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".

[117] ETSI ETR 337: "Broadband Integrated Services Digital Network (B-ISDN); Mobile networks requirements on B-ISDN".

[118] ETSI EN 301 469-1: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS) Test Case Library (TCL); Part 1: Test Suite Structure (TSS) and Test Purposes (TP) - Medium Access Control (MAC) layer".

[119] ETSI EN 301 469-2: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS) Test Case Library (TCL); Part 2: Abstract Test Suite (ATS) - Medium Access Control (MAC) layer - Portable radio Termination (PT)".

[120] ETSI EN 301 469-3: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS) Test Case Library (TCL); Part 3: Abstract Test Suite (ATS) - Medium Access Control (MAC) layer - Fixed radio Termination (FT)".

[121] ETSI EN 301 469-4: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS) Test Case Library (TCL); Part 4: Test Suite Structure (TSS) and Test Purposes (TP) - Data Link Control (DLC) layer".

[122] ETSI EN 301 469-5: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS) Test Case Library (TCL); Part 5: Abstract Test Suite (ATS) - Data Link Control (DLC) layer - Portable radio Termination (PT)".

[123] ETSI EN 301 469-6: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS) Test Case Library (TCL); Part 6: Abstract Test Suite (ATS) - Data Link Control (DLC) layer - Fixed radio Termination (FT)".

[124] ETSI EN 301 469-7: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS) Test Case Library (TCL); Part 7: Test Suite Structure (TSS) and Test Purposes (TP) - Network (NWK) layer".

[125] ETSI EN 301 469-8: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS) Test Case Library (TCL); Part 8: Abstract Test Suite (ATS) - Network (NWK) layer - Portable radio Termination (PT)".

[126] ETSI EN 301 469-9: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS) Test Case Library (TCL); Part 9: Abstract Test Suite (ATS) - Network (NWK) layer - Fixed radio Termination (FT)".

[127] Council Directive 91/263/EEC of 29 April 1991 on the approximation of the laws of the Member States concerning telecommunications terminal equipment, including the mutual recognition of their conformity.

[128] ETSI TS 101 869-1: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Services (DPRS); Profile requirement list and profile specific Implementation Conformance Statement (ICS) proforma; Part 1: Portable radio Termination (PT)".

[129] ETSI TS 101 869-2: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Services (DPRS); Profile requirement list and profile specific Implementation Conformance Statement (ICS) proforma; Part 2: Fixed radio Termination (FT)".

[130] ETSI TS 101 871-1: "Digital Enhanced Cordless Telecommunications (DECT); Application Specific Access Profile (ASAP); DECT Multimedia Access Profile (DMAP); Profile requirement list and profile specific Implementation Conformance Statement (ICS) proforma; Part 1: Portable radio Termination (PT)".

[131] ETSI TS 101 871-2: "Digital Enhanced Cordless Telecommunications (DECT); Application Specific Access Profile (ASAP); DECT Multimedia Access Profile (DMAP); Profile requirement list and profile specific Implementation Conformance Statement (ICS) proforma; Part 2: Fixed radio Termination (FT)".

[132] ETSI TS 101 945-1: "Digital Enhanced Cordless Telecommunications (DECT); Data Services Profile (DSP); Isochronous data bearer services with roaming capability (Service Type D, mobility class 2); Profile requirement list and profile specific Implementation Conformance Statement (ICS) proforma; Part 1: Portable radio Termination (PT)".

[133] ETSI TS 101 945-2: "Digital Enhanced Cordless Telecommunications (DECT); Data Services Profile (DSP); Isochronous data bearer services with roaming capability (Service Type D, mobility class 2); Profile requirement list and profile specific Implementation Conformance Statement (ICS) proforma; Part 2: Fixed radio Termination (FT)".

[134] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).

[135] ETSI TS 101 859-1: "Digital Enhanced Cordless Telecommunications (DECT); DECT Multimedia Access Profile (DMAP); Application Specific Access Profile (ASAP); Profile Test Specification (PTS); Part 1: Summary".

[136] ETSI TS 101 859-2: "Digital Enhanced Cordless Telecommunications (DECT); DECT Multimedia Access Profile (DMAP); Application Specific Access Profile (ASAP); Profile Test Specification (PTS); Part 2: Profile Specific Test Specification (PSTS) Portable radio Termination (PT)".

[137] ETSI TS 101 859-3: "Digital Enhanced Cordless Telecommunications (DECT); DECT Multimedia Access Profile (DMAP); Application Specific Access Profile (ASAP); Profile Test Specification (PTS); Part 3: Profile Specific Test Specification (PSTS) - Fixed radio Termination (FT)".

[138] FCC 02-151: "Federal Communications Commission, Second Report and Order, Amendment of Part 15 of the Commission's Rules Regarding Spread Spectrum Devices".

[139] ITU-R Recommendation M.1457: "Detailed specifications of the radio interfaces of International Mobile Telecommunications-2000 (IMT-2000)".

[140] ITU-R Recommendation M.1579: "Global circulation of IMT-2000 terminals".

[141] ITU-R Recommendation M.1580: "Generic unwanted emission characteristics of base stations using the terrestrial radio interfaces of IMT-2000".

[142] ITU-R Recommendation M.1581: "Generic unwanted emission characteristics of mobile stations using the terrestrial radio interfaces of IMT-2000".

[143] ERC/DEC(99)25: "ERC Decision of 29 November 1999 on the harmonized utilization of spectrum for terrestrial Universal Mobile Telecommunications System (UMTS) operating within the bands 1 900 - 1 980 MHz, 2 010 - 2 025 MHz and 2 110 - 2 170 MHz".

[144] ERC/DEC(00)01: "ERC Decision of 28 March 2000 extending ERC/DEC/(97)07 on the frequency bands for the introduction of terrestrial Universal Mobile Telecommunications System (UMTS)".

[145] ETSI EN 301 489-6: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 6: Specific conditions for Digital Enhanced Cordless Telecommunications (DECT) equipment".

[146] ETSI TS 101 808-1: "Digital Enhanced Cordless Telecommunications (DECT); Wireless Relay Station (WRS); Test Case Library (TCL); Part 1: Test Suite Structure (TSS) and Test Purposes (TP) for Medium Access Control (MAC) layer".

[147] ETSI TS 101 808-2: "Digital Enhanced Cordless Telecommunications (DECT); Wireless Relay Station (WRS); Test Case Library (TCL); Part 2: Abstract Test Suite (ATS) for Medium Access Control (MAC) layer - Cordless Radio Fixed Part Portable radio Termination (CRFP-PT)".

[148] ETSI TS 101 808-3: "Digital Enhanced Cordless Telecommunications (DECT); Wireless Relay Station (WRS); Test Case Library (TCL); Part 3: Abstract Test Suite (ATS) for Medium Access Control (MAC) layer - Cordless Radio Fixed Part Fixed radio Termination (CRFP-FT)".

[149] ETSI TS 101 808-4: "Digital Enhanced Cordless Telecommunications (DECT); Wireless Relay Station (WRS); Test Case Library (TCL); Part 4: Test Suite Structure (TSS) and Test Purposes (TP) - Data Link Control (DLC) layer".

[150] ETSI TS 101 808-5: "Digital Enhanced Cordless Telecommunications (DECT); Wireless Relay Station (WRS); Test Case Library (TCL); Part 5: Abstract Test Suite (ATS) - Data Link Control (DLC) layer; Cordless Radio Fixed Part Portable radio Termination (CRFP-PT)".

[151] ETSI TS 101 808-6: "Digital Enhanced Cordless Telecommunications (DECT); Wireless Relay Station (WRS); Test Case Library (TCL); Part 6: Abstract Test Suite (ATS) - Data Link Control (DLC) layer; Cordless Radio Fixed Part Fixed radio Termination (CRFP-FT)".

[152] ETSI TS 101 808-7: "Digital Enhanced Cordless Telecommunications (DECT); Wireless Relay Station (WRS); Test Case Library (TCL); Part 7: Test Suite Structure (TSS) and Test Purposes (TP) - Network (NWK) layer".

[153] ETSI TS 101 808-8: "Digital Enhanced Cordless Telecommunications (DECT); Wireless Relay Station (WRS); Test Case Library (TCL); Part 8: Abstract Test Suite (ATS) for Network (NWK) layer - Cordless Radio Fixed Part Portable radio Termination (CRFP-PT)".

[154] ETSI TS 101 808-9: "Digital Enhanced Cordless Telecommunications (DECT); Wireless Relay Station (WRS); Test Case Library (TCL); Part 9: Abstract Test Suite (ATS) for Network (NWK) layer - Cordless Radio Fixed Part Fixed radio Termination (CRFP-FT)".

[155] ETSI TS 101 950: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS); Interoperability Test Specification".

[156] ETSI TS 101 946-1: "Digital Enhanced Cordless Telecommunications (DECT); Low Rate Messaging Service (LRMS) including Short Message Service (SMS); Profile requirement list and profile specific Implementation Conformance Statement (ICS) proforma; Part 1: Portable radio Termination (PT)".

[157] ETSI TS 101 946-2: "Digital Enhanced Cordless Telecommunications (DECT); Low Rate Messaging Service (LMRS) including Short Message Service (SMS); Profile requirement list and profile specific Implementation Conformance Statement (ICS) proforma; Part 2: Fixed radio Termination (FT)".

[158] ETSI TS 101 947: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS); Application Specific Access Profile (ASAP): V.24 Interworking".

[159] ETSI TS 102 011 (Parts 1 and 2): "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS); Application Specific Access Profile (ASAP): V.24 Interworking; Profile Implementation Conformance Statement (ICS)".

[160] ETSI TS 102 012: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS); Application Specific Access Profile (ASAP): V.24 Interworking; Profile Test Specification (PTS)".

[161] ETSI TS 101 942: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS); Application Specific Access Profile (ASAP): Ethernet (Eth) Interworking".

[162] ETSI TS 102 013 (Parts 1 and 2): "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS); Application Specific Access Profile (ASAP): Ethernet Interworking; Profile Implementation Conformance Statement (ICS)".

[163] ETSI TS 102 014: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS); Application Specific Access Profile (ASAP): Ethernet Interworking; Profile Test Specification (PTS)".

[164] ETSI EN 301 406: "Digital Enhanced Cordless Telecommunications (DECT); Harmonized EN for Digital Enhanced Cordless Telecommunications (DECT) covering essential requirements under article 3.2 of the R&TTE Directive; Generic radio".

[165] ETSI TR 102 010: "Digital Enhanced Cordless Telecommunications (DECT); DECT access to IP networks".

[166] ETSI EN 301 908-10: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS), Repeaters and User Equipment (UE) for IMT-2000 Third-Generation cellular networks; Part 10: Harmonized EN for IMT-2000, FDMA/TDMA (DECT) covering essential requirements of article 3.2 of the R&TTE Directive".

[167] ETSI TS 101 863-1: "Digital Enhanced Cordless Telecommunications (DECT); DECT/UMTS Interworking Profile (IWP); Part 1: General description and overview".

[168] ETSI TS 101 863-2: "Digital Enhanced Cordless Telecommunications (DECT); DECT/UMTS Interworking Profile (IWP); Part 2: CN-FP interworking".

[169] ETSI TS 101 863-3: "Digital Enhanced Cordless Telecommunications (DECT); DECT/UMTS Interworking Profile (IWP); Part 3: 3,1 kHz speech service".

[170] ETSI TS 101 863-4: "Digital Enhanced Cordless Telecommunications (DECT); DECT/UMTS Interworking Profile (IWP); Part 4: Supplementary services".

[171] ETSI TS 101 863-5: "Digital Enhanced Cordless Telecommunications (DECT); DECT/UMTS Interworking Profile (IWP); Part 5: SMS point-to-point and cell broadcast".

[172] ETSI TS 101 863-6: "Digital Enhanced Cordless Telecommunications (DECT); DECT/UMTS Interworking Profile (IWP); Part 6: Packet switched data".

[173] ETSI TS 102 265: "Digital Enhanced Cordless Telecommunications (DECT); DECT access to IP networks".

[174] ETSI TS 102 342: "Digital Enhanced Cordless Telecommunications (DECT); Cordless multimedia communication system; Open Data Access Profile (ODAP)".

[175] ETSI TS 102 379: "Digital Enhanced Cordless Telecommunications (DECT); Fixed network Multimedia Message Service (F-MMS) Interworking Profile".

[176] FCC 04-219 (1994): "Sixth Report and Order, Third Memorandum Opinium and Order, and Fith Memorandum and Order".

3 Abbreviations

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

ACTE	Approvals Committee for Terminal Equipment
ADPCM	Adaptive Differential Pulse Code Modulation
AMPS	Advanced Mobile Phone Service
AN	Advisory Notes
ARI	Access Rights Identity
ASAP	Application Specific Access Profile
ATS	Abstract Test Suite
CAP	CTM Access Profile
CC	Call Control
CI	Common Interface
CRFP	Cordless Radio Fixed Part
CTA	Cordless Terminal Adapter
CTM	Cordless Terminal Mobility
CTR	Common Technical Regulations
D8PSK	Differential Octal Phase Shift Keying
DAM	DECT Authentication Module
DBPSK	Differential Binary Phase Shift Keying
DCS	Dynamic Channel Selection
DECT	Digital Enhanced Cordless Telecommunications
DLC	Data Link Control
DMAP	DECT Multimedia Application Profile
DMT	Dual Mode Terminal
DPRS	DECT Packet Radio Service
DPSK	Differential Phase Shift Keying
DQPSK	Differential Quadruple Phase Shift Keying
DSP	Data Services Profile
DSS1	Digital Subscriber Signalling System No. 1 protocol
DTAAB	DECT Type Approval Advisory Board
DTMF	Dual Tone Multiple Frequency
EEC	European Economic Community
EMC	ElectroMagnetic Compatibility

EN	European Standard
ES	End System
F-MMS	Fixed line-Multimedia Messaging Service
FP	Fixed Part
FP2FP	Fixed Part to Fixed Part
F-SMS	Fixed line-Short Messaging Service
FT	Fixed radio Termination
FWA	Fixed Wireless Access
GAP	Generic Access Profile
GFSK	Gaussian Frequency Shift Keying
GSM	Global System for Mobile communications
ICS	Implementation Conformance Statement
IDBS	Isochronous Data Bearer Service
iDCS	instantaneous Dynamic Channel Selection
IF	InterFace
IMT	International Mobile Telecommunications
IN	Intelligent Network
IP	Internet Protocol
IS	Intermediate System
ISDN	Integrated Services Digital Network
ITU	International Telecommunication Union
IWP	Inter-Working Profile
IWU	Inter-Working Unit
LAN	Local Area Network
LOS	Line Of Sight
LRMS	Low Rate Message Service
MAC	Medium Access Control
MC	Multi Carrier
MM	Mobility Management
MMS	Multimedia Messaging Service
MSC	Mobile services Switching Centre
NA	Network Aspects
NGN	Next Generation Networks
NMT	Nordic Mobile Telephone
NWK	Network
O&M	Operation and Maintenance
ODAP	Open Data Access Profile
PARK	Portable Access Rights Key
PBX	Private Branch eXchange
PHL	Physical Layer
PICS	Protocol Implementation Conformance Statement
PLMN	Public Land Mobile Network
POTS	Plain Old Telephone Service
PP	Portable Part
PSPDN	Packet-Switched Public Data Network
PSTN	Public Switched Telephone Network
PT	Portable radio Termination
PTS	Profile Test Specification
PWT	Personal Wireless Telecommunications
QAM	Quadrature amplitude modulation
QoS	Quality of Service
RAP	Radio local loop Access Profile
REP	Repeater Part
RFP	Radio Fixed Part
RLL	Radio in the Local Loop
SARI	Secondary Access Rights Identity
SIM	Subscriber Identity Module
SIP	Session Initiation Protocol
SMG	Special Mobile Group
SMS	Short Message Service
SOHO	Small Office and Home Office
TACS	Total Access Communications System

TBR	Technical Basis for Regulation
TCAM	Telecommunication Conformity Assessment and Market surveillance committee
TCL	Test Case Library
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
TIA	Telecommunications Industry Association
TISPAN	Telecoms & Internet converged Services & Protocols for Advanced Networks
TRAC	Technical Regulations Application Committee
UDI	Unrestricted Digital Information
UMTS	Universal Mobile Telecommunications System
UPCS	Unlicensed Personal Communications Service
VoIP	Voice over Internet Protocol
WLL	Wireless Local Loop
WRS	Wireless Relay Station

4 DECT services and applications

DECT is a general radio access technology for wireless telecommunications.

It is a high capacity digital technology, for cell radii ranging from a few meters to several kilometres, depending on application and environment.

It provides telephony quality voice services, and a broad range of data services, including Integrated Services Digital Network (ISDN) and packet data over the Internet.

It can be effectively implemented in a range from simple residential cordless telephones up to large systems providing a wide range of telecommunications services, including FWA (WLL).

Figure 1 gives a high level graphic overview of applications and features of DECT.

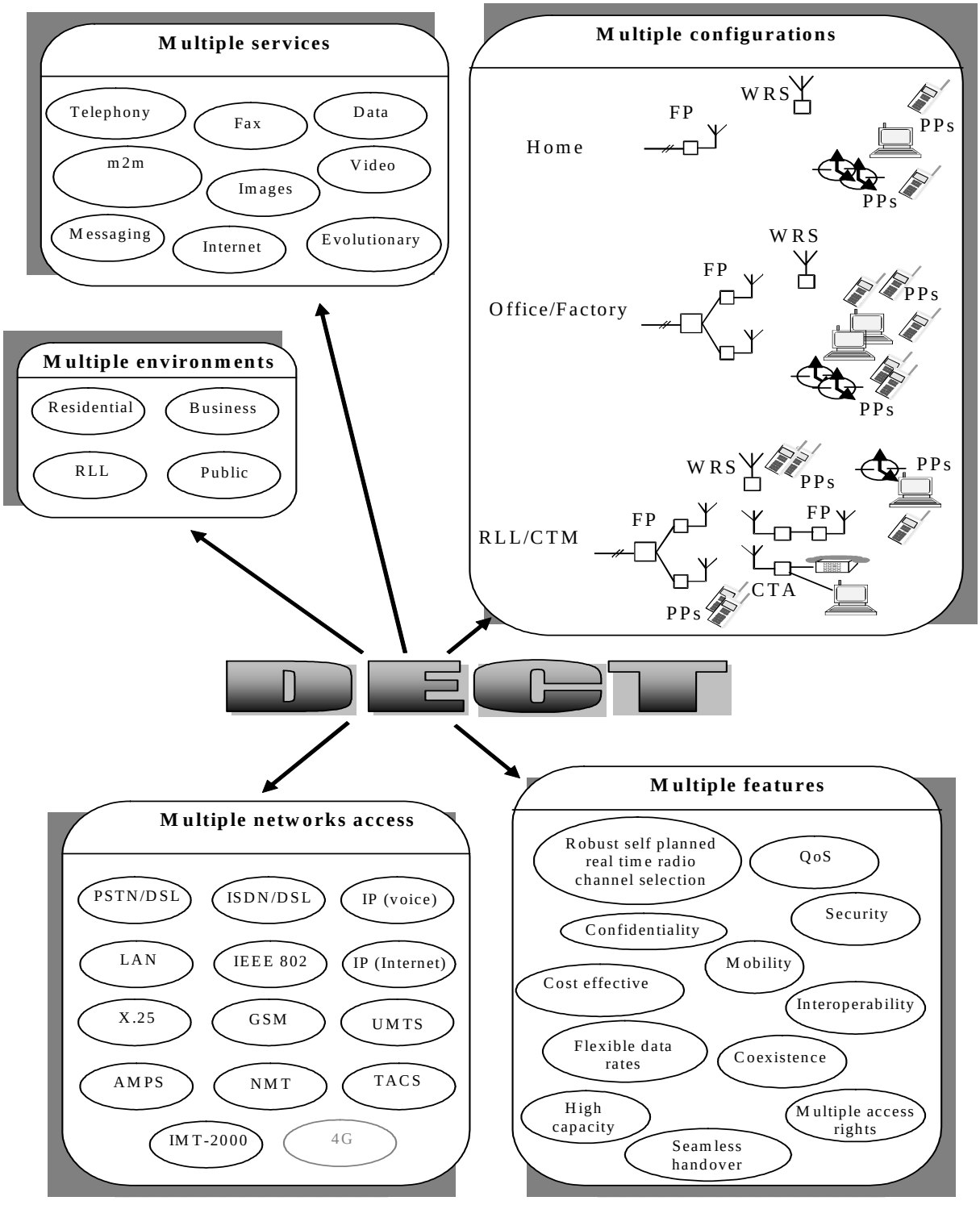


Figure 1: Overview of DECT applications and features

In addition to the basic FP to PP communication DECT also provides "Direct PP to PP Communications", "Direct FP to FP (FP2FP) Communications", and "Distributed Communications" (see clause 6.1.3).

4.1 General access technology

DECT, as a general radio access technology, can be used by many different applications to connect to different telecommunication networks.

It is essential to see the implications of the difference between an access technology and mobile radio systems like NMT, TACS, AMPS, GSM or UMTS. In these mobile radio systems the whole network is part of the specification and a mobile unit can only access the unique network that is part of the mobile radio system. DECT as a general access technology provides a comprehensive set of protocols, which provide the flexibility to interwork between numerous different applications and networks, including UMTS and IP networks.

Thus a local and/or public network is not part of the DECT specification. Figure 2 illustrates this.

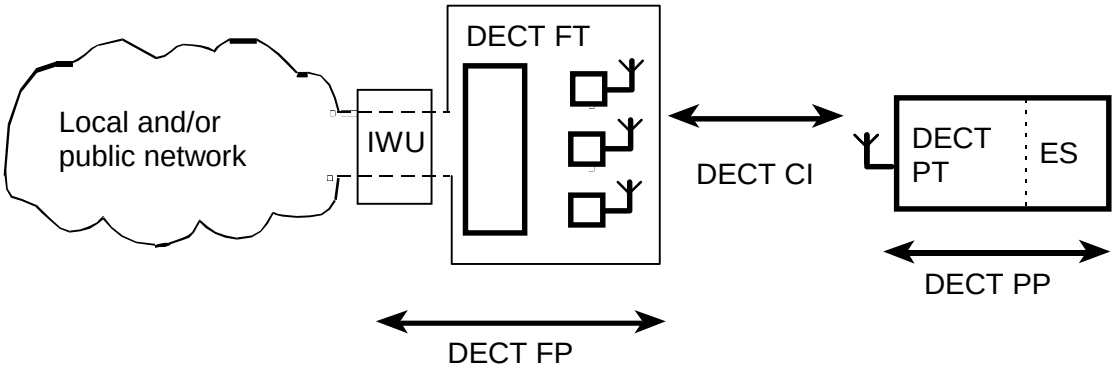


Figure 2: The DECT Common Interface (CI)

DECT covers, in principle, only the air interface between the DECT Fixed Part (FP) and Portable Part (PP). The Inter-Working Unit (IWU) between a network and the DECT Fixed radio Termination (FT) is network specific and is not part of the DECT CI specification. Similarly, the End System (ES), the application(s) in a DECT PP is also excluded. The IWU and end systems are only specified as regards general end-to-end compatibility requirements e.g. on speech transmission. The IWU and ES are also subject to general attachment requirements for the relevant public network, e.g. the PSTN/ISDN.

NOTE: An ES depends on the application supported in a PP. For a speech telephony application the ES may be a microphone, speaker, keyboard and display. The ES could equally well be a serial computer port, a fax machine or whatever the application requires.

For each specific network, local or global, the specific services and features of that network are made available via the DECT air interface to the users of DECT PPs/handsets. Except for cordless capability and mobility, DECT does not offer a specific service; it is transparent to the services provided by the connected network.

Thus the DECT CI standard is, and has to be, a tool box with protocols and messages from which a selection is made to access any specific network, and to provide means for market success for simple residential systems as well as for much more complex systems e.g. office ISDN services.

The detailed requirements that have governed the DECT standardization efforts are provided by the ETR 043 [90], "Common Interface (CI); Services and facilities requirements specification", where one requirement is flexibility for additions and evolutionary applications.

The DECT CI standard has a layered structure and is contained in EN 300 175 parts 1 [1] to 8 [8], see clause 6.1. It contains a complete set of requirements, procedures and messages. The messages also contain codes that are reserved for evolutionary applications and proprietary extensions.

The basic telephony speech quality offered by DECT is very high compared to other wireless systems. This is provided by application of the ITU-T Recommendation G.726 [106] 32 kbit/s ADPCM speech codec and other speech transmission characteristics defined in EN 300 175-8 [8].

The DECT authentication algorithm and the DECT encryption algorithm are not part of the CI standard, but are obtained from ETSI through a special legal procedure.

The administration of global unique DECT identity codes for manufacturing, installation and public operation are also handled by ETSI.

4.2 Support of multiple applications

The DECT Instant or Continuous Dynamic Channel Selection provides effective coexistence of multiple applications on the common designated DECT frequency band.

Furthermore different DECT applications can share the same resources:

- the same PP; and/or
- the same base station.

4.2.1 Co-existence of uncoordinated installations on a common frequency band

The mandatory Instant Dynamic Channel Selection messages and procedures provide effective co-existence of uncoordinated private and public systems on the common designated DECT frequency band and avoid any need for traditional frequency planning. Each device has access to all channels (time/frequency combinations). When a connection is needed, the channel is selected, that at that instant and at that locality, is least interfered of all the common access channels. This avoids any need for traditional frequency planning, and greatly simplifies the installations. This procedure also provides higher and higher capacity by closer and closer Radio Fixed Parts (RFPs) installation, while maintaining a high radio link quality. Not needing to split the frequency resource between different services or users gives a very efficient use of the allocated spectrum.

There is a large spectrum efficiency gain in sharing spectrum between applications and between operators.

Much unique knowledge and experience is available in the DECT community on the subject of sharing spectrum between uncoordinated installations. To assist regulators, operators and manufacturers, information on this subject has been collected in TR 101 310 [101]. TR 101 310 [101] describes configurations for typical DECT applications and relevant mixes of these, including residential, office, public and RLL applications, and the traffic capacity is analysed, mainly by advanced simulations. These results are used together with relevant deployment scenarios to estimate spectrum requirements for reliable services, specifically for a public multi-operator licensing regime. Recommendations are given on conflict solving rules that conserves the high spectrum efficiency gain of shared spectrum while maintaining required control of the service quality of the own system. These recommendations regard synchronization, directional gain antennas, traffic limits per DECT Radio Fixed Part (RFP), use of Wireless Relay Stations (WRSs), different rules for private and public operators, and procedures needed for timely local adjustments where and when the local traffic increases.

4.2.2 Access to different systems by the same PP

Each DECT system, FP, has a broadcast globally unique Access Rights Identity (ARI). To each ARI are linked the available services, the related protocols and when required e.g. a cipher-key and/or authentication-key. For each service suitable protocols have been selected from the CI toolbox to efficiently provide these services.

Similarly each DECT PP (handset) has one or more Portable Access Rights Keys (PARKs). One PARK relates to one FP or a group of FPs belonging to the same operator. To each PARK are linked the corresponding FP ARIs, related services and protocols, and when required e.g. a ciphering-key and/or authentication-key.

Thus the same PP will have access to several different types of systems, if equipped with the relevant PARKs and associated protocols. Thus, it is basically not a common protocol for all systems that provide inter system roaming, but it is that the PP is equipped with access rights and related protocols to the wanted systems. A detailed description of the flexible and powerful DECT identity provisions are found in EN 300 175-6 [6].

4.2.3 Access to several applications through the same base station

DECT also provides the means for sharing base stations or systems between different operators or applications, e.g. hosting private user groups in a large public system, Providing public access through a privately owned system, or hosting public access to several service providers in one system owned by one of the service providers. The ARIs related to available additional accesses are broadcast as Secondary Access Rights Identities (SARIs) by a system, FP.

5 The standards making process

This clause describes the bodies which have influence on the DECT standardization and gives an introduction to the DECT related ETSI documents.

5.1 Standardization bodies

5.1.1 ETSI EP DECT

The DECT standardization has been carried out by the members of the European Telecommunications Standards Institute (ETSI).

More specifically, the technical work has been carried out by the Technical Body ETSI Project DECT (EP DECT). EP DECT has defined several working groups which focus on special areas like CI, Data, Testing, etc.

NOTE: Initially the ETSI Technical Body responsible for DECT standardization was the Radio Equipment and Systems Sub-Technical Committee No. 3 (STC RES-03). Following re-organization in ETSI along project-oriented lines the work of STC RES-03 had been transferred to EP DECT in October 1996. In the followings the DECT Technical Body in ETSI is referred to as EP DECT regardless whether the actual work has been carried out by STC RES-03.

The membership of ETSI is open to manufacturers, operators, users and regulators of telecommunications systems.

5.1.2 Related work in other ETSI Technical Bodies

5.1.2.1 ElectroMagnetic Compatibility (EMC) standards

Like all other electronic equipment sold in EU member states, DECT equipment is subject to the requirements of the EMC directive 89/336/EEC [103]. It is the responsibility of ETSI to produce the standards which define the actual EMC performance requirements for compliance to the directive. The Technical Committee for EMC and Radio Spectrum Matters (TC ERM) is responsible for writing all EMC standards.

The relevant EMC standard for DECT equipment is EN 301 489-6 [145]. The ETS 300 329 [17], which initially contained the DECT EMC requirements, became obsolete when EN 301 489-6 [145] had been implemented throughout European countries in 2003. EN 301 489-6 [145] specifies the applicable test conditions, performance assessment and performance criteria for DECT equipment.

Outside Europe other EMC standards may be applicable according to local regulations.

5.1.2.2 Network standardization related to DECT

DECT is designed as an access technology to many networks. The DECT standards specify protocols which allow the provision of the mobility. But DECT does not define how the networks behind a DECT FP keep track of the location of a PP or deliver an incoming call to the PP. There is work in various ETSI committees to introduce the necessary protocols to support mobility in different networks.

ETSI and ECMA have produced standards that specify mobility support in private telecommunications networks, thereby providing the ability for users to roam between different company offices connected to a corporate network.

2G and 3G networks such as GSM and UMTS standardized in ETSI and the Third Generation Partnership Project (3GPP), in which ETSI is a leading partner, already support mobility. The ETSI Telecoms & Internet converged Services & Protocols for Advanced Networks (TISPAN) project is looking in this issue in the area of fixed networks. There is therefore interest to re-use the mobility protocols of GSM/UMTS networks and [fixed] Next Generation Networks (NGN) in conjunction with the DECT air interface (these are DECT/GSM and DECT/UMTS interworking). The work of Special Mobile Group (SMG) in the past, and, the work of the 3GPP and TISPAN today therefore are of relevance to the DECT standardization.

ETSI Technical Committee Network Aspects (TC NA) and Technical Committee Signalling Protocols & Switching (TC SPS) have produced standards that specify mobility support in IN based networks thereby allowing users to roam across very wide areas of the public network. This work formed part of the ETSI Project Cordless Terminal Mobility (EP CTM). The CTM Project also included roaming between different networks (public-public and/or public-private).

5.1.3 Other bodies

In addition to ETSI several other bodies are involved in or related to the DECT standardization process.

The Commission of the European Community provides support in developing the market for DECT equipment both in terms of legislation covering the allocation of the frequencies used by DECT (in conjunction with CEPT ERC), in supporting the regulatory environment for DECT products (through the ACTE committee), and financing of part of the standardization effort.

CEPT has a membership of 45 European administrations. Its ECTRA committee is responsible for managing telecommunications matters; its ERC committee manages radio matters. The ERC plans and allocates spectrum for pan-European services and promotes measures to harmonize standards and regulatory requirements for these services.

ACTE was the Approvals Committee for Terminal Equipment. It did consist of representatives of telecommunications regulators from all EC countries. ACTE was replaced under the new R&TTE Directive [134] by a committee which is called TCAM (Telecommunication Conformity Assessment and Market Surveillance Committee) composed of representatives of the Member States and chaired by a representative of the Commission.

DTAAB (DECT Type Approval Advisory Board) was a sub-group of the Technical Regulations Application Committee (TRAC). It included representatives from test houses, operators, standardization bodies, type approval authorities, regulatory authorities and manufacturers. DTAAB considered the resolution of problems in a harmonized way relating to the DECT area. The common understanding was recorded in various Advisory Notes (ANs) which combine to define a set of advice on the best practice to be applied to regulatory type examination and approval of DECT terminal equipment. DTAAB was closed under the new R&TTE Directive [134].

There is a close co-operation between ITU and EP DECT regarding the standardization work for the International Mobile Telecommunications 2000 system (IMT-2000). ITU-R has included DECT as one of the five radio interfaces in the recommendation ITU-R Recommendation M.1457 [139] that contains the detailed specifications for the IMT-2000 radio interfaces.

The Telecommunications Industry Association (TIA) and ETSI have signed a document exchange agreement. Under this agreement the TIA publishes the PWT standards, which are based in major part on the DECT standards, but changes have been made to conform to North American national regulations.

5.2 ETSI documents

There are several types of documents that have been produced by EP DECT:

ETSI ENs (European Standards (telecommunications series))

The European Standards (telecommunication series) contain the detailed technical requirements and are published after a formal European wide review process (Public Enquiry and Vote).

The set of DECT related European Standards consists of:

- the basic DECT standards;
- profiles; and
- testing standards.

The basic DECT standards specify a set of protocols, telecommunication services, interfaces and encoding rules. They are described in clause 6.

The DECT profiles identify a consistent set of chosen options from one or more base specifications for a given application. Base specifications are mainly the basic DECT standards (especially DECT CI) but they may be also other profiles. Information on the currently existing profiles and their applications is given in clause 7.

Furthermore testing standards are specified which are described in clauses 8 and 9.

NOTE 1: Following the re-organization of ETSI new deliverable types and procedures have been introduced. Prior to this change most of the DECT standards were published as ETSs; new editions of DECT ETSs (ETSI European Standards) are published as ENs.

ETSI Technical Specification (TSs)

TSs contain the detailed technical requirements and are published after the approval of the technical body thereby allowing for shorter time to market, validation and maintenance.

The set of DECT related TSs currently consists of:

- Profiles; and
- testing standards.

For new specifications and standards the preferred delivered type is TS, and the number of ENs will see a corresponding decrease.

ETSI Technical Basis for Regulations (TBRs) and Harmonized Standards (H ENs)

TBRs contain technical requirements and test methods for use in the corresponding Common Technical Regulations (CTRs), earlier used in Europe. Some TBRs have still value for conformance testing, but have no regulatory impact any longer in Europe. Some non-European countries may still have regulations related to DECT TBRs.

The new regulatory standards for Europe are Harmonized Standards. The issue of regulatory requirements are covered in further detail in clause 10.

ETSI Technical Reports (TRs and ETRs)

Technical Reports contain information of a more general nature which provides useful background information on the standards. A summary of DECT Technical Reports is given in clause 11.

NOTE 2: Following the re-organization of ETSI new deliverable types and procedures have been introduced. Prior to this change the DECT technical reports were published as ETRs; new editions of ETRs (ETSI Technical Reports) are published as TRs.

6 The basic DECT standards

The basic DECT standards are the:

- DECT Base Standard, Common Interface (CI);
- Wireless Relay Station (WRS); and
- DECT Authentication Module (DAM).

6.1 The DECT Base Standard, Common Interface (CI)

6.1.1 General

The base standard for DECT is the Common Interface (CI) EN 300 175 [1] to [8]. It defines the operation of the DECT air interface and contains details of all messages and procedures used in DECT equipment. Not all of the procedures described in EN 300 175 [1] to [8] are actually required in any particular application. EN 300 175 [1] to [8] do not specify which procedures are required in each particular application. To achieve interoperability of equipment other documents (profiles, see clause 7) are required to specify more specific requirements for each applications.

The content of each part of EN 300 175 [1] to [8] is now described.

EN 300 175 Part 1: Overview [1]

This is a general introduction to the other parts of EN 300 175 [1] to [8]. Among others, it contains a comprehensive list with definitions and abbreviations used by the DECT technology specification.

EN 300 175 Part 2: Physical Layer (PHL) [2]

The PHL layer describes the requirements of the radio parameters of the DECT system, e.g. the frequency of operation, the modulation method, the TDMA data transmission structure, power limits, spurious emission requirements, etc. Most of the requirements of this part of the base standard are applicable to all DECT products.

EN 300 175 Part 3: Medium Access Control (MAC) layer [3]

The MAC layer defines the procedures and protocols used to set-up transmission bearers across the air interface.

EN 300 175 Part 4: Data Link Control (DLC) layer [4]

The DLC layer is concerned with the provision of reliable data links to the Network layer. Its function can be compared to the ISDN layer 2 LAPD protocol.

EN 300 175 Part 5: Network (NWK) layer [5]

The NWK layer is the main signalling layer of the protocol stack, containing the functions for call control, mobility management, connection oriented service, connectionless message service and supplementary services.

EN 300 175 Part 6: Identities and addressing [6]

Each DECT equipment, whether Portable Part (PP) of Fixed Part (FP), requires to be programmed with various identities to enable PPs to access the appropriate networks and to route calls to the appropriate terminal. DECT has a very flexible identity structure, which is explained in part 6.

EN 300 175 Part 7: Security features [7]

The use of radio in telecommunications introduces several security issues, including, but not limited to, prevention of eavesdropping and fraudulent access to networks via impersonation of PT identities. The DECT security procedures are defined in part 7.

EN 300 175 Part 8: Speech coding and transmission [8]

Part 8 defines the telephony requirements for DECT systems used for the transmission of 3,1 kHz speech e.g. digital transmission levels, audio frequency masks, echo control/suppression requirements necessary to ensure interworking with public telecommunications networks.

6.1.2 DECT special properties

6.1.2.1 The DECT 4-level/8-level/16-level/64-level modulation option

Initially the DECT base standard provided 2-level modulation option only. Driven by requirements for higher data rates backwards compatible 4-, 8-level, 16-level and 64-level modulation options were introduced, which provide up to 5 Mbit/s effective user data services via a single DECT radio as shown in table 1.

Table 1: Available physical layer bit rates

Levels	Narrow bandwidth
2	1,152 Mbit/s
4	2,304 Mbit/s
8	3,456 Mbit/s
16	4,608 Mbit/s
64	6,912 Mbit/s

The 4-level modulation is π/4-DQPSK, the 8-level modulation π/8-D8PSK, the 16-level modulation 16-QAM and the 64-level modulation 64-QAM. The shaping filter shall be root-raised cosine with Ts = 1/1 152 000 s (Ts = symbol duration) and roll-off (α) = 0,5 for all types of modulation. π/2-DPSK may be generally used as 2-level modulation instead of the GFSK modulation.

The higher level modulation schemes options increase the bit rate of single radio DECT equipment by a factor 2, 3, 4 or 6 with retained transmitter bandwidth, carrier spacing and slot structure.

It is only allowed to use 4-level and/or higher level modulation in the B + Z or the A + B + Z fields EN 300 175-3 [3], whereby the S + A or the S field respectively shall use the π/2-DBPSK 2-level modulation. π/2-DPSK may be generally used as 2-level modulation instead of the GFSK modulation. The allowed combinations of modulation schemes are defined in table 2.

Table 2: Allowed combinations of modulation schemes

Configuration	S-field	A-field	B + Z-field
1a	GFSK	GFSK	GFSK
1b	π/2-DBPSK	π/2-DBPSK	π/2-DBPSK
2	π/2-DBPSK	π/2-DBPSK	π/4-DQPSK
3	π/2-DBPSK	π/2-DBPSK	π/8-D8PSK
4a	π/2-DBPSK	π/4-DQPSK	π/4-DQPSK
4b	π/2-DBPSK	π/8-D8PSK	π/8-D8PSK
5	π/2-DBPSK	π/2-DBPSK	16-QAM
6	π/2-DBPSK	π/2-DBPSK	64-QAM

Configuration 1a is the basic DECT modulation scheme. Configurations 2, 3, 5 and 6 ensure that equipment with basic 2 level modulation, and equipment with a higher rate option, can efficiently share a common base station infrastructure. The GFSK modulation can be detected for instance in a non-coherent π/2-DPSK receiver, and the π/2-DPSK modulation can be detected in a GFSK receiver. Therefore all A-field information including broadcast system information, paging and call control can be received independently of whether configuration 1, 2, 3, 5 or 6 is used.

The modulation accuracy for configurations 1b, 2, 3, 4a, 4b, 5 and 6 shall be such that high performance coherent demodulation and equalization can be implemented in the receivers. The chosen types of modulation are also suitable for differential detector implementations. A typical sensitivity of -95 dBm is expected for the 4-level modulation if coherent demodulation is implemented, and about -93 dBm with a differential digital detector.

In addition to the higher level modulation schemes channel coding based on turbo channel encoding combined with puncturing has been introduced. The Encoder is intended to mitigate deep fading effects that damage the B-field data transmission. Burst errors during the transmission affect both useful bits and parity bits. Decoding processing leads to an improved decision on transmitted useful bits. Turbo decoding integrated in an iterative processing loop ensures an efficient and adaptive decoding processing fit to the propagation channel constraints and the desired bit rate target and QoS to the service transmission. The Puncturing combined with several modulation level schemes allows a large available bit rate range for each propagation scenario. The adaptive bit rate implementation is adjusted in regards with the concerned propagation scenario and the B-field data framing. Puncturing gives an efficient mapping of encoded bits within every symbol. It is defined in such a way that parity bits and net bits are arranged in a specific way within the symbols.

6.1.2.2 DECT broadband option

With the introduction of the DECT 4-level/8-level/16-level/64-level modulation options indicated in clause 6.1.2.1 the rough data rate which a DECT system can provide has come up to 6,912 Mbit/s. A further extension to the DECT technology, the so called DECT broad band option, has brought the effective data rate up to 20 Mbps.

This solution utilizes multi-connections data links. Each data link could utilize the data service provided by up to 3 connections with each connection being capable of up to 6,912 Mbit/s data rate, thereby bringing the total link capacity to just above 20 Mbps.

6.1.2.3 Extended frequency bands

DECT provides for extension to the basic frequency allocation in a fully backward compatible way. Where additional frequencies are available this is indicated in the dummy bearer transmissions of each RFP. PPs will only utilize the additional frequencies where this is indicated by the FP transmissions.

DECT carriers have been defined for the whole spectrum range 1 880 MHz to 1 980 MHz and 2 010 MHz to 2 025 MHz in EN 300 175 [2]. This allows for expansion of the basic DECT allocation or allows DECT services to be introduced in countries where the basic DECT frequencies 1 880 MHz to 1 900 MHz are not available. Extended or new frequency allocations do not cause regulatory difficulties for roaming DECT handsets. The reason is that it is mandatory for DECT FP to broadcast not only its ARIs, but also other information as regarding which carrier frequencies the specific FP is allowed to operate on. It is mandatory for PPs not to start transmission on carriers others than those informed to the PP by the FP in the FP broadcast messages.

6.1.2.4 Coexistence with other TDMA technologies

DECT instantaneous Dynamic Channel Selection (iDCS) provides co-existence between TDMA systems with different carrier spacing, different carrier bandwidth and different slot length, as long as the TDMA frame cycle is a 10 ms or a sub-multiple of 10 ms. Efficient co-existence with DECT requires 10 ms frame cycle time, and duplex (or double simplex) bearers defined on the same carrier with 5 ms separation between the time slots. The difference in carrier bandwidth/spacing and in slot length should not be very large.

This allows for possible sophisticated evolution of DECT with backwards compatible coexistence properties, as well as coexistence with new technologies using iDCS and 10 ms frame cycle time and duplex (or double simplex) bearers defined on the same carrier with 5 ms separation between the time slots.

6.1.2.5 DECT as IMT-2000 family member

The ITU has adopted DECT as family member of the International Mobile Telecommunications 2000 (IMT-2000) system and included in ITU-R Recommendation M.1457 [139]: "Detailed specifications of the radio interfaces of IMT-2000" where five terrestrial radio interfaces are defined:

- IMT-2000 CDMA Direct Spread (UTRA FDD or WCDMA);
- IMT-2000 CDMA Multi-carrier (cdma2000);
- IMT-2000 CDMA TDD (UTRA TDD 1,28 Mcps and 3,84 Mcps);
- IMT-2000 TDMA Single Carrier (UWC-136);
- IMT-2000 FDMA/TDMA (DECT).

Of those five standardized radio interfaces, the fifth IMT-2000 family member (DECT) is the only family member with a radio access technology optimized for uncoordinated use on an unlicensed spectrum.

In Europe, besides Harmonized EN for DECT [164] for the basic designated 1 880 MHz to 1 900 MHz band, DECT is also covered by a Harmonized EN for IMT-2000 [166] including the frequency bands 1 900 MHz to 1 920 MHz and 2 010 MHz to 2 025 MHz.

DECT has also been included in the ITU-R Recommendations M.1580 [141] "Generic unwanted emission characteristics of base stations using the terrestrial radio interfaces of IMT-2000" and M.1581 [142] "Generic unwanted emission characteristics of mobile stations using the terrestrial radio interfaces of IMT-2000". ITU-R has adopted DECT as part of the ITU-R Recommendation M.1579 [140] "Global circulation of IMT-2000 terminals", which therefore supports the world wide circulation of DECT terminals.

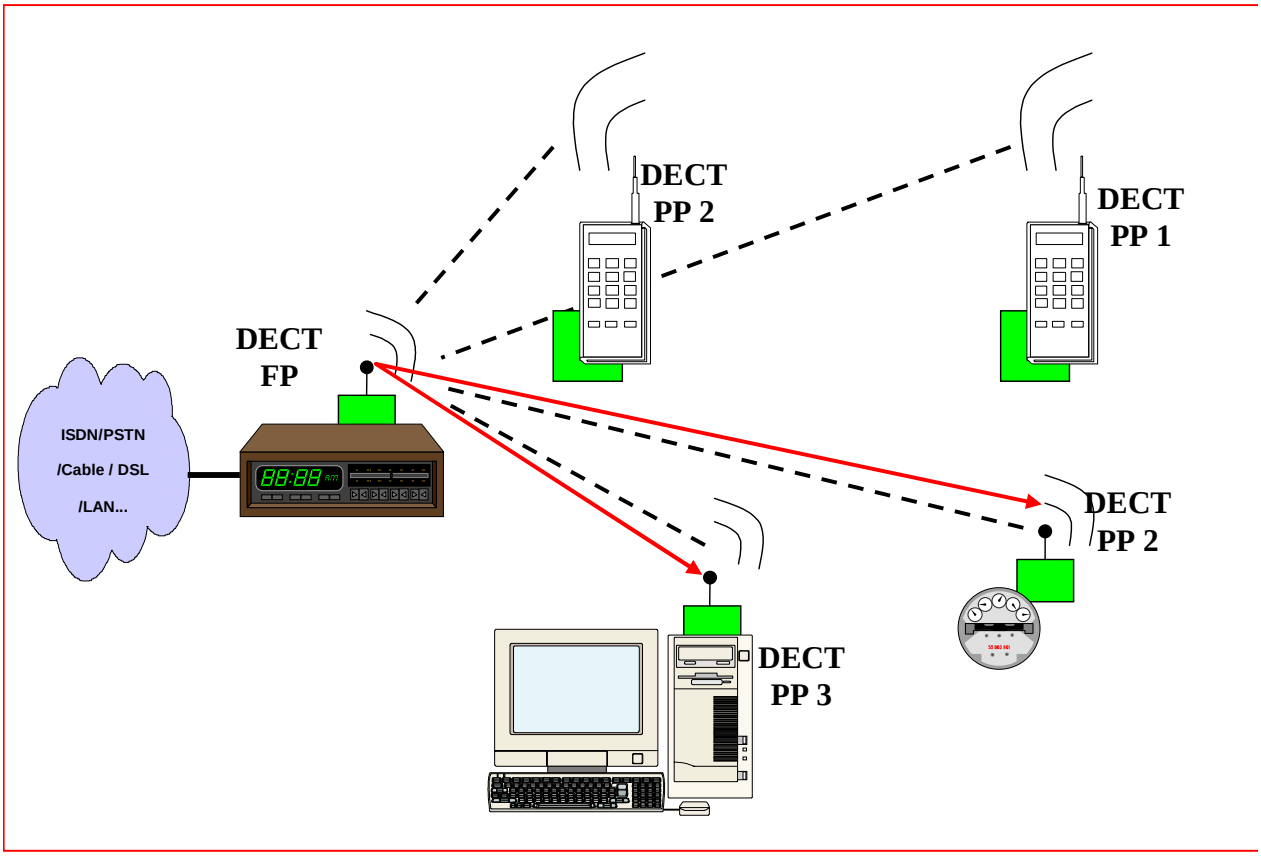
Applications and services based on DECT is a growing market with over 100 Million devices in operation, and DECT has already since many years spectrum allocated within the IMT-2000 frequency bands for unlicensed, typically residential and enterprise system installations.

DECT is by definition an IMT-2000 technology, or more popular a 3G technology, which legitimates the present and future DECT spectrum allocations within the IMT-2000 bands.

6.1.3 DECT system topology

6.1.3.1 Basic

The basic DECT system topology is a "STAR" topology in which a number of DECT PP can communicate with the accessed network and one to another only via a DECT FP.

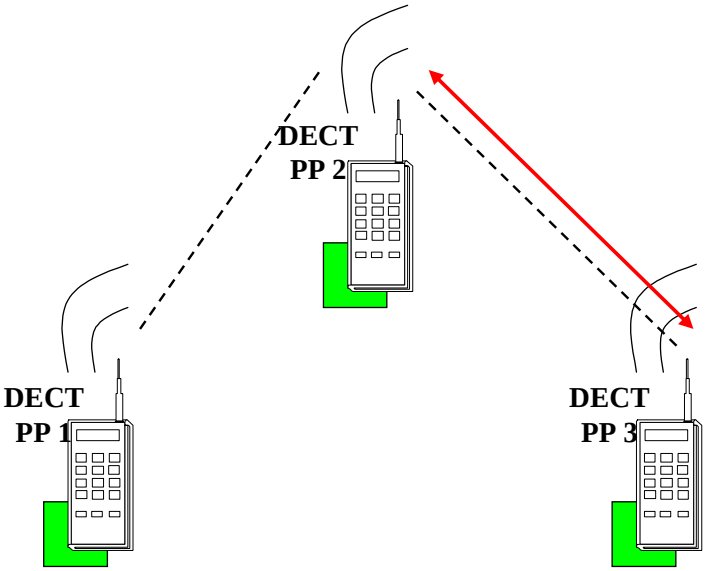


NOTE: The red arrow between PP2 and PP3 shows the communication path between two PPs in this topology scenario.

Figure 3: DECT Basic STAR topology

6.1.3.2 Direct PP to PP communications

Direct PP to PP communication, see EN 300 175-3 [3], annex G, is a notation for a PP (or CTA) feature that provides ad hoc networking with specific temporary system ad hoc identities. A PP temporarily switches into FT mode to provide direct access to any of the other PPs of the ad hoc network. There is no requirement or need to being locked to an RFP. Since no RFP is involved in the communication link, direct PP to PP communication only uses half the spectrum compared to normal calls routed via RFPs.

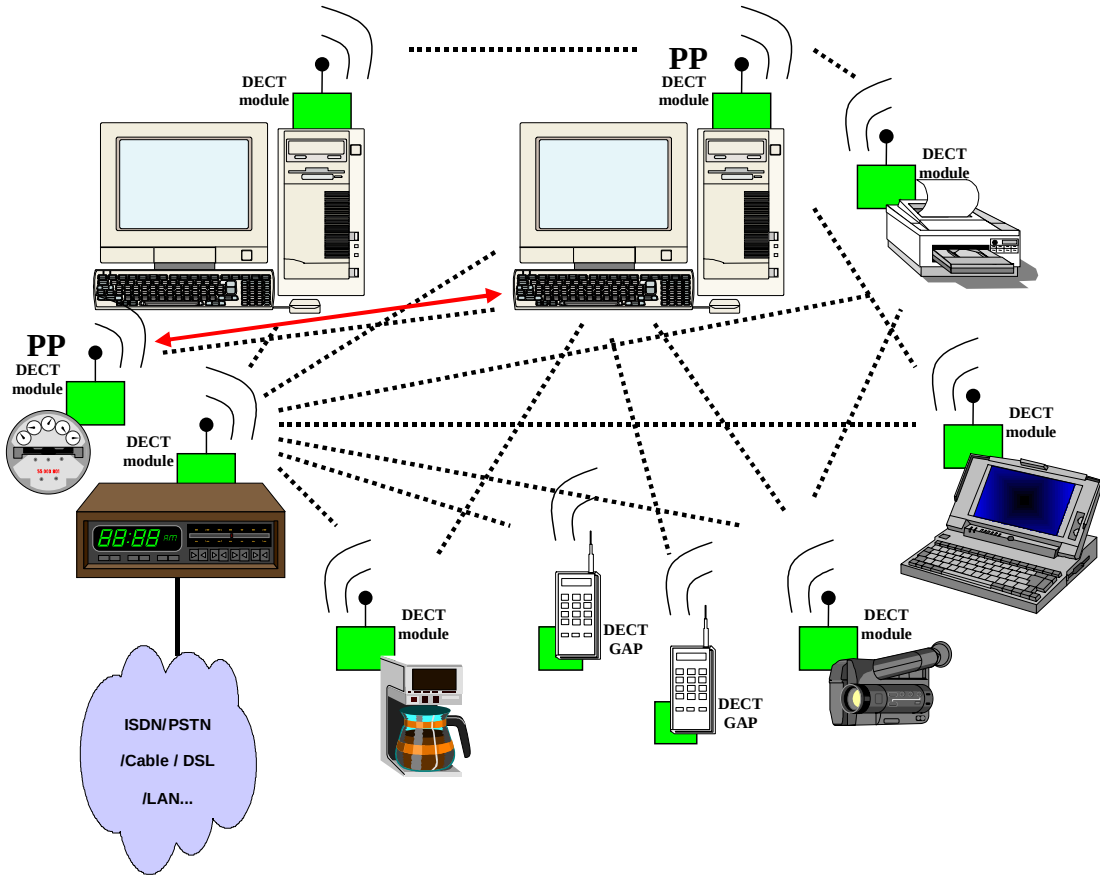


NOTE: The red arrow between PP2 and PP3 shows the communication path between two PPs in this topology scenario.

Figure 4: PP to PP communication where PP1 has assumed the role of an FP

6.1.3.3 Distributed communications

Distributed communications, EN 300 175-5 [5], annex I, is a notation for a DECT system feature providing direct links between PPs (or CTAs). Such PPs and CTAs are also called Hybrid Parts, HyP. The HyPs always stay in lock with the DECT system and an RFP is always involved in the direct link connection. Either just by providing the locking and time synchronization, or also by direct involvement in the set up procedure. The main target application is data local networking. Since no RFP is involved in the user communication link, the distributed communications option only uses half the spectrum compared to normal calls routed via RFPs. Figure 5 shows an example, where the instant aggregated user data rate could exceed well beyond 20 Mbit/s.

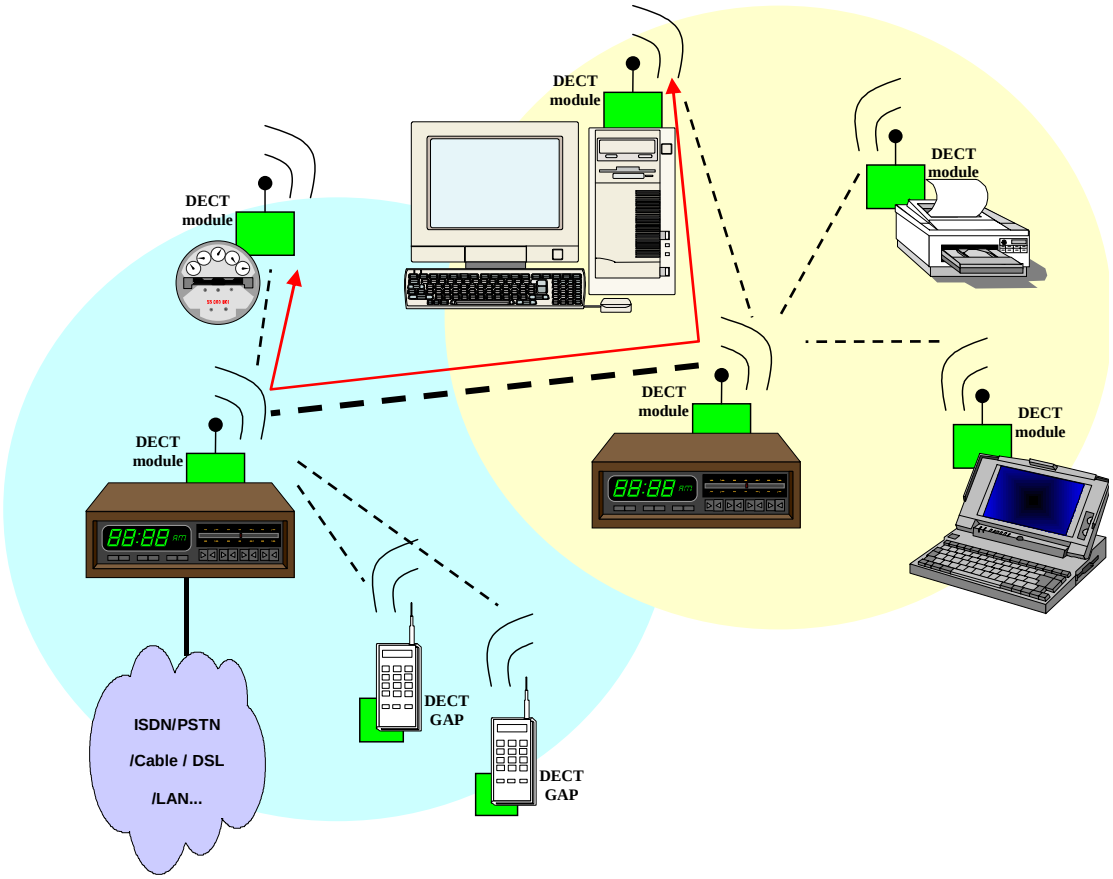


NOTE: The red arrow between PP2 and PP3 shows the communication path between two PPs in this topology scenario.

Figure 5: Wireless Ethernet (LAN) with Distributed Communication - FT implemented as a Router (including Gateway); Voice capability; all possible direct connections not shown

6.1.3.4 Direct FT to FT (FT2FT) communications

DECT provides as well a direct FP to FP (FP2FP) communication, see EN 300 175-3 [3], annex H. Wireless FT to FT communication (W-FT2FT) is a notation for a FP (or HyP) feature that provides the possibility of wireless communication between two independent DECT systems served by two different FPs. The W-FT2FT communication apart of providing direct communication between two FPs can be used implicitly to provide communication between a PP locked to an FT and another FT and all services that this second FT provides. The main difference between a WRS (see clause 6.2) and a FP supporting W-FT2FT communication is that the later does not relay calls rather uses two separate independent calls.



NOTE: The red arrow between PP2 and PP3 shows the communication path between two PPs in this topology scenario.

Figure 6: FT2FT communication

6.2 Wireless Relay Station (WRS)

The WRS standard EN 300 700 [111] describes a special DECT unit capable of relaying DECT radio transmissions.

A WRS is an additional building block for the DECT fixed network. It has the basic functionality of a normal base station, RFP, but with the advantage of not needing a wired access to the radio exchange or base station controller. See figure 7.

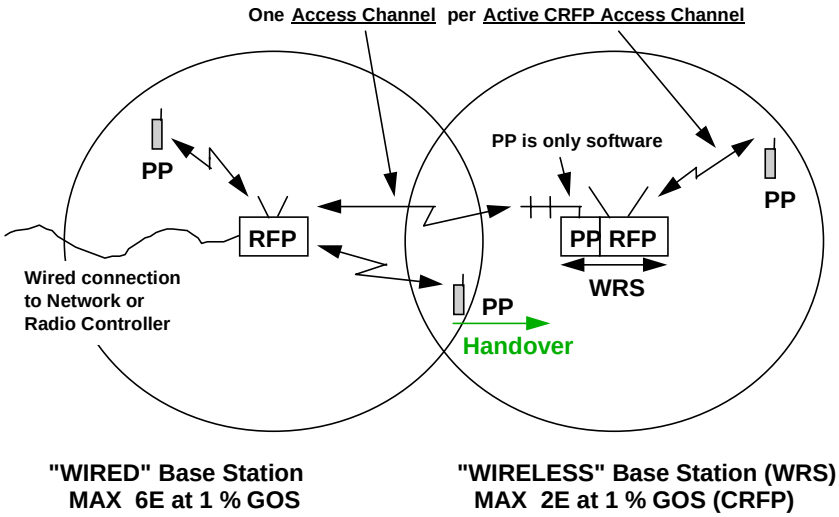


Figure 7: The DECT Wireless Relay Stations, WRS

EN 300 700 [111] defines provisions needed for a controlled and reliable application of the DECT WRS infrastructure building block. These provisions are not related to any specific profile.

The standard defines two types of WRS, the CRFP type and the REP type. Present applications only use the CRFP type.

WRS utilizes the intelligent way DECT accesses the radio frequency spectrum. The WRS works by linking two DECT radio links working on two different time slots. CRFP and REP use different mappings to link time slots. The Dynamic Channel Selection (DCS) functionality is available to each of these links independently.

The RFP element acts towards a PP exactly as an ordinary RFP. The PP element acts like a PP towards the RFP, and is locked to the closest RFP. A PP can not distinguish between a WRS and an RFP. Standard PP handover procedures are applied. The WRS contains inter-working between its RFP and PP elements, including transparent transfer of the higher layer DECT services. WRS links may be cascaded.

A WRS shall comply with the general identities requirements for RFPs. Installing or adding a WRS to a DECT infrastructure is not possible outside the control of the system operator/installer/owner, who provides the required system identities, access rights and authentication/encryption keys.

WRS is suitable to provide cost effective infrastructures for low traffic density applications, for improving/extending coverage indoors (or outdoors) or behind obstacles and for providing integrated fixed - mobile services from the same infrastructure. A typical application is illustrated in figure 8.

Compared to an RFP, WRS may introduce capacity restrictions to the services offered. The restrictions may increase with the number of cascaded WRS links. Single WRS link applications can be generally applied. However, special precautions are needed when applying cascaded WRS links. The capacity may be too low or there may be a need to adjust the echo control requirements.

ETR 246 [96] provides more information on the application of WRS.

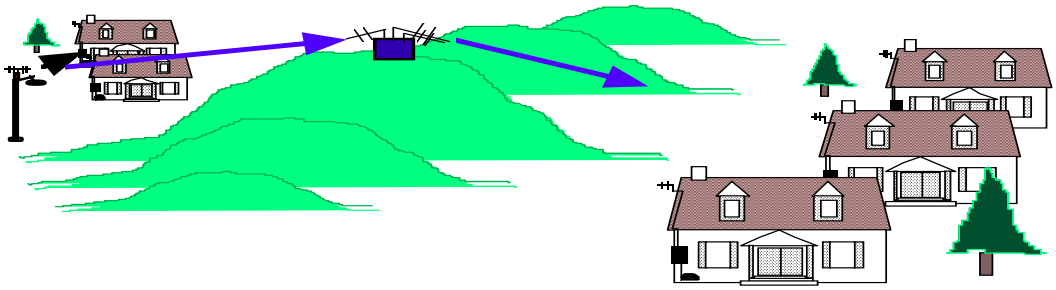


Figure 8: Typical WRS application

6.3 DECT Authentication Module (DAM)

Access rights information and other subscription related information can be loaded into a PP either over the air, via a connector, or by inserting a DAM.

The DECT Authentication Module is a chip card that can be programmed with DECT identities and inserted into a DECT PP with an appropriate DAM card interface. It provides means by which a DECT system operator can load user identities, access rights information and security parameters (authentication and cipher keys) into a PP.

A DAM card can be used in conjunction with different profiles, i.e. it is not restricted to any particular DECT application profile.

The DAM card is specified in ETS 300 331 [18] and is compatible with the corresponding card in GSM (the SIM card). ETS 300 825 [71] covers the requirements for DAM cards using 3V technology.

7 DECT profile standards

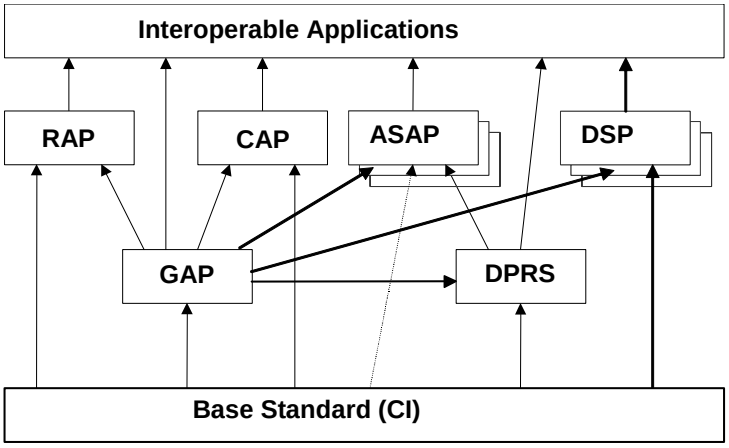
A DECT profile standard is a chosen subset from one or more base specifications for a specific application. Most of the DECT profiles are based on only one base specification: the DECT CI standard. Others may be based additionally on other basic DECT standards or more frequently on other DECT profiles. In addition some DECT Profiles may be based on a non DECT standard, e.g. ISDN, GSM, UMTS, etc.

DECT profile standards include the minimum requirements for interoperability for equipment from different manufacturers and with different systems. If the base specification has some ambiguity in regard to a particular service/feature, or lacks some provision, this is clarified or added in the profile standard. All defined features are process mandatory for those that claim support of a particular profile. This means that if a feature is used, it is used in a specified manner. Whether the provision of a feature is mandatory or optional is stated separately for FPs and PPs.

If FPs and PPs conform to an ETSI defined profile standard, minimum interoperability for equipment from different manufacturers and with different systems is ensured for a specific service and application. Examples are the Generic Access Profile (GAP), the DECT/GSM Inter-Working Profile (IWP), the DECT Packet Radio Service (DPRS) profile and the set of Application Specific Assess Profiles in the DECT data domain, and, the DECT access to IP networks.

The main difference between profiles is protocols related. The radio requirements as defined in EN 300 175-2 [2] are generally applicable to all DECT profiles. The telephony requirements as defined in EN 300 175-8 [8] are applicable to all profile applications supporting 3,1 kHz speech.

Creating new profiles is a means for enhancing the DECT standard and/or introducing evolutionary applications and services. Figure 9 shows an overview of the actual profiles.



NOTE: Due to the great number and complex relations between the DECT profiles not all of them are shown on the figure.

Figure 9: Overview of basic DECT profiles

7.1 Generic Access Profile (GAP)

The Generic Access Profile (GAP), EN 300 444 [24] is the basic DECT profile for any private or public DECT application supporting a 3,1 kHz telephony teleservice. It defines the minimum interoperability requirements including mobility management and security features. If has different requirements on public and private FPs. The GAP is the industry standard for a basic fall back speech service with mobility management. This basic service does not need to be generally used, but it can always be available, when requested by a roaming PP or by an FP to which the PP has roamed.

The protocol elements of GAP can be broadly related to Mobility Management (MM) or Call Control (CC).

The NWK layer CC protocols are closely related to the provision of speech telephony services. The CC protocols of other speech telephony applications are often based on GAP. The GAP specification of the lower layers protocols needed for the provision of the CC is used by many other speech and non -speech telephony applications profiles as well.

The MM protocols cover aspects related to mobility such as location tracking, identities and security features. The MM protocols are applicable (with perhaps some minor changes) to all mobility applications (both speech and non-speech). The MM protocols of most profiles are based on GAP.

The GAP defines those components of the DECT CI standard, which need to be met in order to achieve basic cordless interoperation.

Most of the physical layer requirements of EN 300 175-2 [2] are required by GAP equipment.

The speech telephony requirements of EN 300 175-8 [8] are required in GAP equipment.

The protocol components of parts 3, 4, 5, 6 and 7 of the base standard (EN 300 175 [3] to [7]) required for GAP equipment are given in the GAP.

To build a GAP PP or FP, a manufacturer also has to take into account the requirements of the relevant EMC and safety legislation, and (for the FP) the requirements of the telecommunications network to which the FP is intended to be connected.

The relationship between the standards and GAP products is shown in figure 10.

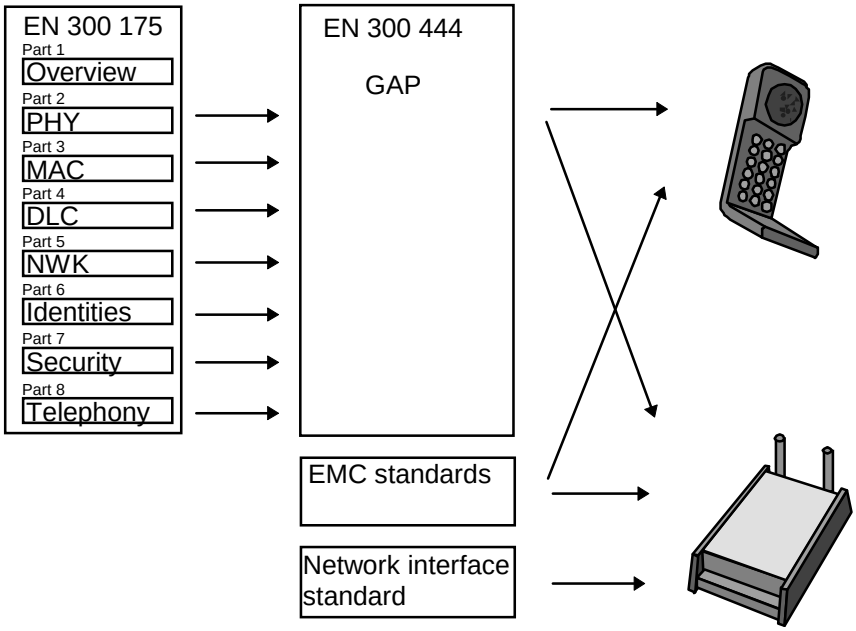


Figure 10: Standards relating to GAP

7.2 Data Service Profiles (DSPs)

DECT is equipped with powerful wireless data capabilities. A family of Data Services Profiles (DSPs) complete the open standard character of such services, by ensuring inter-operability between products from different manufacturers. They all exploit the lower-layer data services of DECT, which are specifically oriented towards LAN, multimedia and serial data capability, but each member of the profile family has been optimized for a different kind of user service

Due to DECT's advanced radio protocol it is possible to offer widely varying bandwidths by combining multiple bearers into a single channel. DECT can support net data throughput from n X 24 kbit/s (2-level modulation) up to 5 Mbit/s (64-level modulation) and 20 Mbit/s (64-level modulation broad band). Wide band carriers combining 2 or more "normal" DECT carriers can provide even higher data rates.

The DECT Data Profiles also support full authentication and encryption, thus ensuring that it is a suitable medium for confidential data information transfer. This is often considered a serious problem with other wireless technologies.

The high speed error correction, fast connection set-up, asymmetric channels and dynamic slot aggregation provide support for packet data equivalent to (and in many cases in excess of) existing Wireless LANs. DECT achieves Wireless LAN performance by providing**:**

- Channel set-up < 50 ms;
- Error rates better that 10^{-9};
- Throughput of up to 5 Mbit/s with 64-level modulation.

The family of DECT data profiles is described in the current clause.

7.2.1 DECT Packet Radio Service (DPRS)

The DECT Packet Radio Service, DPRS, EN 301 649 [87] specifies common features and services for all packet data applications. This profile also serves as a base specification for other data profiles. DPRS does not contain GAP [24] speech functionality but whenever needed (e.g. CC and MM procedures) it refers to the procedures defined in GAP, all additional procedure support necessary for data applications is explicitly specified in DPRS.

The DPRS specifies frame relay and character oriented packet data service allowing operation in two modes: class 1 and class 2.

Service Class 2 offers a full DECT C-plane, including call-set-up procedures and mobility management. The applications are intended for private and public roaming, and service parameters are negotiated during the call-set-up phase, and may be changed during the active phase of the call.

Service Class 1 is a simplified version of Service Class 2 without higher layer control intended for some types of private network applications without mobility (no intercell handover).

NOTE: The DPRS contains requirements of, and replaces the earlier data profiles A/B.1, A/B.2, C.1, C.2.

Interworkings with V.24 interfaces, Ethernet, Token Ring LANs, direct interworking with Internet Protocol (IP) and PPP and, a Generic media encapsulation protocol allowing for various different media protocols to utilize one transport have been defined.

The standard contains specifications for applications for which a high degree of data integrity is necessary and includes connection oriented bearer services. A set of fast suspend and resume procedures is provided to overcome the drawbacks in regard to resource utilization that can be identified in most of the connection oriented service.

DPRS also extends the data stream service into environments, such as public services, where significant mobility is a characteristic. This service may be used to provide interworking with a voice-band modem service over public networks such as PSTN or ISDN.

Annexes to the DPRS specify a set of services that can be provided. There are two types of services:

- Frame Relay Service includes transport of protocols with user-delimited frames. DPRS defines the following frame-relay services:
  1) IEEE 802.3 [112] (Ethernet);
  2) IEEE 802.5 [113] (Token Ring);
  3) Internet Protocol (IP);
  4) Point to Point Protocol (PPP).
  5) Generic media encapsulation protocol.
- Character Oriented service incorporates a packet assembling and disassembling (PAD) functionality to transport a stream data. DPRS incorporates the following Character Oriented services:
  - V.24 (asynchronous data).

USB interworking is provided as well.

The DECT packet radio service is the core standard for most packet-data applications over DECT, and its main provisions are as listed here.

- High speed data transfer capabilities: max channel capacity available to user applications: 3x824 kSymbol/s
- DECT Multibearer and asymmetrical operation (where DECT slots are reversed to increase instantaneous speed in one direction)
- High spectrum efficiency, where:
  - Air interface is used only when there are data to transmit
  - It allows statistical reusing of air interface resource
- Powerful Automatic retransmission (ARQ) mechanisms
- Control of maximum retransmission delay
- A set of Frame Relay and character oriented services
  - New services can be easily added to the standard
- Provisions for simultaneous support of voice and data services
- Powerful DECT authentication mechanisms
- Powerful DECT ciphering
- Complete DECT call-control signalling and procedures
- Complete DECT mobility management features:
  - Bearer replacement
  - Bearer handover intracell
  - Bearer handover intercell
  - Connection handover
  - External handover
  - Automatic allocation of dynamic operating parameters

Figure 11: DPRS key features

The relationship between the standards and DPRS is shown in figure 12.

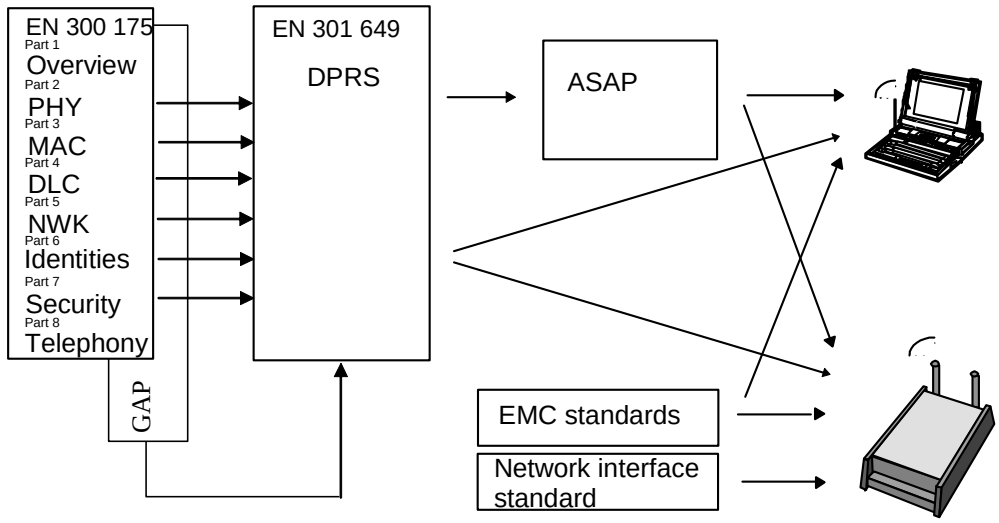


Figure 12: Standards relating to DPRS

7.2.2 ASAP

ASAPs are Application Specific Access Profiles that identify a specific application scenario and selects a subset of DPRS services for such applications.

More information on the ASAPs is provided in the following clauses.

7.2.2.1 DECT Multimedia Access Profile (DMAP)

The DECT Multimedia Access Profile (EN 301 650 [88]) defines a basic subset of functions and facilities from DPRS EN 301 649 [87] and GAP EN 300 444 [24]. The TS 101 859 parts 1 [135] to 3 [137] specify the DMAP Profile Test Specification (PTS) and the TS 101 871 parts 1 [130] and 2 [131] specify the DMAP Profile requirement list and profile specific Implementation Conformance Statement (ICS) proforma respectively.

DMAP shall guarantee interoperability between conforming equipment on selected basic data functions including LAN access, wireless modem and simple file transfer in addition to GAP voice capabilities.

DMAP has the residential and small office market as main target. It adds to GAP a selection of basic data capabilities to efficiently support voice, data networking and Internet services. It includes access to and between PCs and Laptops. The standards relations relevant for DMAP are shown on figure 13.

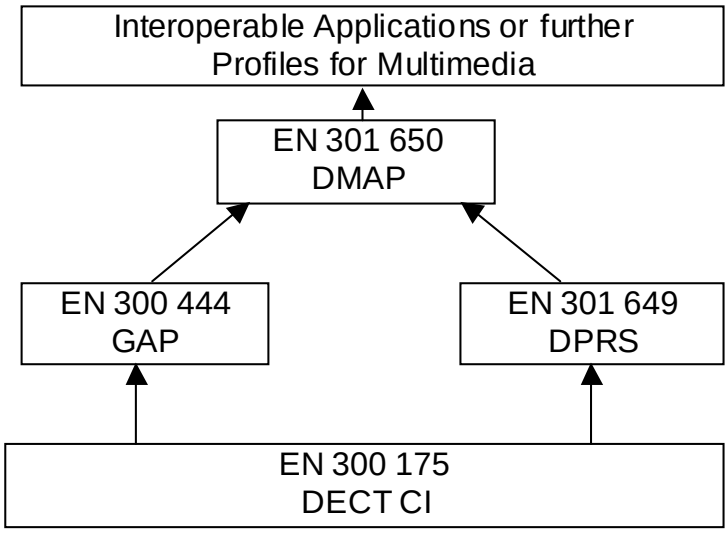


Figure 13: Dependencies of DMAP

7.2.2.2 Ethernet Interworking

TS 101 942 [161] defines a data Application Specific Access Profile (ASAP) intended for enterprise, Small Office and Home Office (SOHO) and Home (residential/private) markets combining a selection of Ethernet Interworking DECT-DPRS (EN 301 649 [87]) data services. The TS 102 014 [163] specify the Ethernet ASAP Test Specification (PTS) and the TS 102 013 (Parts 1 and 2) [162] specify the Ethernet ASAP requirement list and profile specific Implementation Conformance Statement (ICS) proforma respectively.

The aim of TS 101 942 [161] is to guarantee a sufficient level of interoperability and to provide an easy route for development of DECT DATA LAN applications.

7.2.2.3 V.24 Interworking

TS 101 947 [158] defines a data Application Specific Access Profile (ASAP) intended for enterprise, Small Office and Home Office (SOHO), and home (residential/private) markets combining a selection of V.24 Interworking DECT-DPRS (EN 301 649 [87]) data services. The TS 102 012 [160] specify the V.24 ASAP Test Specification (PTS) and the TS 102 011 (Parts 1 and 2) [159] specify the V.24 ASAP requirement list and profile specific Implementation Conformance Statement (ICS) proforma respectively.

The aim of TS 101 947 [158] is to guarantee a sufficient level of interoperability and to provide an easy route for development of DECT DATA simple cable replacement applications.

7.2.3 D profiles

D.2 profile - EN 301 238 [72]

The type D profile, service class 2 supports Isochronous Data Bearer Services (IDBSs) with mobility and is suitable for transparent transfer of isochronous data streams. It is intended for use in private and public roaming applications. Video telephony, video conferencing and secure telephone services (end-to-end encrypted) over external networks can be considered as applications of IDBS.

It provides an unprotected service offering an unrestricted digital 32 kbit/s data bearer service, strongly based on the Generic Access Profile (GAP), and an unprotected single bearer, multiple rate, rate adaptation service to interwork to synchronous ITU-T Recommendations V-series interfaces.

In addition to the above, the current D.2 profile supports an asynchronous version of the unprotected single bearer, multiple rate, rate adaptation service to interwork with asynchronous ITU-T Recommendations V-series interfaces.

Further phases of this profile may additionally provide multiple rate, multibearer support and limited error correction capability for services/applications requiring higher rates and high quality isochronous data transmission.

D.1 profile - EN 301 239 [73]

This profile provides the equivalent service to the D.2 profile for Closed User Groups (no intercell handover).

7.2.4 Industrial and home non-voice applications - Open Data Access Profile (ODAP)

The TS 102 342 ODAP [174] profile specifies the DECT interworking profile aimed at the provision of industrial and home applications requiring low data rate and low battery power utilization.

ODAP allows the creation of an accessories market for alarms, sensors and similar devices, which can be connected through a DECT base station to users and/or servers in either a home or industrial environment.

ODAP provides a generic low-rate messaging encapsulation transport mechanism over the DECT GAP air interface capable of satisfying the needs of various types of devices, e.g. industrial and household sensors, alarms, machines (M2M), surveillance cameras, etc. This enables for example home applications such as automatic voice calling or messaging when a fire or smoke alarm goes off, as well as, remote control for home appliances; whereas in an industrial environment, sensors can be monitored reliably using the protected DECT frequency band and the DECT Dynamic Channel Selection (DCS) mechanism.

The ODAP specifies a GAP based packet Cordless Multimedia Communication End System (ES) that allows distributing the burden of the data applications and transport protocols between the DECT Portable Part (PP) and the DECT Fixed Part (FP) with the aim of putting the complexity into the FP and reducing the complexity, and hence reducing the cost of the Portable Parts.

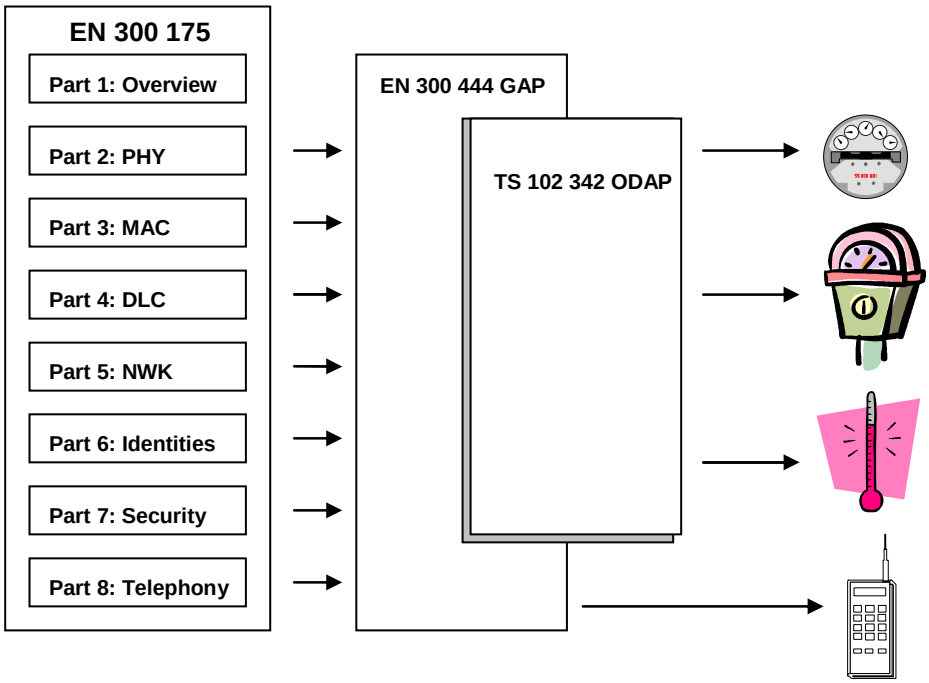


Figure 14: DECT protocol standards relating to ODAP

7.2.5 DECT messaging

7.2.5.1 Low Rate Message Service (LRMS) including SMS

The ETSI EN 300 757 [57] profile defines low rate messaging service including Short Message Service (SMS) with roaming mobility.

The profile provides a means for the low rate and low power consumption transfer of different types of messages, including alphanumeric paging messages. It provides both point-to-point and point-to-multipoint services. This service may be used for private and public roaming messaging applications such as the GSM Short Message Service (SMS). Description of GSM SMS interworking within public and business DECT networks can also be found. Interworking description for GSM networks can be found in ETS 300 764 [63].

Fixed line SMS (F-SMS) service could be provided over DECT based on the requirements specified in this profile as well. The interworking between the DECT FT and the fixed network providing the F-SMS service within the FP is left to the designers and is not specified in a DECT profile.

7.2.5.2 Fixed line Multimedia Messaging Service (F-MMS)

The TS 102 379 [175] profile specifies the DECT interworking with Fixed line Multimedia Messaging Service (F-MMS). The profile specifies various options for transport of F-MMS protocol data units acros the DECT air interface, e.g. a high data rate option and a SMS u-plane option utilizing the Generic media encapsulation protocol specified in DPRS [87]; other options provided are based on the ODAP [174] and the LRMS [57] profiles respectively.

7.3 Profiles for ISDN

Two profiles are defined so far for the DECT/ISDN Interworking, the End System (ES) profile and the Intermediate System (IS) profile, plus a standard for access to Broadband ISDN.

ISDN End System (ES) profile - EN 300 434 Parts 1 [22] and 2 [23]

In the ISDN ES, the PP has access to the services of the ISDN network via the FP using DECT signalling over the air interface, see figure 15.

The ISDN ES profile provides for interoperability of FPs and PPs from different manufacturers allowing access to ISDN where the FP and the PP together appear to the network as an ISDN terminal (TE1). The ES might be a voice or another type of ISDN terminal.

The ISDN ES profile defines detailed interworking mappings between the DECT protocols on the air interface and the ISDN protocols at the network interface.

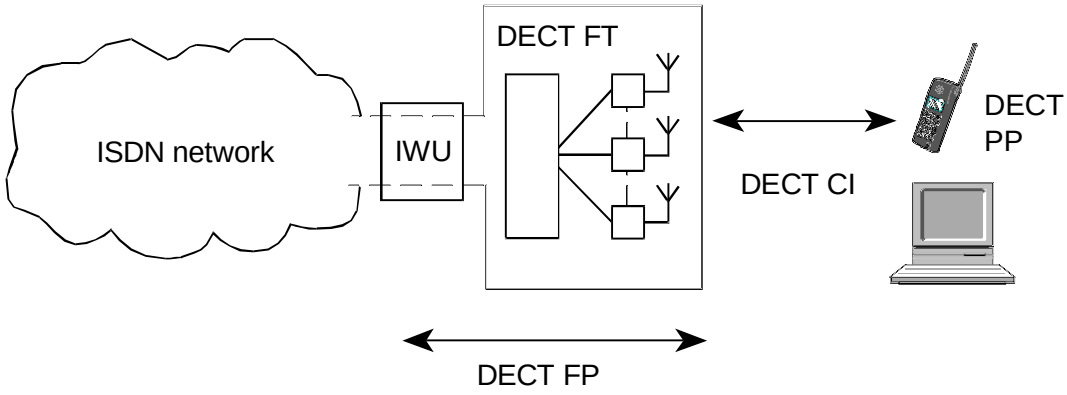


Figure 15: DECT ISDN End System

In addition to the basic features of GAP, the ISDN end system profile provides these features:

- the FP provides interworking between a GAP PP and ISDN;
- the supplementary services of ISDN can be made available to the user by a suitable PP;
- access to the 64 kbit/s unrestricted digital information bearer service is possible via a suitable PP.

EN 300 434 Parts 1 [22] and 2 [23] do not provide support for mobility. For profiles which define the necessary messages to convey mobility management information between the terminal and network elements refer to clause 7.5.

Where the PP is a speech terminal, the PP requirements are very closely related to the GAP with optional additions. An ISDN ES FP supporting 3,1 kHz voice telephony, will inter-operate with a GAP PP, (although obviously the additional optional features in ISDN ES cannot inter-operate with a pure GAP PP). Similarly where the ISDN ES PP is a speech terminal, it will inter-operate with a GAP FP.

The relationship between the standards and ISDN ES products is shown in figure 16.

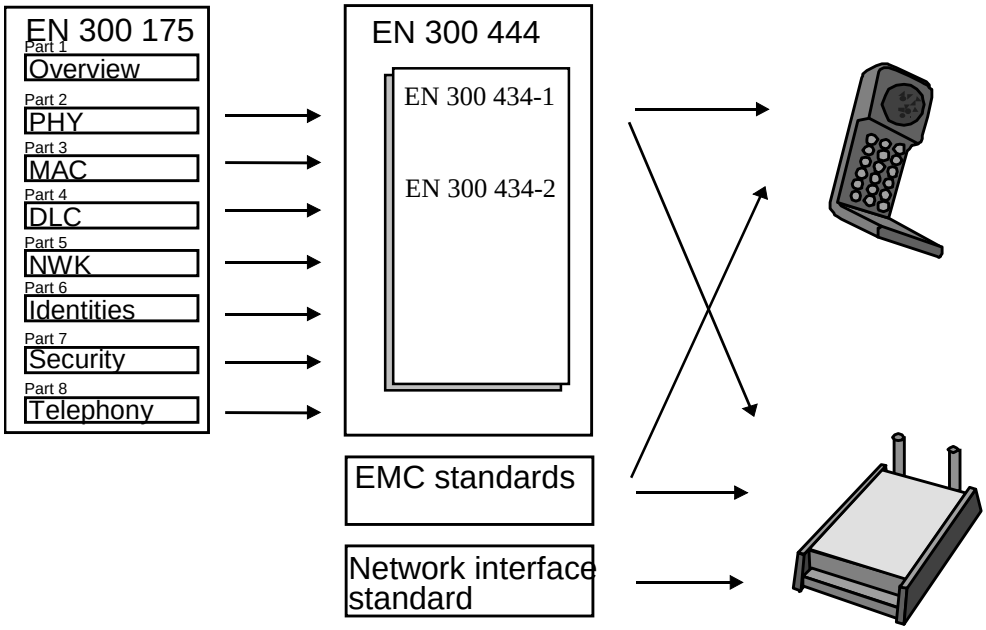


Figure 16: Standards relating to ISDN End System

ISDN Intermediate System profile - EN 300 822 [69]

The IS (see figure 17) provides for a wireless link between an ISDN network and one or more ISDN terminals (TE1s) connected to an S-Interface at the S-reference point. The TE1s have transparent access to all network defined services based upon the basic channel structure 2B + D. B-channels support is provided in an intelligent manner allowing for efficient use of the DECT spectrum.

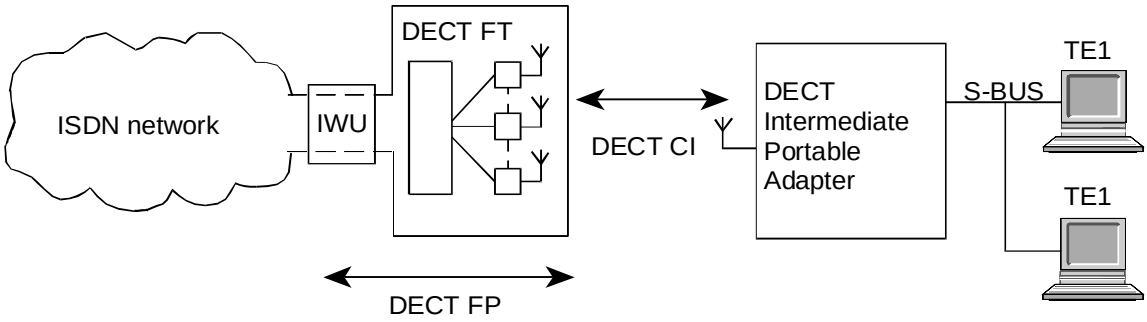


Figure 17: DECT ISDN Intermediate System

The DECT ISDN IS profile is based on EN 300 175 [1] to [8]. It defines that all ISDN signalling is conveyed transparently by using the DECT network layer for the transport of ISDN messages.

ISDN protocol messages are conveyed across the air interface to the S reference point at the PT. This is rather different to GAP where the PT is also a telephony handset. Therefore a simple GAP handset can only inter-operate if the DECT FP supports the GAP profile in addition to the DECT IS profile. Mobility management based on GAP is provided for use where the network access supports mobility protocols.

Depending on the application in the terminal equipment more than one DECT bearer may be required in ISDN IS. The ISDN IS FP monitors the ISDN layer 3 traffic, and dynamically allocates bearer resources as required.

The ISDN IS ensures that the minimum number of bearers is used. For speech applications ADPCM coding is always used thus reducing spectrum requirement for each ISDN B channel from 64 kbit/s to 32 kbit/s and requiring only a single DECT bearer.

Signalling information is normally carried in the signalling channel associated with the DECT bearer except for short periods when a complete DECT bearer may be needed to provide adequate bandwidth.

Broadband ISDN (B-ISDN) interworking for DECT is specified in TS 101 679 [114]. TS 101 679 [114] is aimed at interoperability between DECT implementations of direct interworking with B-ISDN high-capacity networks.

7.4 Cordless Terminal Mobility (CTM) applications

The ETSI defined CTM service allows users of cordless terminals to be mobile within and between networks. Where radio coverage is provided and the cordless terminal has appropriate access rights, the user shall be able to make calls from, and receive calls at, any location within the **fixed** public and/or private networks, and may move without interruptions of a call in progress.

The CTM Access Profile (CAP) EN 300 824 [70], is based on GAP with the following main additions:

- external handover, enhanced location registration;
- emergency call;
- terminal display management, message waiting indication.

A handset supporting GAP features only will inter-operate with a CTM network.

The scope of application of CTM is fairly similar to the scope of DECT-GSM interworking (clause 7.9). One important difference is that DECT-GSM interworking adds to a pre-existing network, whereas CTM is defining a network in support of mobility including (but not limited to) DECT.

EN 301 361-1 [77] defines the DECT/ISDN interworking for CTM support for the case when ISDN network is used to access CTM services over the ISDN alpha interface (a network access interface).

The relationship between the standards and CAP products is shown in figure 18.

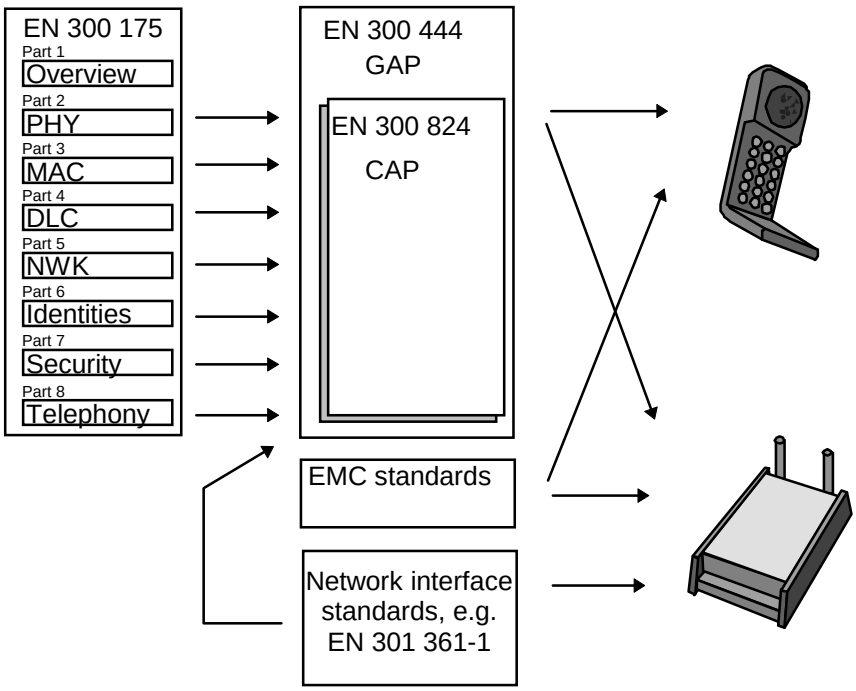


Figure 18: Standards relating to CAP

7.5 DECT/GSM applications

Since the mobility functionality for GSM networks is already standardized it is attractive to re-use them to provide mobility through a DECT air interface. EP DECT has defined standards which enable direct or indirect access to PLMNs.

The DECT/GSM Inter-Working Profile (IWP) EN 300 370 [20] defines air interface protocol requirements and details of how the DECT protocols are mapped to the GSM A interface protocols.

DECT/GSM IWP is based on GAP EN 300 444 [24] adding requirements for interworking with GSM networks. It defines the interworking via the GSM A interface which is directly connected to a GSM Mobile services Switching Centre (MSC). The most important additional requirements to GAP are:

- the PP has to support GSM PLMN authentication algorithms, which are different from the standard DECT authentication algorithms;
- the GSM PLMN cipher keys have to be used;
- GSM PLMN identities have to be used;
- interworking of GSM procedures to DECT procedures adds some protocol additions (compared to GAP) to the DECT FP and PP.

DECT/GSM IWP covers basic telephony (3,1 kHz speech). Other bearer services and supplementary services have been defined in GSM. There are DECT standards specifying how these services may be supported across a DECT air interface. For more information see tables in annex A.

It is a requirement that PPs intending to interwork with a GSM PLMN (i.e. conforming to DECT/GSM IWP) are capable of inter-operating with GAP FPs. The opposite i.e. GAP PP inter-operating with FPs connected to a GSM PLMN is not a requirement, since the additional protocol elements of DECT/GSM IWP are essential to interworking with such an FP.

NOTE: The FT may support access to both "GAP" and PLMN networks in which case such interworking would be possible.

From the interworking point of view, the DECT FP is connected to the GSM PLMN network via an IWU. The PLMN will see a DECT user as a GSM subscriber. ETS 300 499 [47] defines the MSC - FP interconnection.

As an alternative to direct interworking over the A interface it is also possible to interwork with a PLMN indirectly via ISDN interfaces. EN 301 361-2 [78] defines DECT/ISDN interworking for GSM support over the ISDN alpha interface re-using the air interface protocols defined in DECT/GSM IWP.

For further information see ETR 159 [93] and ETR 341 [98].

The relationship between the standards and the DECT/GSM equipment is shown in figure 19.

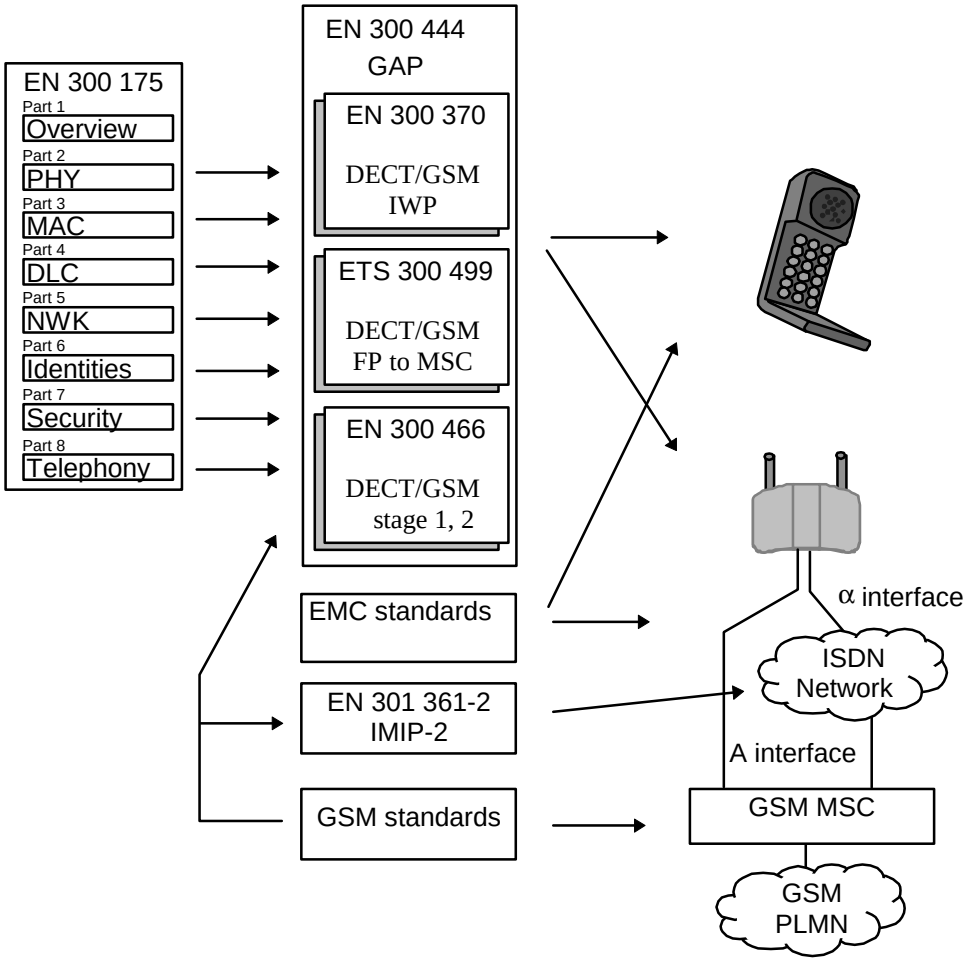


Figure 19: Documents relating to DECT/GSM interworking

7.6 Dual-mode Terminals

Standards have been defined for terminals containing both DECT and GSM air interfaces. The terminal may access a network via either air interface using the same subscription, or might have multiple subscriptions. A user could replace a cellular phone and a cordless phone in the office with a single terminal.

EN 301 242 [76] describes DECT/GSM integration based on dual-mode terminals.

The objective of the EN 301 439 [82] was to provide the attachment requirements (according to earlier European regulatory regime) for terminal equipment for DECT/GSM Dual Mode Terminals applications that are specified in EN 301 242 [76]. EN 301 439 [82] has however presently no regulatory impact (see clause 10 on regulations).

7.7 Radio in the Local Loop (RLL)

RLL generally refers to the provision of a telephony service to a "standard telephone" by use of a radio interface. The need for copper wire in the final part of the connection from the local exchange is removed. Thus a very expensive part of the access network is eliminated.

Being derived from a mobile technology, DECT RLL employs an interoperability profile standard, which in principle means that the Fixed Part (base station) may be manufactured by one manufacturer, the equipment at the subscribers premises by another, and perhaps wireless relay stations by another whilst still being able to offer a useful level of service to the user. The advantage of multiple vendor sources for the operator is apparent and allows the manufacturers the choice to specialize in one segment of the network. Commonality with other DECT products and applications will allow the RLL application to enjoy benefits of high volume product from the outset.

The DECT RLL Access Profile (RAP) standard, EN 300 765 [64] to [65], is divided into two parts:

RAP Part 1 (RAP-1) - EN 300 765-1 [64]:

"Basic telephony services", which includes Plain Old Telephone Service (POTS) services (unprotected 32 kbit/s ADPCM), a (protected) 64 kbit/s PCM bearer service and over-the-air Operation and Maintenance services; The basic RLL applications (PSTN replacement) are covered in RAP-1.

RAP-1 [64] is closely based on GAP, with minimal changes and additions. The basic changes are:

- user originated signalling information, DTMF tones, pulse dialled digits, register recall, and local exchange originated signalling, metre pulses, line reversals, need to be transferred across the air interface;
- removal of GAP features not relevant to RLL e.g. partial release;
- call clearing is modified to meet requirements for emergency calls;
- support for 64 kbit/s bearer service to enable use of fax and modems (allowing V.90 modem service). (32 kbit/s ADPCM is not transparent to modem tones above 9 600 baud);
- addition of features to allow for Operations and Maintenance.

A RAP PP CTA will not interwork with a GAP FP unless the FP supports both GAP and RAP profiles.

The relationship between the standards and DECT RAP-1 equipment is shown in figure 20.

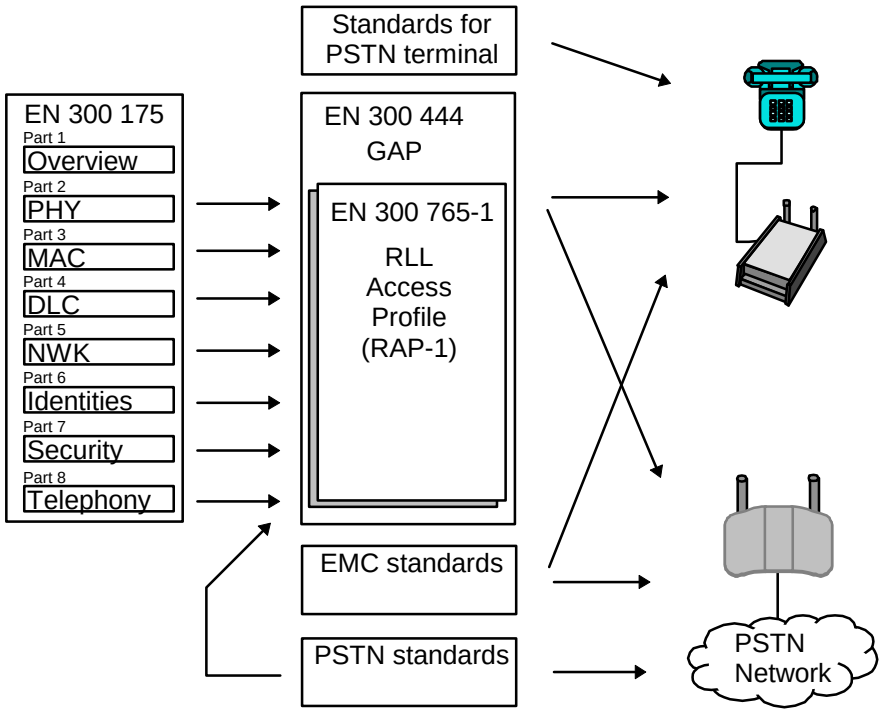


Figure 20: Documents relating to RLL (basic telephony via PSTN)

RAP Part 2 (RAP-2) - EN 300 765-2 [65]

"Advanced telephony services", which specifies 2B + D ISDN services (possible 30B + D in the future). A data port for broadband packet data services (up to 552 kbit/s with 2-level modulation, higher with 4- and 8-level) is also specified.

RAP-2 [65] refers completely to existing profiles for the optional provision of the services:

- DECT-ISDN intermediate system as defined in EN 300 822 [69] for offering an ISDN basic rate service, (the ISDN IS standardization work will also include interworking of ISDN primary rate access, suitable for interfacing to ISDN PABXs); and
- the data profiles:
  - as defined in DPRS EN 301 649 [87] for providing Internet access and modem support; and
  - as defined in clause E.2 of EN 300 757 [57] for providing Group 3 Fax support.

The RAP-2 speech service has the same spectrum efficiency as all other DECT services using 32 kbit/s ADPCM. The RAP-2 profile (and of course the data and ISDN profiles) provides efficient transfer of data without the need to digitalize modem signals. This is much more efficient than modem over 32 kbit/s ADPCM. The DECT ISDN service monitors the ISDN layer 3 information, and allocates DECT bearer resources only when and as required by the specific instant ISDN services. The ISDN speech service has the same spectrum efficiency as the POTS speech service, and transmitting a specific amount of data (e.g. a document) via ISDN is much more spectrum efficient and loads in average the radio devices less than via POTS (modem). For packet data, transmission over the Data Port is much more spectrum efficient and loads in average the radio devices much less than any modem service or ISDN service. In addition, features have been introduced in RAP-2 for the Operation and Maintenance of Cordless Terminal Adapters (CTAs) supporting the above mentioned profiles and services. The Operation and Maintenance features are largely based upon those defined in RAP-1.

The relationship between the standards and DECT RAP-2 equipment is shown in figure 21.

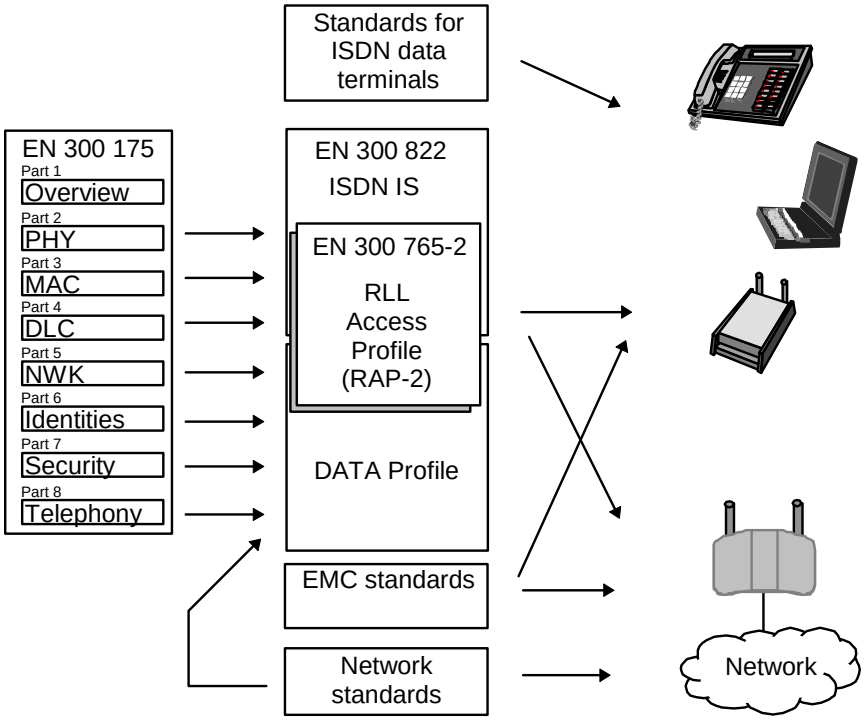


Figure 21: Documents relating to RLL (advanced telephony)

A RAP PP is also referred to as a Cordless Terminal Adapter (CTA). A CTA could provide multiple (replicated) analogue lines, suitable for interfacing to a PBX.

The reference model for DECT RLL systems is presented in figure 22.

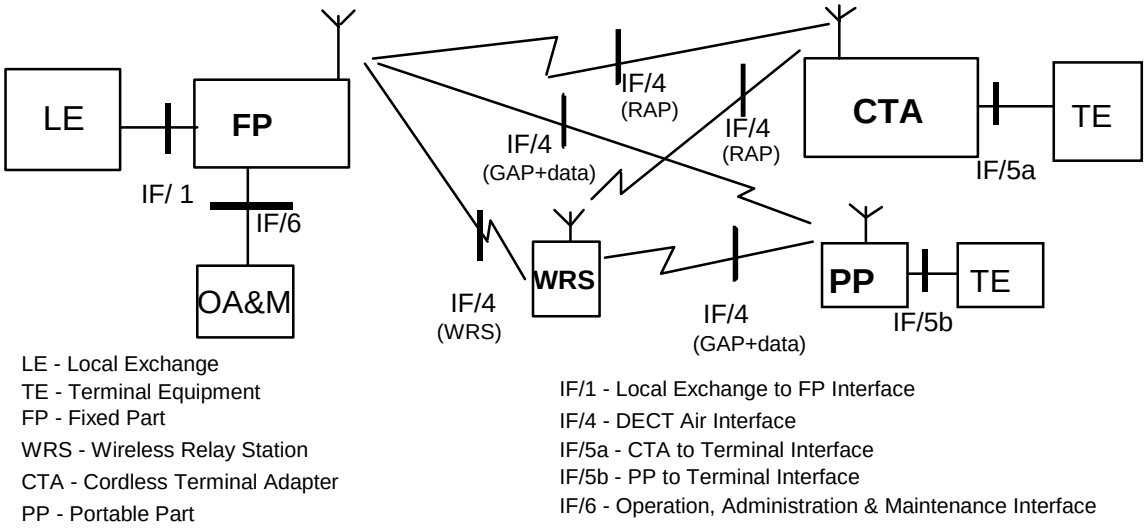


Figure 22: DECT RLL reference model

Depending on whether the end-user uses a CTA or a PP, the IF/4 interface can be either RLL Access Profile (RAP) or GAP-compliant. Services facilities and configurations for DECT in the local loop, ETR 308 [97]), focuses on RAP and describes the services available at IF/1 that are expected to be provided at IF/5a. The O&M facilities defined in RAP are only the ones that require information to be transported over the RAP air interface. It should be noted that effective radio ranges achieved in the DECT RLL application using CTAs, will be considerably greater than when DECT is used in the mobile mode. The signal path is more consistent, it is often line-of-sight and base stations and CTAs may use high gain antennas, whose directionality also reduces multi-path signals.

DECT provides high capacity FWA (RLL) services with typically 40 E to 150 E average traffic per DECT Access Site (DAS), in a 20 MHz allocation. The DAS may be highly sectored and are deployed in cellular pattern. 10 dBi to 22 dBi antennas are used.

For low traffic density scenarios, the capacity is not an issue, but the range is. High gain directive antennas and WRSs are often applied in order to increase the range of the links. The service and facilities description for DECT FWA requires a range up to several kilometres for a DECT radio link. A Line Of Sight (LOS) range of about 5 km is feasible with 12 dBi antennas at each end and reasonable antenna heights. Thus adding a WRS could double the range.

The DECT standard advance timing of the CTAs increases the range up to typically 17 km with maintained TDD guard space. LOS ranges of 10 km to 15 km to a CTA or to a pool of WRSs in a remote village are thus reachable. This however requires high antenna gain (larger antennas) and higher antenna installation.

A single radio CTA can provide 1 to 12 lines (trunks) at the interface. Note that even if 12 lines are provided, the corresponding bearers on the air interface are only set up if there is a call on the line. These lines (trunks) can have an analogue 2-wire IF/5a interface, or the D/A conversion in the CTA is deleted, whereby 4-wire digital 64 kbit/s PCM lines (IF/5a) are provided. This is suitable when interfacing to digital PABXes and for CENTREX services. By using narrow angle sectorized antennas, especially in line-of-sight conditions, a large number of such trunks can be effectively provided for an office.

The ability of an FP to support GAP and RAP and WRS applications (figure 22) provides means for integration of fixed and mobile services, which will appear on the emerging deregulated telecommunications markets.

The DECT RLL applications are supported by three Technical Reports:

a) A review of the services, facilities and configurations required to be supported by DECT for RLL has been published as ETR 308 [97].

b) A review of the spectrum needs and traffic capacity issues of DECT in the RLL application, and how RLL coexists with other DECT applications will be published as TR 101 310 [101].

c) TR 101 370 [102] is a guide how to implement and test DECT FWA (WLL) systems operating in TDD and FDD duplex modes at frequencies outside the frequency-bands described in EN 300 175-2 [2]. It includes radio frequency bands for Fixed Services within 2 200 MHz to 105 GHz and has special focus on applications in the 3,4 GHz to 3,7 GHz band.

7.8 DECT/UMTS applications

EP DECT has defined a multi part standard (TS 101 863 parts 1 [167] to 6 [172]) which enable that the Universal Mobile Telecommunication System (UMTS) services can be provided over DECT.

To enable DECT terminals to interwork with DECT systems which are connected to the UMTS infrastructure, two items are considered:

- DECT side: the multi part standard is based on EN 300 444 [24] and on the DECT Common Interface specification EN 300 175 parts 1 [1] to 8 [8] (for the cases not covered by Generic Access Profile (GAP)),

- UMTS side: the multi part standard assumes interworking with UMTS specification release 1999 and later.

An air-interface profile is specified for a particular set of UMTS services so that inter-operability of DECT equipment for these services can be achieved. Interworking functions/mappings are specified for Mobile Switching Centre (MSC) attachment for the DECT FP as the FP is using the Iu-interface towards the UMTS core network in the respect that the FP emulates a UTRAN Radio Network Controller (RNC) with regards to the UTRAN messages which are relevant to the multi part standard. Interworking functions/mappings for the PP are specified for MSC environment.

The provision of the (UMTS) Subscriber Identity Module (SIM, USIM) and DECT Authentication Module (DAM) within the DECT portable are also considered.

UMTS interfaces to non-UMTS networks are out of the scope of the multi part standard.

7.9 DECT access to IP based networks

The TS 102 265 [173] profile specifies the DECT interworking with IP networks. The profile specifies in particular DECT interworking with Session Initiation Protocol (SIP) and Mobile IP service. It is based and develops further the findings of the TR 102 010 [165].

In regard to Mobile IP, IP addressing associated with the FT and/or with the PT is specified. In regard to SIP interworking, Voice over IP (VoIP) and multimedia sessions are covered. In the case of voice, the VoIP is terminated in the FT and "normal" GAP based voice is used over the DECT air interface.

NOTE: In comparison, the IP interworking service specified in DPRS [87] is a transparent service which assumes IP protocols knowledge in the PT or in the applications attached to the PT.

8 The distinction between conformance testing and regulation

Product standards define behaviour of an equipment. It is also necessary to define the methods by which compliance to the defined behaviour is checked. For very simple systems, if the product standard is suitable detailed and specific, a competent engineer can easily derive a test method. In more complex systems, where many possible behaviour sequences need to be checked, a separate document specifying conformance tests is required.

Conformance testing standards provide a tool for manufacturers to check that they have in fact met the requirements of a standard, and will obviously assist in the process of assuring that equipment from multiple vendors actually does interwork. The process of producing a test standard results in further review of the product standard and may provide further input to the validation and refinement of the product standard. The ETSI publication "Making Better Standards - practical ways to greater efficiency and success" (see bibliography) provides useful background information concerning conformance testing standards.

So far regulatory issues have not been mentioned. It is possible to have a conformance standard for voluntary conformance testing by a manufacturer with no regulatory requirement for the manufacturer to comply. There can be other (non-regulatory) factors such as customer demands that effectively compel a manufacturer to test compliance to a standard.

In situations where the requirements have to be met for good reasons, usually to avoid harm or annoyance to others, there may be a legal, regulatory requirement to conform to essential requirements which could be defined in a Harmonized Standard, and it may be required for a product to declare the compliance with this requirements prior to being placed on the market.

Conformance testing of DECT products is addressed in clause 9.

The regulatory issues relating to DECT products are covered in clause 10.

9 Conformance and Interoperability testing

In this clause the specific documents related to the conformance and Interoperability testing of DECT application profiles is covered. For more information about the structure and relationship of protocol and profile conformance testing specifications refer to ETS 300 406 [21]. DECT testing specific information may be found in TR 102 183 [94].

9.1 Radio conformance testing

The relevant document describing the conformance testing of the DECT radio requirements is EN 300 176-1 [15]. EN 300 176-1 [15] is applicable to all DECT equipment, regardless of application.

9.2 Telephony conformance testing

The relevant document describing the conformance testing of the DECT telephony requirements is EN 300 176-2 [16]. EN 300 176-2 [16] is applicable to DECT equipment providing 3,1 kHz speech telephony applications.

9.3 Protocol conformance testing

Protocol testing, to ensure that a particular equipment complies to a particular set of requirements specified in a particular standard, is an extremely complex issue. This clause describes briefly how the various conformance test documents relate to each other. More extensive information for DECT conformance testing may be found in TR 102 183 [94]. The DECT conformance testing concept is closely aligned with the one standardized in the ISO/IEC 9646 [109] series.

9.3.1 The Protocol Implementation Conformance Statement (PICS)

The prerequisite to an Abstract Test Suite (ATS) development for a base standard is the development of a PICS standard listing all capabilities related to the particular protocol together with the required status for each particular capability. The PICS for the case of the DECT CI is the EN 300 476 [28] to [34]. EN 300 476 provides protocol capabilities requirements status for the 3 DECT protocol layers: MAC, DLC and NWK. It is in the form of a questionnaire on the status of each requirement in the Base Standard.

9.3.2 The Test Case Library (TCL)

As it has been mentioned earlier the DECT standardization work has taken the approach of an intensive development of profiles based on the DECT CI standard and if relevant on standards related to the particular network DECT is accessing. Depending on the set of features a profile is supporting and the services it offers it is therefore possible for a set of tests to be common for a number of profiles.

Behind the EN 300 497 parts 1 [38] to 9 [46] DECT CI TCL lays the idea of establishing a collection of test cases that is to be used for conformance testing for a set of standards. If relevant tests exist in this library, the profile test specifications make reference to these instead of describing the tests all over again.

The standard provides protocol testing for the 3 DECT protocol layers MAC, DLC and NWK both PT and FT with emphases on tests needed by the GAP and CAP profiles. The Physical layer testing is covered by EN 300 176-1 [15].

9.3.3 The Profile Implementation Conformance Statement (Profile ICS)

Each DECT profile further clarifies the status of a sub-set of the Base Standard capabilities that have been identified as relevant to the profile. This is done by referencing the PICS and modifying the status of the requirements when necessary. Capabilities that form part of the profile sub-set but do not require changes to the status in the relevant PICS may be excluded from the Profile ICS.

If a profile is intended to include services covered by other DECT profiles, references to the relevant Profile ICS(s) and the related capability requirements listed in that Profile ICS(s) may be included (e.g. in the case for DECT/GSM IWP ICS, ETS 300 704 parts 1 [52] and 2 [53] references to GAP ICS, EN 300 474 parts 1 [26] and 2 [27] are made).

If a profile is intended to cover access to other non DECT systems references to the relevant PICS(s) and related capability requirements listed in that non DECT PICS(s) may be included (e.g. in the case for DECT/ISDN ES ICS, ETS 300 705 parts 1 [54] and 2 [55] references to EN 300 052 parts 1 [9] to 6 [14] are made).

9.3.4 The Profile Test Specification (PTS) standards

For each DECT profile there should be a Profile Test Specification standard which identifies the test purposes and test cases which are relevant for the particular profile. This is done by cross referencing the appropriate test purposes and tests in the Base Standard ATS or any relevant PTS (e.g. TCL, GAP PTS or any other relevant non DECT standard Protocol or Profile ICS). If a test purpose is recognized as relevant but the TCL test case is not applicable to a specific application profile, new test cases may be provided. Further profile specific test purposes and test cases may be added if required.

9.4 WRS conformance requirements

The use of WRS is not any longer profile independent, a CRFP interworking with GAP-based Fixed Parts is defined. The relevant documents for conformance testing of WRS equipment are given in figure 23.

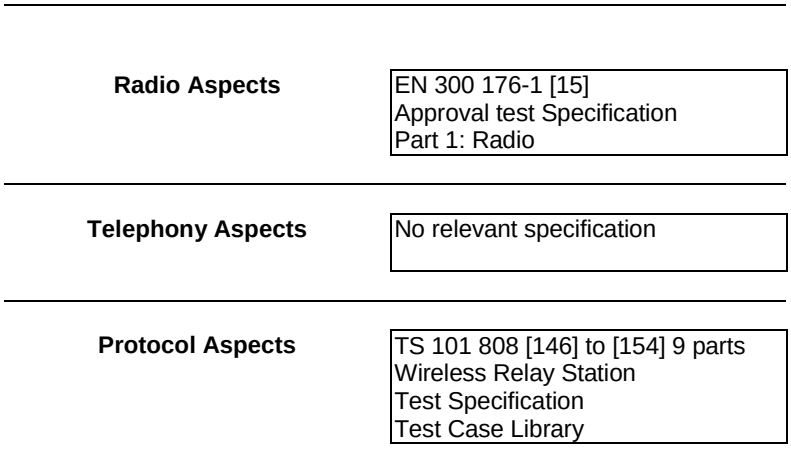


Figure 23: Conformance testing documents related to WRS

9.5 DAM conformance requirements

The DECT Authentication module could be used to provide subscription data in conjunction with any DECT application profile. There are conformance test documents both for the DAM cards (ETS 300 759 [61], ETS 300 760 [62]).

9.6 Other conformance requirements

There may be a need to check conformance to other standards, for example electromagnetic compatibility, safety, network standards (for FPs). These are not covered further in the present document.

9.7 Documents applicable to specific profiles

9.7.1 GAP

The relevant documents for conformance testing of GAP equipment are given in figure 24.

Radio Aspects	EN 300 176-1 [15] Approval test Specification Part 1: Radio
Telephony Aspects	EN 300 176-2 [16] Approval test Specification Part 2: Speech
Protocol Aspects	EN 300 476 [28] to [34] 7 parts Common Interface PICS proforma
	EN 300 497 [38] to [46] 9 parts Common Interface Test Case Library
	EN 300 474 [26] and [27] 2 parts Generic Access Profile Profile ICS proforma
	EN 300 494 [35] to [37] 3 parts Generic Access Profile Profile Test Specification

Figure 24: Conformance testing documents related to GAP

9.7.2 DPRS

For DPRS EN 300 176-2 [16] does not apply because it is without 3,1 kHz speech components.

The relevant documents for conformance testing of DPRS are given in figure 25.

Radio Aspects	EN 300 176-1 [15] Approval test Specification Part 1: Radio
Telephony Aspects	Not applicable
Protocol Aspects	EN 300 476 [28] to [34] 7 parts Common Interface PICS proforma
	EN 300 497 [38] to [46] 9 parts Common Interface Test Case Library
	EN 301 469 [118] to [126] 9 parts DPRS Test Case Library
	TS 101 869 [128] to [129] 2 parts DPRS Profile ICS proforma
	TS 101 950 [155] DPRS Interoperability Test Specification

Figure 25: Conformance testing documents related to DPRS

9.7.3 Application Specific Access Profile (ASAP)

Since DMAP, Ethernet and V.24 refer to both GAP and DPRS this is also reflected in which conformance test specifications are needed.

The relevant documents for conformance testing of DMAP, Ethernet or V.24 conform equipment are given in figure 26.

Radio Aspects	EN 300 176-1 [15] Approval test Specification Part 1: Radio
Telephony Aspects	EN 300 176-2 [16] Approval test Specification Part 2: Speech
Protocol Aspects	EN 300 476 [28] to [34] 7 parts Common Interface PICS proforma
	EN 300 497 [38] to [46] 9 parts Common Interface Test Case Library
	EN 300 474 [26] and [27] 2 parts Generic Access Profile Profile ICS proforma
	EN 300 494 [35] to [37] 3 parts Generic Access Profile Profile Test Specification
	EN 301 469 [118] to [126] 9 parts DPRS Test Case Library
	TS 101 871 [130] to [131] 2 parts DECT Multimedia Access Profile (DMAP) Profile ICS proforma
	TS 101 859 [135] to [137] 3 parts DECT Multimedia Access Profile (DMAP); Profile Test Specification (PTS)
	TS 102 011 [159] DECT V.24 Interworking; Profile ICS proforma
	TS 102 012 [160] DECT V.24 Interworking; Profile Test Specification (PTS)
	TS 102 013 [162] DECT Ethernet Interworking; Profile ICS proforma
	TS 102 014 [163] DECT Ethernet Interworking; Profile Test Specification (PTS)

Figure 26: Conformance testing documents related to ASAPs

9.7.4 Other Data Service Profiles (DSPs)

As the data profiles are (in general) without 3,1 kHz speech components, EN 300 176-2 [16] does not apply.

The relevant documents for conformance testing of Data equipment are given in figure 27.

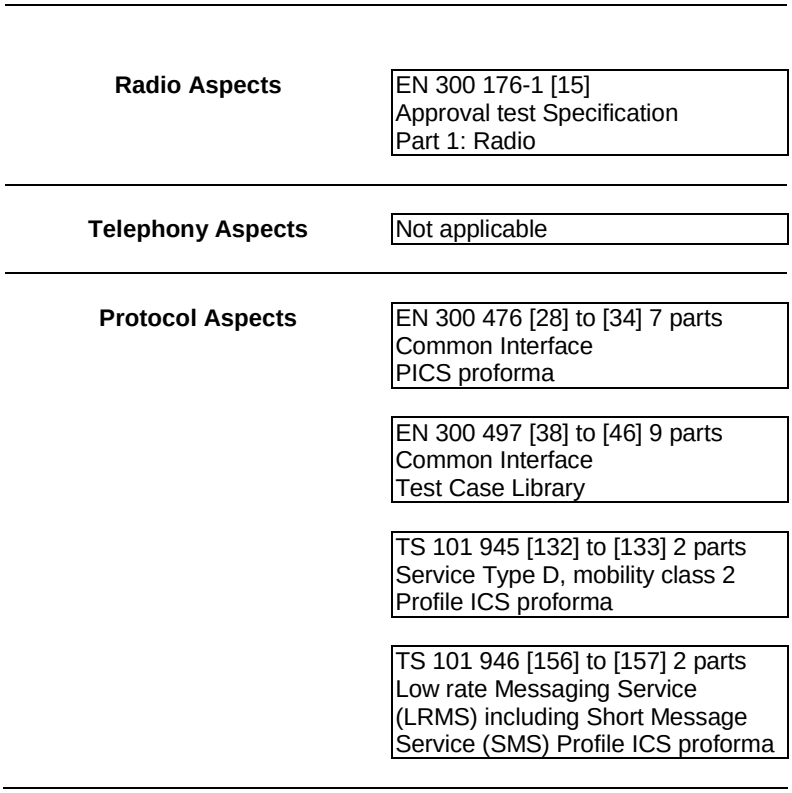


Figure 27: Conformance testing documents related to DSPs

NOTE: There are no test standards developed for ODAP [174] and DECT F-MMS [175] interworking profiles.

9.7.5 ISDN End System

The relevant documents for conformance testing of ISDN ES equipment are given in figure 28. If an ES application supports 3,1 kHz voice telephony, the GAP conformance testing documents are also applicable.

Radio Aspects	EN 300 176-1 [15] Approval test Specification Part 1: Radio
Telephony Aspects (where 3,1 kHz voice telephony service is supported)	EN 300 176-2 [16] Approval test Specification Part 2: Speech
Protocol Aspects	EN 300 476 [28] to [34] 7 parts Common Interface PICS proforma
	EN 300 497 [38] to [46] 9 parts Common Interface Test Case Library
	ETS 300 705 [54] to [55] 2 parts ISDN ES Profile ICS proforma
	ETS 300 758 [58] to [60] 3 parts ISDN ES Profile Test Specification
where 3,1 kHz voice telephony service is supported:	EN 300 474 [26] and [27] 2 parts Generic Access Profile Profile ICS proforma
	EN 300 494 [35] to [37] 3 parts Generic Access Profile Profile Test Specification

Figure 28: Conformance testing documents related to ISDN ES

9.7.6 ISDN Intermediate System

Where 3,1 kHz voice telephony is supported, EN 300 176-2 [16] applies to the FP. The 3,1 kHz telephony requirements for the PT have to be derived from EN 300 176-2 [16] and the terminal telephony parameters. EN 300 176-1 [15] applies for the radio aspects.

Radio Aspects	EN 300 176-1 [15] Approval test Specification Part 1: Radio
Bearer services (where 3,1 kHz voice telephony service is supported)	EN 300 176-2 [16] Approval test Specification Part 2: Speech (see text above)
Protocol Aspects	EN 300 476 [28] to [34] 7 parts Common Interface PICS proforma
	EN 300 497 [38] to [46] 9 parts Common Interface Test Case Library
	EN 301 241 [74] to [75] 2 parts ISDN IS Profile ICS proforma
	EN 301 614 [84] to [86] 3 parts ISDN IS Profile Test Specification
where 3,1 kHz voice telephony service is supported:	EN 300 474 [26] and [27] 2 parts Generic Access Profile Profile ICS proforma
	EN 300 494 [35] to [37] 3 parts Generic Access Profile Profile Test Specification

Figure 29: Conformance testing documents related to ISDN IS

9.7.7 CTM applications

The relevant documents for conformance testing of CAP equipment are given in figure 30.

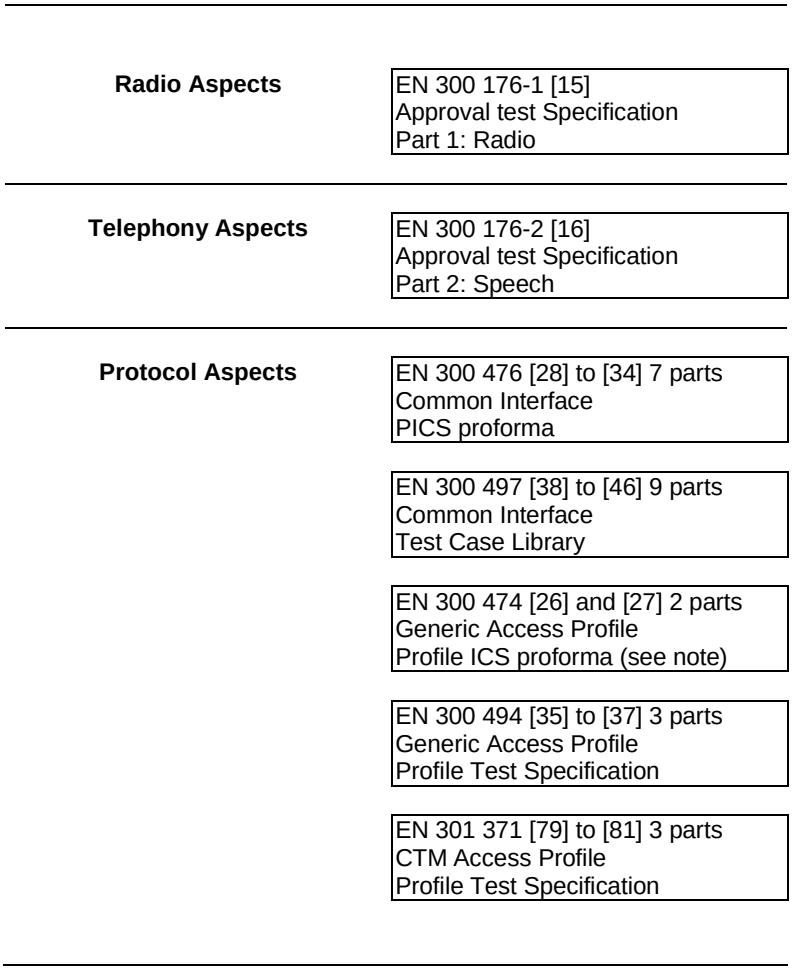
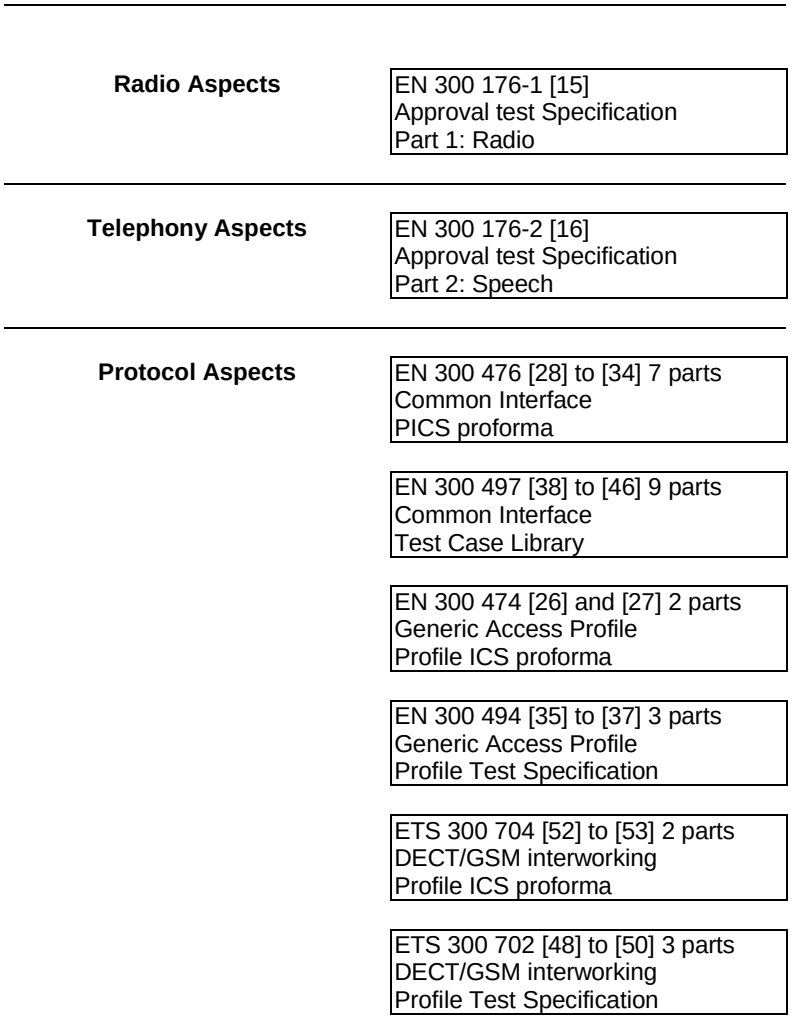


Figure 30: Conformance testing documents related to CAP

9.7.8 DECT/GSM interworking applications

The relevant documents for conformance testing of DECT/GSM equipment are given in figure 31.

Radio aspects are covered by EN 300 176-1 [15]. Telephony aspects are covered by EN 300 176-2 [16]. There are test specifications related to the basic telephony aspects of EN 300 370 [20], but at the time of writing there are no conformance test specifications related to other GSM applications, e.g. supplementary services, SMS, fax, etc.



NOTE: The above documents cover basic telephony only. There are no test standards for SMS, fax, supplementary services, etc.

Figure 31: Conformance testing documents related to DECT/GSM

9.7.9 DECT/GSM Dual Mode Terminals

The relevant documents for conformance testing of the DECT-Part of DECT/GSM Dual Mode Terminals depend on the application of the DECT part. At least the GAP-relevant conformance testing documents apply, see clause 9.7.1. In addition other conformance testing documents may apply depending on the application e.g. CAP, DMAP, etc.

For the GSM-Part the relevant GSM conformance testing documents apply which are out of scope of the present document. For more information in this issue refer to TR 101 072 [99].

9.7.10 RLL Access Profile (RAP)

The relevant documents for conformance testing of RAP equipment are given in figure 32.

EN 300 176-2 [16] applies to the FP. The requirements for the PT have to be derived from EN 300 176-2 [16] and the PSTN telephony parameters (which will vary between different countries). EN 300 176-1 [15] applies for the radio aspects.

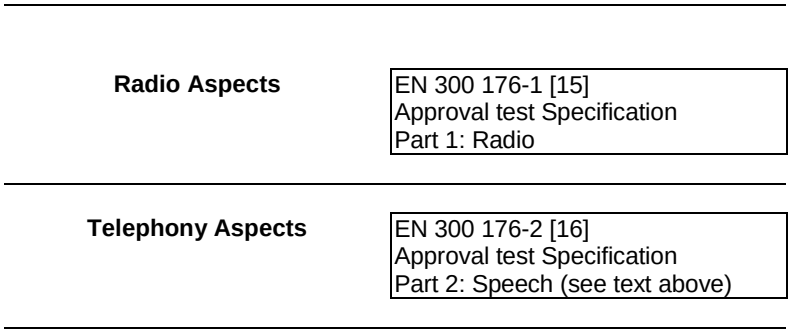


Figure 32: Conformance testing documents related to RAP

9.7.11 DECT access to IP networks profile

There are no testing standards developed for the DECT access to IP networks [173] profile.

9.8 Interoperability testing

Whereas the conformance testing focuses on relatively static assessment of product compliance to the requirements specified by the protocol or the profile, i.e. the correct semantic and syntax implementation of PDUs and the requirements regarding their exchange, the interoperability testing focuses on the real life assessment whether two products can work together in order to provide the user with a satisfactory service.

Conformance testing can guarantee a good level of interoperability between products but only a true interoperability testing standard can achieve sufficient assessment of compliance to standards in regard to interoperability.

The TS 101 950 [155] DPRS Interoperability test specification is an excellent example in this direction. It describes testing scenarios, testing tools, testing procedures, and assessment criteria for testing DPRS compliant products for interoperability. The testing does not require sophisticated testing tools rather it assumes availability of an air monitoring device and can be performed in any desirable environment.

10 Regulatory

This clause covers the regulatory regime for DECT equipment in the member states of the EU. The regulatory situation in non-EU states is outside the scope of the present clause.

10.1 The R&TTE Regime

In light of the European Community's key objective of creating an open single competitive market, a regulatory regime for radio equipment and telecommunications terminal equipment allowing manufacturers greater flexibility in marketing their products was established by the R&TTE Directive [134]. As a result, the earlier Terminal Directive regime (Directive 98/13/EC) was superseded in April 2000 by the R&TTE regime.

Key to the new regime are essential requirements which equipment within the scope of the Directive must satisfy before it may be placed on the single market - these essential requirements differ from those under the previous regime. A more fundamental difference is that, subject to certain conditions, manufacturers may declare compliance with the essential requirements themselves, without having to consult a notified body, and therefore place their equipment on the market without any delay.

10.1.1 Essential Requirements

The essential requirements under article 3 of the R&TTE Directive [134] are shown in table 3.

Table 3: Article 3 of the R&TTE Directive

1. The following essential requirements are applicable to all apparatus: (a) the protection of the health and the safety of the user and any other person, including the objectives with respect to safety requirements contained in Directive 73/23/EEC, but with no voltage limit applying; (b) the protection requirements with respect to electromagnetic compatibility contained in Directive 89/336/EEC [103]; 2. In addition, radio equipment shall be so constructed that it effectively uses the spectrum allocated to terrestrial/space radio communication and orbital resources so as to avoid harmful interference. 3. The Commission may also decide (see note) that apparatus within certain equipment classes or apparatus of particular types shall be so constructed that: (a) it interworks via networks with other apparatus and that it can be connected to interfaces of the appropriate type throughout the Community; and/or that (b) it does not harm the network or its functioning nor misuse network resources, thereby causing an unacceptable degradation of service; and/or that (c) it incorporates safeguards to ensure that the personal data and privacy of the user and of the subscriber are protected; and/or that (d) it supports certain features ensuring avoidance of fraud; and/or that (e) it supports certain features ensuring access to emergency services; and/or that (f) it supports certain features in order to facilitate its use by users with a disability.
NOTE: In accordance with the procedure laid down in article 15 of the Directive.

Hence, as a rule, telecommunications terminal equipment is subject to the requirements of article 3(1) only, while radio equipment (in this case DECT) is required to comply with article 3(1) and, additionally, article 3(2).

As a rule, the requirements under article 3(3) are not applicable to either radio equipment or telecommunications terminal equipment. Only when the Commission decides that compliance with a requirement under article 3(3) is necessary does this requirement become applicable. Until now that is not the case for DECT. The Commission has, however, stated that it intends to apply these requirements sparingly and in justified cases only. The aim is for the market to regulate these aspects itself on a voluntary basis.

To simplify, it could be said that, currently, the R&TTE Directive [134] only ensures that the use of radio equipment or telecommunications terminal equipment does not pose a threat to the life and limb of the user and that no excessive interference is caused to the radio spectrum.

Generally speaking, the new R&TTE Directive [134] has considerably decreased the depth of regulation.

This means, for instance, that the application of harmonized standards does not automatically imply interoperability at or with a specific interface, unlike the interoperability guaranteed at the GSM or DECT air interface, for example, through application of the earlier CTRs.

As a result, regulation loses its characteristic strength of ensuring the interworking of terminal equipment with its network. This is currently seen as a self-regulatory task of the market, with market players (manufacturers, network operators) themselves voluntarily agreeing and guaranteeing such interworking.

10.1.2 Harmonized Standards

The Commission (after consultation with the Member States through the Telecommunication Conformity Assessment and Market Surveillance Committee, TCAM) issues mandates to ETSI, and to other European standardization bodies recognized by the EU, to develop documents for use as harmonized standards under the R&TTE Directive [134] and covering specific essential requirements. The candidate harmonized standards are usually drawn up by ETSI using the same approval procedures as for a European Norm (EN) and are then forwarded to the Commission with a request for publication in the OJ. Once a candidate harmonized standard has been published in the OJ, it can be applied as a harmonized standard for assessing and declaring compliance with the essential requirements under the R&TTE Directive [134].

Manufacturers using a harmonized standard for declaring conformity with the essential requirements are always on the safe side because, as stated in article 5(1) of the R&TTE Directive [134], compliance with the essential requirements covered by the standard can then be presumed.

Examples for Harmonized Standards for DECT are:

a) Covering article 3.1 b requirements:

   - EN 301 489-6 [145].

b) Covering article 3.2 requirements:

   - EN 301 406 [164]; and

   - EN 301 908-10 [166], for the UMTS band.

10.1.3 Placing on the market and putting into service and right to connect

Equipment meeting the essential requirements of the R&TTE Directive [134] must not be required by Member States to comply with any additional provisions in respect of placing on the market. The simplest way for manufacturers to prove such compliance is to apply a harmonized standard, if available, which Member States will recognize.

The Commission's essential objective behind the R&TTE Directive [134] is to ensure the placing on the market and putting into service in the Member States of (radio) equipment which meets the essential requirements of the Directive.

The Member States and the Commission largely agree in respect of the placing on the market. However, the "putting into service in their territory of apparatus bearing the CE marking", Articles 7 and 8 of the R&TTE Directive [134], has become the subject of discussion in the case of equipment intended for frequency bands whose use is not harmonized throughout the Community.

Frequency bands whose use is not harmonized throughout the Community are currently still the rule.

However, the use of the DECT band 1 800 MHz to 1 900 MHz is considered harmonized in the Community by a TCAM agreement (and no notification according to article 6.4 of the R&TTE Directive [134] is required).

10.1.4 Declaration of conformity with the essential requirements

The mandatory procedure for declaring conformity with the essential requirements of article 3 of the R&TTE Directive [134] is described in article 10 of the Directive.

10.2 Documents relating to the European old regulatory regime

Documents relating to the previous European regulatory regime, are for example ETSI Technical Basis for Regulations (TBRs). Some TBRs will still have value for conformance testing, but have no regulatory impact in Europe. Some non-European countries may still have regulations related to DECT TBRs.

11 Summary of the DECT Technical Reports

ETSI Technical Reports support the introduction and application of the DECT standards.

11.1 ETR 041: DECT transmission aspects; 3,1 kHz telephony

ETR 041 [89] contains a detailed description of the 3,1 kHz telephony application contained in the Base Standard plus associated information on DECT 3,1 kHz telephony interworking with various networks. This ETR was written by ETSI Technical Committee Transmission and Multiplexing (TC-TM).

11.2 ETR 043: DECT services and facilities

ETR 043 [90] describes the range of services and facilities which DECT is required to provide and support. The information is intended to be network and product independent. The information, though covering all DECT services and facilities, is of general descriptive nature. The document describes basic transmission services, the basic bearer services and various network applications.

11.3 ETR 056: DECT system description document

An overall description of the DECT system in terms of inter-working and interfacing to local and public networks such as PSTN, ISDN, X.25 etc. is provided in ETR 056 [91]. Emphasis has been placed on the special features of DECT, for example the identity structures allowing for attachment to different network types, aspects of mobility management, etc. along with recommendations for efficient inter-working of DECT and various networks. ETR 056 [91] formed a basis for the first specification of DECT, but has not been updated to cover the latest developments. It needs therefore to be remembered that DECT in addition to the PSTN, ISDN, X.25 PSPDN and GSM PLMN also has interworking specifications to Internet (including TIPHON), UMTS (IMT-2000) and B-ISDN regarding global networks.

11.4 ETR 139: Radio in the Local Loop

ETR 139 [92] is not specifically related to DECT. It examines technologies in use or under development in Europe for Radio in the Local Loop. ETR 139 [92] defines the relevant applications and services appropriate to radio access in the local loop network, and considers existing and recognized standards and technologies in Europe suitable for RLL and assesses the operational and regulatory issues associated with RLL. ETR 308 [97], TR 101 310 [101] and TR 101 370 [102] relate specifically to DECT RLL.

11.5 ETR 159: DECT wide area mobility using GSM

ETR 159 [93] describes the possible requirements when a DECT system is attached to a GSM fixed network. ETR 159 [93] provides an introduction to the requirements of wide area mobility, and describes how the GSM network can be a basis for wide area DECT mobility, utilizing the mobility functions available in GSM but not available in PSTN.

11.6 TR 102 183: Testing a DECT equipment

TR 102 183 [94] provides an introduction in DECT conformance testing. It gives a general overview on the DECT system, an introduction on conformance testing and DECT conformance testing in particular. It further shows how an ETSI customer can use the DECT Conformance test standards.

TR 102 183 [94] contains an abstract of the DECT standard, the ISO/IEC 9646 [109] standard and the resulting issues from applying the requirements and techniques of ISO/IEC 9646 [109] on the DECT protocol stack together with a set of examples derived from the currently available test specification material from the test suites for different DECT layers.

11.7 TR 102 185 DECT Data Services Profile; overview

TR 102 185 [95] describes the objectives, structure and content of the DECT Data Services Profiles, which define a set of profile standards for systems conforming to the DECT standard. They are a family of profile standards which build upon, and extend, each other, aimed at the general connection of terminals offering non-voice services between themselves or to other communications network, both public and private, via a DECT Fixed Part.

TR 102 185 [95] also describes possible user scenarios in wireless computing. These scenarios have formed the guidelines of the DECT Data Services Profiles.

11.8 ETR 246: DECT Wireless Relay Stations

An overall description of Wireless Relay Stations (WRS) is provided in ETR 246 [96]. WRS is an additional building block for the DECT fixed network. It is suitable to provide cost effective infrastructures for low traffic density applications.

11.9 ETR 308: DECT Services and configurations for RAP

ETR 308 [97] provides a comprehensive review of all the services and features related to RLL applications, including basic PSTN analogue telephone replacement and more advanced services. It also identifies the many possible RLL configurations. It provides detailed information on the features, which need to be supported by the DECT RAP profiles. Much of the information is also relevant to RLL applications using other technologies.

ETR 308 [97] examines in detail the specific services that may be offered by DECT RLL. It identifies the basic wired analogue PSTN services that could be replaced by an RLL system, and also identifies that there are market opportunities for very much more advanced services than are possible with today's "standard telephones".

11.10 ETR 341: DECT/GSM interworking profile overview

ETR 341 [98] gives an overview and description of the standards within the DECT/GSM Inter-Working Profile (IWP).

11.11 TR 101 072: DECT/GSM Integration based on dual-mode terminals

TR 101 072 [99] investigates radio and network aspects and clarifies the possibilities as well as the problems related to dual-mode terminals.

TR 101 072 [99] focuses on possible early implementations in the sense that it identifies how basic Dual Mode Terminals (DMTs) can be type approved using existing TBRs. For GSM, both phase 1 and phase 2 specifications are considered.

11.12 TR 101 159: Implementing DECT in an arbitrary spectrum allocation

TR 101 159 [100] is a guide how to implement and test DECT systems operating at frequencies outside the frequency-bands described in EN 300 175-2 [2]. The need to have this arises if DECT equipment is to be adapted to national requirements of countries which do not allow to use the basic 1 880 MHz to 1 900 MHz DECT frequency band. TR 101 159 [100] is partly outdated, because EN 300 175-2 [2] presently includes much broader frequency band definitions than TR 101 159 [100].

11.13 TR 101 178: A high level guide to the DECT standardization

The present document.

It provides a high level description of the various components of the DECT standardization. It is directed to a wide audience, regulators, operators, manufacturers and others, and attempts to provide a basic overview of the DECT standards, without requiring detailed technical knowledge of DECT as a prerequisite.

11.14 TR 101 310: DECT Traffic capacity and spectrum requirements

TR 101 310 [101] describes the traffic capacity and the spectrum requirements for multi-system and multi-service DECT applications coexisting on a common frequency band.

Configurations for typical DECT applications, and relevant mixes of these, including residential, office, public and RLL applications, are defined and the traffic capacity is analysed, mainly by advanced simulations. These results are used together with relevant deployment scenarios to estimate spectrum requirements for reliable services, specifically for a public multi-operator licensing regime. Recommendations are given on conflict solving rules that conserve the high spectrum efficiency gain of shared spectrum while maintaining control of the service quality in one's own system. These recommendations cover synchronization, directional gain antennas, traffic limits per DECT Radio Fixed Part (RFP), use of Wireless Relay Stations (WRS), different rules for private and public operators and procedures needed for timely local adjustments where and when the local traffic increases.

11.15 TR 101 370: Implementing DECT Fixed Wireless Access (FWA) in an arbitrary spectrum allocation

TR 101 370 [102] is a guide how to implement and test DECT FWA (WLL) systems operating in TDD and FDD duplex modes at frequencies outside the frequency-bands described in EN 300 175-2 [2]. The need to have this arises if DECT equipment is to be adapted to national frequency allocations that differ from the basic 1 880 MHz to 1 900 MHz DECT frequency band. This includes the radio frequency bands for Fixed Services within 2 200 MHz to 105 GHz and has special focus on applications in the 3,4 GHz to 3,7 GHz band.

11.16 TR 102 010: DECT access to IP networks

TR 102 010 [165] describes the scenarios, services and related features for a wireless access to IP-networks using the Digital Enhanced Cordless Telecommunications (DECT) system. The reference configuration, network architecture and the network functional entities are described. Specific issues are further investigated and possible further standardization areas are identified.

11.17 Other TRs

Other TRs, finished or under preparation, are given in the table of DECT documents in annex A.

12 Market acceptance and product availability of DECT

12.1 Countries with spectrum for DECT applications

DECT is a world wide standard.

DECT is also an ITU IMT-2000 [139] family member, called IMT-FT, the only member that provides for uncoordinated installations on an unlicensed spectrum (see clause 6.1.2.5).

DECT has already since many years spectrum allocated within the IMT-2000 bands available in more than 110 countries (information from DECT Forum).

DECT carriers are specified [2] for the whole frequency range 1 880 MHz to 1 980 MHz and 2 010 MHz to 2 025 MHz. The exact DECT carrier positions can be found in clause B.4.

The most common protected spectrum allocation is 1 880 MHz to 1 900 MHz, but outside Europe spectrum is also available in 1 900 MHz to 1 920 MHz and in 1 910 MHz to 1 930 MHz (several countries in Latin America).

For applications and spectrum for the North American market see clause 12.3.

12.2 System types

The majority DECT shipments are in residential and small business applications in Europe. DECT dominates the European cordless residential market and the enterprise local (PABX) voice mobility market, and is expected to do for several years ahead. The voice services dominate, but data applications increase.

DECT has proved to be cost effective for the low end consumer market, having potential for further cost reductions.

The DECT Dynamic Channel Selection and quick Handover procedures have also proved to be efficient and reliable for large office/industrial indoor/outdoor installations with 4 000 to 5 000 users per installation.

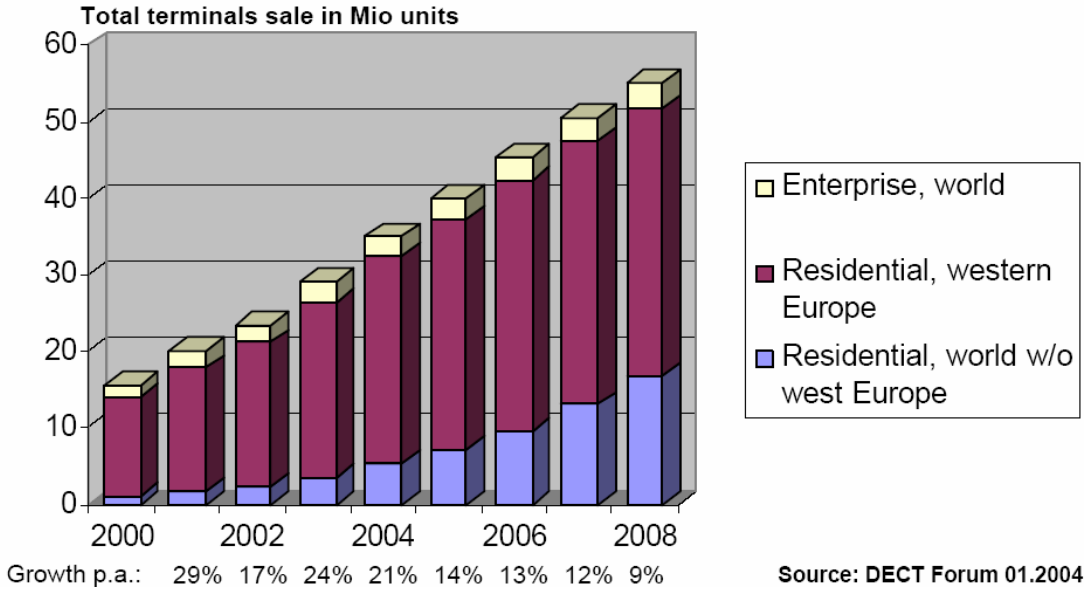


Figure 33: Number of shipped DECT units per year

DECT is a mass market technology (see figure 33 on annual sales). The residential applications dominate. Second comes the enterprise market. Third, not shown on the figure, comes DECT Wireless Local Loop (WLL) systems with markets predominantly in India, Africa and South America.

DECT is also technically well suited for public pedestrian and WLL applications. Interoperability profile standards are available for both applications. There are possibilities to have a common infrastructure for pedestrian and WLL applications (see clause 12.4). However, the general availability of subsidized cellular phones combined with low cost and low commitment subscription alternatives, limit the business opportunities for DECT public pedestrian implementations.

The WLL applications support voice telephony, ISDN and packet data internet user data access up to a few hundreds of kbps. This suits needs in developing countries. With the introduction of broadband DECT, IP based VoIP and high data speed RLL solutions are possible. Being optimized for a low cost and low power consumption, together with the minimization of size, makes DECT suitable for various home and industrial appliances solutions, e.g. wireless sensors, alarms, surveillance systems, etc.

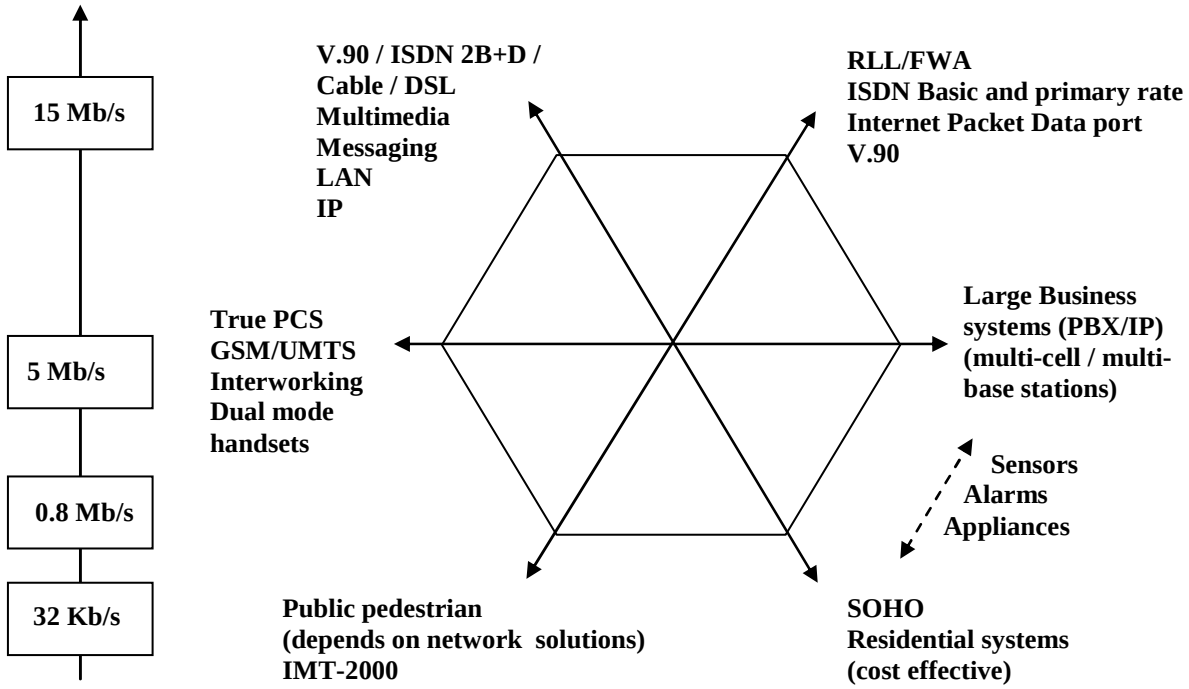


Figure 34: Graphic high level overview of DECT services and applications

12.3 DECT in the USA

The Personal Wireless Telecommunications interoperability standards, PWT and PWT/E, in North America (standardized within the Telecommunications Industry Association, TIA), are based on DECT and provide basically the same services as DECT. PWT and PWT/E uses the DECT frame structure, MAC, DLC, etc., but has a different modulation and different bandwidth and carrier spacing to meet local regulatory requirements. PWT operates in the US Unlicensed Personal Communications Service (UPCS) band 1 920 MHz to 1 930 MHz. PWT-E is an extension into the licensed bands 1 850 MHz to 1 910 MHz and 1 930 MHz to 1 990 MHz. PWT may also be allowed in some Latin American countries. Since September 2004 standard DECT (with some minor modification, e.g. transmit power) can be applied in the US within the 1 920 MHz to 1 930 MHz UPCS band [176].

Standard DECT, as well, can since May 2002 be applied in the US within the ISM bands 902 MHz to 928 MHz, 2 400 MHz to 2 483,5 MHz and 5 725 MHz to 5 850 MHz [138] and [2].

NOTE 1: UPCS provides a protected spectrum. The 20 MHz spectrum designated for DECT in Europe and many other countries require that equipment using this spectrum have to comply to the DECT dynamic channel selection procedures, power levels etc. Such a spectrum is here called a protected DECT spectrum. It provides for maintained high spectrum efficiency and maintained high quality radio links (e.g. speech and video) in an environment of a multitude of uncoordinated system installations. For the UPCS band there are also basic channel access rules etc. [176], which define (a family of) technologies that coexist well in an environment of uncoordinated system installation. The basic access rules are compatible with DECT access rules. Therefore, from a DECT perspective, the UPCS band is also a protected spectrum. However, since a broader range of system parameters are accepted for the UPCS band, than for a 'pure' DECT band, spectrum efficiency becomes somewhat lower for the UPCS band.

NOTE 2: The IMS band is unprotected. Opposite to a protected DECT spectrum, or the protected UPCS spectrum, allowing for uncoordinated DECT installations, the ISM bands allows for uncoordinated usage of a variety of incompatible communication devices and also industrial, scientific and medical devices. Therefore maintenance of high quality of service will not be guaranteed when other types of ISM devices (non-DECT devices) are used in the same local area. This applies especially to voice and video services, but is less critical for best effort packet data services, where non-time-critical retransmissions are applied. The band 902 MHz - 928 MHz could be preferred over the 2 400 MHz to 2 483,5 MHz band due to lack of potential interference from IEEE 802.11b WLANs, microwave ovens and Bluetooth devices. The 900 MHz spectrum provides better range than the 2,4 GHz spectrum.

12.4 Fixed/mobile service integration

The emerging deregulation of fixed services will speed up fixed-mobile convergence in service offerings from operators. The different DECT interoperability profile standards are designed to facilitate provision of mixtures of fixed and mobile services through a single infrastructure. The powerful and flexible DECT identity structure, also provides mixture of private and public access rights in the same infrastructure, and provides means for private wireless sub networks in public networks. Figures 35a, 35b and 35c give an overview of possible scenarios.

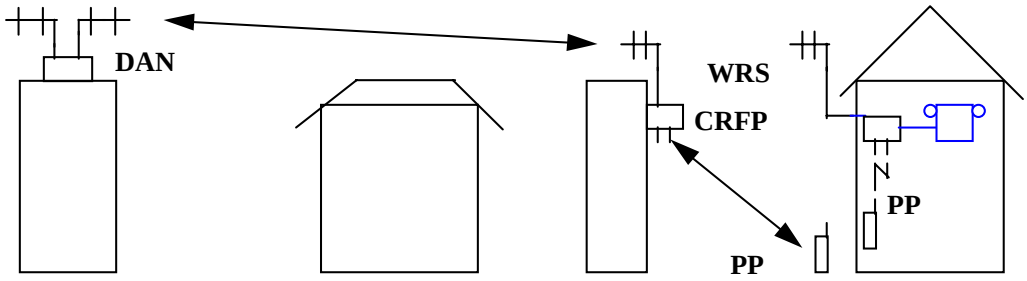


Figure 35a: DECT fixed/mobile integration

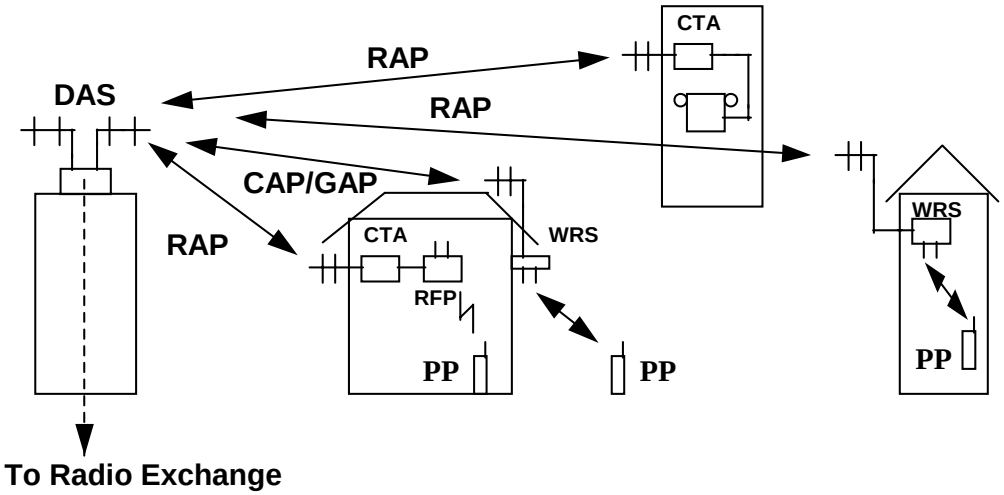


Figure 35b: DECT fixed/mobile integration

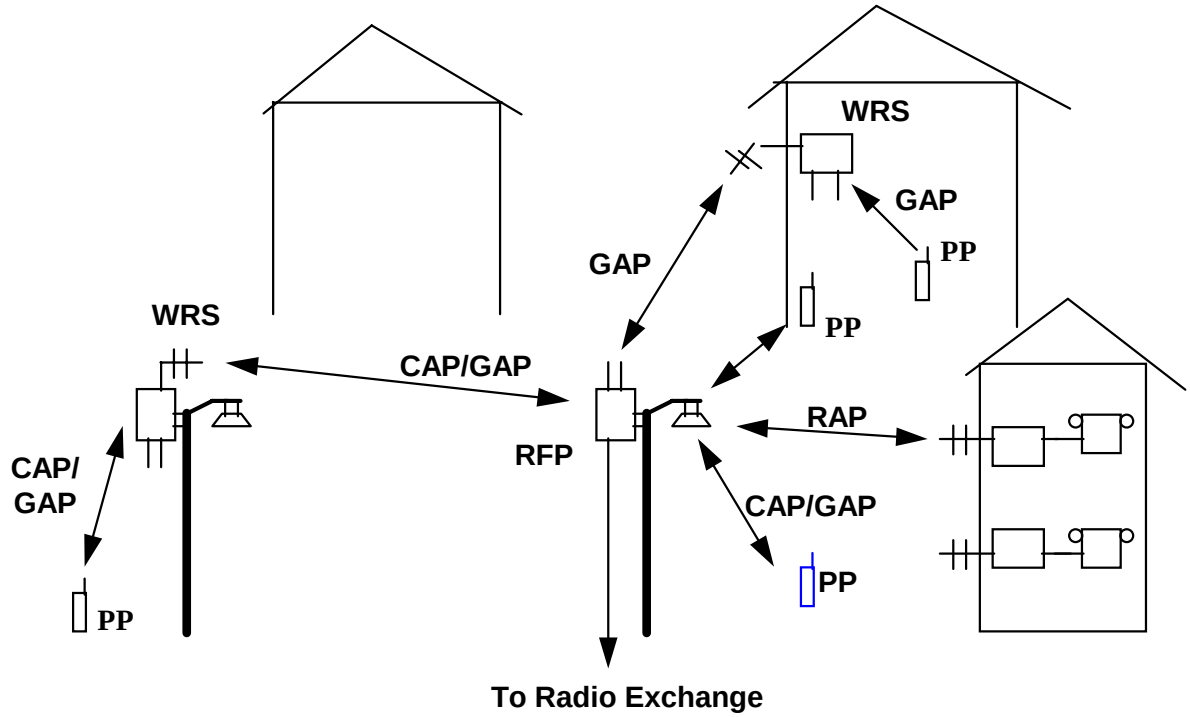


Figure 35c: DECT fixed/mobile integration

For new operators it is important that the technology chosen is a recognized standard with testable standardized air interfaces, and with product support from most major suppliers. DECT offers this support.

Secondly, it has to provide the platform for present and future application of ISDN, Internet and other Multimedia services, both as RLL (WLL) services to offices and residents as well as for wireless services within offices and residents and for public mobility services. DECT provides this platform as it can be seen in figure 1.

13 New developments of DECT

The DECT standard is a very complete radio access standard. There are over 100 million DECT units in operation (2002). Together with DECT/GSM/UMTS interworking and dual (triple mode) mode handsets, evolving products could provide many required future mobile radio services.

One essential requirement in the scope of the DECT Standardization is flexibility for additions and evolutionary applications. This has been provided by the above described tool box concept, and is further amplified by the provision of escape codes and a multitude of reserved codes in messages in every layer of the specification. These reserved codes are reserved for future ETSI defined enhancements and for proprietary additions.

Besides defining new profiles from the existing tool box, it is also easy to add new contents to the tool box. Examples of new contents are 7 kHz telephony service provision, low bit rate speech codecs, lower and higher transmission bit rate options, new or extended frequency allocations (pan-European, national or outside Europe). Equipment based on these new features, could be required to be compliant to GAP or not, dependent upon the application.

It is possible to go further, e.g. by defining a dual mode physical layer, where the second layer is optimized for long range or for higher bit rates.

For new developments readers should consult the EP DECT standardization area on the ETSI web portal at http://portal.etsi.org (DECT).

Annex A:
Summary table of DECT standards

The following tables list the DECT deliverables as of the time of publication of the current document.

A.1 Regulatory documents

EN	EN 301 406 [164]	Harmonized Standard for R&TTE Directive of DECT equipment	Published
EN	EN 301 908-10 [166]	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS) and User Equipment (UE) for IMT-2000 Third-Generation cellular networks; Part 10: Harmonized EN for IMT-2000, FDMA/TDMA (DECT) covering essential requirements of article 3.2 of the R&TTE Directive	Published
EN	EN 301 489-6 [145]	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 6: Specific conditions for Digital Enhanced Cordless Telecommunications (DECT) equipment	Published
EN	ETS 300 329 [17]	ElectroMagnetic Compatibility (EMC) for Digital Enhanced Cordless Telecommunications (DECT) equipment	Published. Superseded by [145]

A.2 Common Interface documents

ETR	ETR 043 [90]	Services and facilities requirements specification	Published
EN	EN 300 175-1 [1]	Part 1: Overview	Published
EN	EN 300 175-2 [2]	Part 2: Physical Layer (PHL)	Published
EN	EN 300 175-3 [3]	Part 3: Medium Access Control (MAC) Layer	Published
EN	EN 300 175-4 [4]	Part 4: Data Link Control (DLC) layer	Published
EN	EN 300 175-5 [5]	Part 5: Network (NWK) layer	Published
EN	EN 300 175-6 [6]	Part 6: Identities and Addressing	Published
EN	EN 300 175-7 [7]	Part 7: Security Features	Published
EN	EN 300 175-8 [8]	Part 8: Speech Coding and Transmission	Published
EN	EN 300 176-1 [15]	Approval test specification; Part 1: Radio	Published
EN	EN 300 176-2 [16]	Approval test specification; Part 2: Speech	Published
EN	EN 300 476 [28] to [34] 7 parts	Protocol Implementation Conformance Statement (PICS) proforma	Published
EN	EN 300 497 [38] to [46] 9 parts	Test Case Library (TCL)	Published

A.3 Cordless Terminal Mobility (CTM) documents

EN	EN 300 824 [70]	CTM Access Profile (CAP)	Published
EN	EN 301 371 [79] to [81] 3 parts	CTM Access Profile (CAP); Profile Test Specification (PTS)	Published
EN	EN 302 096 [110]	Feature Package 1 (FP1); CTM circuit-switched data profile, 32 kbit/s and 64 kbit/s Unrestricted Digital Information (UDI)	Published

A.4 DECT DATA documents

TR	TR 102 185 [95]	Profile overview	Published
EN	EN 301 649 [87]	DECT Packet Radio Services (DPRS)	Published
TS	TS 101 869 [128] to [129] 2 parts	DECT Packet Radio Services; Profile requirement list and profile specific Implementation Conformance Statement (ICS) proforma	Published
EN	EN 301 469 [118] to [126] 9 parts	DPRS Test Case Library (TCL)	Published
TS	TS 101 947 [158]	DECT Packet Radio Service (DPRS); Application Specific Access Profile (ASAP): V.24 Interworking	Published
TS	TS 102 011 [159] 2 parts	DECT Packet Radio Service (DPRS); Application Specific Access Profile (ASAP): V.24 Interworking; Profile Implementation Conformance Statement (ICS)	Published
TS	TS 102 012 [160]	DECT Packet Radio Service (DPRS); Application Specific Access Profile (ASAP): V.24 Interworking; Profile Test Specification (PTS)	Published
TS	TS 101 942 [161]	DECT Packet Radio Service (DPRS); Application Specific Access Profile (ASAP): Ethernet (Eth) Interworking	Published
TS	TS 102 013 [162] 2 parts	DECT Packet Radio Service (DPRS); Application Specific Access Profile (ASAP): Ethernet Interworking; Profile Implementation Conformance Statement (ICS)	Published
TS	TS 102 014 [163]	DECT Packet Radio Service (DPRS); Application Specific Access Profile (ASAP): Ethernet Interworking; Profile Test Specification (PTS)	Published
TS	TS 101 950 [155]	DECT Packet Radio Service (DPRS); Interoperability Test Specification	Published
EN	EN 301 650 [88]	DECT Multimedia Access Profile (DMAP)	Published
TS	TS 101 871 [130] to [131] 2 parts	DECT Multimedia Access Profile (DMAP); Profile Implementation Conformance Statement (ICS)	Published
TS	TS 101 859 [135] to [137] 3 parts	DECT Multimedia Access Profile (DMAP); Profile Test Specification (PTS)	Published
ETS	ETS 300 435	Base standard including interworking to connectionless networks (service types A and B, class 1)	Historical
ETS	ETS 300 701	Generic frame relay service with mobility (service types A and B, class 2)	Historical
ETS	ETS 300 699	Generic data link service for closed user groups (service type C, class 1)	Historical
ETS	ETS 300 651	Generic data link service (service type C, class 2)	Historical
EN	EN 301 239 [73]	Isochronous data bearer services for closed user groups (service type D, mobility class 1)	Published
EN	EN 301 238 [72]	Isochronous data bearer services with roaming capability (Service Type D, mobility class 2)	Published
EN	EN 300 757 [57]	Low rate messaging service (service type E, class 2)	Published
ETS	ETS 300 755	Multimedia Messaging Service (MMS) with specific provision for facsimile services (service type F, class 2)	Historical
EN	EN 301 240	Point-to-Point Protocol (PPP) interworking for internet access and general multi-protocol datagram transport	Historical
TS	TS 101 946 [156] to [157] 2 parts	Low rate Messaging Service (LRMS) including Short Message Service (SMS); Profile requirement list and profile specific Implementation Conformance Statement (ICS) proforma	Published
TR	TR 102 179	AT command interface for DECT	Published
TS	TS 102 342 [174]	Open Data Access Profile (ODAP)	Published
TS	TS 102 379 [175]	DECT - F-MMS interworking profile	Published

A.5 Generic Access Profile (GAP) documents

EN	EN 300 444 [24]	Generic Access Profile (GAP)	Published
EN	EN 300 494 [35] to [37] 3 parts	Profile Test Specification (PTS)	Published
ETS	EN 300 474 [26] and [27] 2 parts	Profile requirement list and profile specific Implementation Conformance Statement (ICS) proforma	Published

A.6 Global System for Mobile communications (GSM)

TR	TR 101 176 [116]	DECT/GSM advanced integration of DECT/GSM dual-mode terminal equipment	Published
TR	TR 101 072 [99]	DECT/GSM integration based on dual-mode terminals	Published
ETR	ETR 341 [98]	DECT/GSM Interworking Profile (IWP); Profile overview	Published
ETR	ETR 159 [93]	Wide area mobility using GSM	Published
EN	EN 301 439 [82]	Attachment requirements for DECT/GSM dual-mode terminal equipment	Published
EN	EN 301 242 [76]	DECT/GSM integration based on dual-mode terminals	Published
EN	EN 300 370 [20]	DECT/GSM Interworking Profile (IWP); Access and mapping (protocol/procedure description for 3,1 kHz speech service)	Published
TBR	TBR 036 [115]	Global System for Mobile communications (GSM); DECT access to GSM Public Land Mobile Networks (PLMNs) for 3,1 kHz speech applications	Published
EN	EN 300 466 [25]	DECT/GSM Interworking Profile (IWP); General description of service requirements; Functional capabilities and information flows	Published
EN	EN 300 703 [51]	DECT/GSM Interworking Profile (IWP); GSM Phase 2 supplementary services implementation	Published
ETS	ETS 300 756 [56]	DECT/GSM Interworking Profile (IWP); Implementation of bearer services	Published
ETS	ETS 300 792 [68]	DECT/GSM Interworking Profile (IWP); Implementation of facsimile group 3	Published
ETS	ETS 300 764 [63]	DECT/GSM Interworking Profile (IWP); Implementation of short message service, point-to-point and cell broadcast	Published
ETS	ETS 300 499 [47]	DECT/GSM Interworking Profile (IWP); Mobile services Switching Centre (MSC) - Fixed Part (FP) interconnection	Published
ETS	ETS 300 702 [48] to [50] 3 parts	DECT/GSM Interworking Profile (IWP)	Published
ETS	ETS 300 704 [52] to [53] 2 parts	DECT/GSM Interworking Profile (IWP); Profile Implementation Conformance Statement (ICS)	Published
ETS	ETS 300 787 [66]	Integrated Services Digital Network (ISDN); DECT access to GSM via ISDN; General description of service requirements	Published
ETS	ETS 300 788 [67]	Integrated Services Digital Network (ISDN); DECT access to GSM via ISDN; Functional capabilities and information flows	Published

A.7 Integrated Services Digital Network (ISDN)

EN	EN 301 440 [83]	Attachment requirements for terminal equipment for DECT/ISDN interworking profile applications	Published
EN	EN 300 434-1 [22]	DECT/ISDN interworking for end system configuration; Part 1: Interworking specification	Published
EN	EN 300 434-2 [23]	DECT/ISDN interworking for end system configuration; Part 2: Access profile	Published
ETS	ETS 300 705 [54] to [55] 2 parts	DECT/ISDN interworking for end system configuration; Profile Implementation Conformance Statement (ICS)	Published
ETS	ETS 300 758 [58] to [60] 3 parts	DECT/ISDN interworking for end system configuration; Profile Test Specification (PTS)	Published
EN	EN 300 822 [69]	DECT/ISDN interworking for intermediate system configuration; Interworking and profile specification	Published
EN	EN 301 614 [84] to [86] 3 parts	DECT/ISDN interworking for intermediate system configuration	Published
EN	EN 301 241 [74] to [75] 2 parts	DECT/ISDN interworking for intermediate system configuration; Profile Implementation Conformance Statement (ICS)	Published
EN	EN 301 361-1 [77]	ISDN Mobility protocol Interworking specification Profile (IMIP); Part 1: DECT/ISDN interworking for Cordless Terminal Mobility (CTM) support	Published
EN	EN 301 361-2 [78]	ISDN Mobility protocol Interworking specification Profile (IMIP); Part 2: DECT/ISDN Interworking for Global System for Mobile communications (GSM) support	Published

A.8 Wireless Relay Station (WRS)

ETR	ETR 246 [96]	Application of DECT Wireless Relay Stations (WRS)	Published
EN	EN 300 700 [111]	Wireless Relay Station (WRS)	Published
TS	TS 101 808 [146] to [154] 9 parts	Wireless Relay Station (WRS); Test Case Library (TCL)	Published

A.9 General DECT reports

TR	TR 101 178	A High Level Guide to the DECT Standardization	Published (the present document)
TR	TR 102 183 [94]	Digital European Cordless Telecommunications (DECT); Testing a DECT equipment.	Published
ETR	ETR 041 [89]	Digital European Cordless Telecommunications (DECT); Transmission aspects 3,1 kHz telephony Interworking with other networks	Published
ETR	ETR 056 [91]	System description document	Published
TR	TR 101 159 [100]	Implementing DECT in an arbitrary spectrum allocation	Published
TR	TR 101 310 [101]	Traffic Capacity and Spectrum Requirements for Multi-System and Multi-Service DECT Applications Co-existing in a Common Frequency Band	Published

A.10 DECT Authentication Module (DAM)

ETS	ETS 300 331 [18]	DECT Authentication Module (DAM)	Published
ETS	ETS 300 825 [71]	3 Volt DECT Authentication Module (DAM)	Published
ETS	ETS 300 759 [61]	DECT Authentication Module (DAM); Test specification for DAM	Published
ETS	ETS 300 760 [62]	DECT Authentication Module (DAM); Implementation Conformance Statement (ICS) proforma specification	Published

A.11 DECT access to IP networks

TR	TR 102 010 [165]	DECT access to IP networks	Published
TS	TR 102 265 [173]	DECT access to IP networks	Published

A.12 Radio in the Local Loop (RLL)

ETR	ETR 308 [97]	Services, facilities and configurations for DECT in the local loop	Published
TR	TR 101 370 [102]	Implementing DECT Fixed Wireless Access (FWA) in an arbitrary spectrum allocation	Published
EN	EN 300 765-1 [64]	Radio in the local loop (RLL) Access Profile (RAP); Part 1: Basic telephony services	Published
EN	EN 300 765-2 [65]	Radio in the Local Loop (RLL) Access Profile (RAP); Part 2: Advanced telephony services	Published

A.13 Broadband ISDN

ETR	ETR 337 [117]	Mobile networks requirements on B-ISDN	Published
TS	TS 101 679 [114]	Broadband Integrated Services Digital Network (B-ISDN); DECT/B-ISDN interworking	Published

A.14 IMT-2000 support standards

EN	EN 301 908-10 [166]	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS) and User Equipment (UE) for IMT-2000 Third-Generation cellular networks; Part 10: Harmonized EN for IMT-2000, FDMA/TDMA (DECT) covering essential requirements of article 3.2 of the R&TTE Directive	Published

A.15 Universal Mobile Telecommunication System (UMTS)

TS	TS 101 863-1 [167]	Digital Enhanced Cordless Telecommunications (DECT); DECT/UMTS Interworking Profile (IWP); Part 1: General description and overview	Published
TS	TS 101 863-2 [168]	Digital Enhanced Cordless Telecommunications (DECT); DECT/UMTS Interworking Profile (IWP); Part 2: CN-FP interworking	Published
TS	TS 101 863-3 [169]	Digital Enhanced Cordless Telecommunications (DECT); DECT/UMTS Interworking Profile (IWP); Part 3: 3,1 kHz speech service	Published
TS	TS 101 863-4 [170]	Digital Enhanced Cordless Telecommunications (DECT); DECT/UMTS Interworking Profile (IWP); Part 4: Supplementary services	Published
TS	TS 101 863-5 [171]	Digital Enhanced Cordless Telecommunications (DECT); DECT/UMTS Interworking Profile (IWP); Part 5: SMS point-to-point and cell broadcast	Published
TS	TS 101 863-6 [172]	Digital Enhanced Cordless Telecommunications (DECT); DECT/UMTS Interworking Profile (IWP); Part 6: Packet switched data	Published

Annex B:
Technical characteristics for DECT

B.1 Basic Technical Data for DECT

Table B.1 shows basic system parameters and services for DECT.

Table B.1: Key system parameters and services for DECT

System	DECT
Frequency band	(1 880 MHz to 1 900 MHz)
Access technique	MC/TDMA/TDD
Symbol rate	1 152 kSymbol/s
Carrier spacing	1 728 kHz
Frame duration	10 ms
Access channels/RF carrier	12 duplex 32 kbit/s channels
Traffic channels/single radio TRX	12
Traffic Channel assignment	Instant dynamic
Control carriers	Not needed
Max. RSSI level f. channel selection	Non
Modulation	GFSK (BT = 0,5) and optional higher level modulations
LO stability ppm	25 ppm
Portable average RF power	10 mW
Portable peak RF power	240 mW 24 dBm
Base Station sensitivity at 0,1 % BER	-86 dBm (for GAP) (Typical -90 dBm to -94 dBm)
Basic link budget	110 dBm (Typ.114 dBm to 118 dBm)
Speech codec	32 kbit/s ADPCM
Protected 64 kbit/s bearer service	Yes
V.34 Modem transfer (protected)	Yes
ISDN Basic Rate	Yes
Seamless Handover	Yes
Multi-bearers with protection	Yes, up to 552 kbit/s user data with 2-level modulation in full slots. Up to 5 Mbit/s user data rate with the higher level modulation options. Up to 15 Mbit/s with the Broadband option.
Privacy (ciphering)	Yes, (GSM type cipher)
Travelling speed (depends on hand over speed)	70 km/h
Base station ant. Diversity	Switched. Post detection selection optional
Dual antennas in handset	Optional
Tolerance to time dispersion with selection antenna diversity	200 ns (500 ns possible with low-cost non-coherent equalizer)
Wireless base station	Yes
Portable to Portable communication	Yes
Base station to Base station communication	Yes
Distributed (incl. ad-hoc) communication	Yes
Messaging (SMS and MMS)	Yes
Access to IP networks	Yes

B.2 Slot and Frame Structure

In this clause, the slot and frame structure for the DECT full slot with basic 2-level modulation is presented as example. Please note, that the actual number of bits and a few other parameters differs according to slot-, frame and modulation type. EN 300 175-2 [2] (Physical Layer) and EN 300 175-3 [3] (MAC layer) provides all details of the various combinations possible.

B.2.1 Frame, full-slot, double-slot, and half-slot structure

To access the medium in time, a regular TDMA structure is used. The structure repeats in frames of 11 520 bits, and the data is transmitted at a bit rate of 1 152 kbit/s. Within this frame 24 full-slots are created, each consisting of two half-slots. A double slot has a length of two full slots, and starts concurrently with an even numbered full slot (see figures B.1, B.2 and B.3).

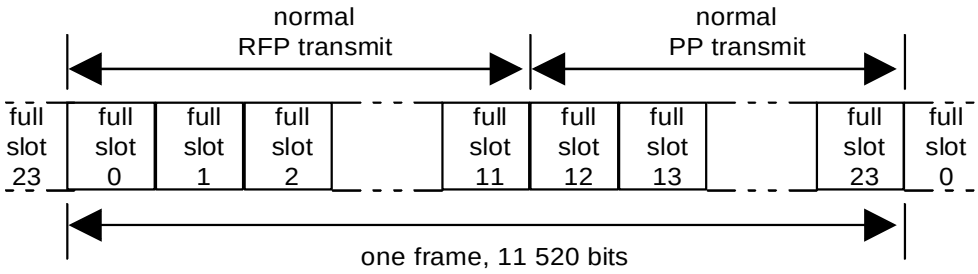


Figure B.1: Full slot format

Each full-slot has a duration of 480 bit intervals. A full slot can be split in two half slots:

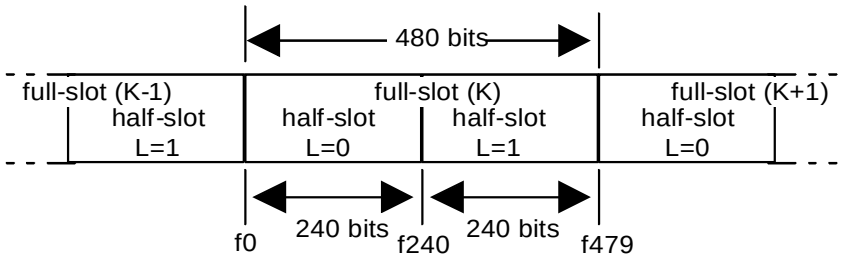


Figure B.2: Half-slot format

Two full slots can be merged into one double slot:

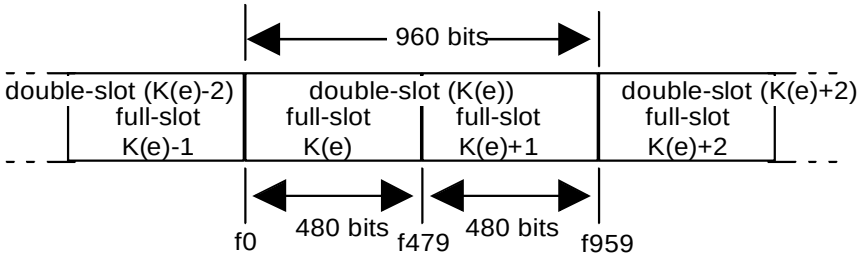


Figure B.3: Double slot format

B.2.2 Frame Structure

B.2.2.1 Physical packets

Data is transmitted within the frequency, time, and space dimensions using physical packets. Each physical packet contains a synchronization field S and a data field D. The packets (except from type p00) may contain an optional collision detection field, Z. Figure B.4 provides an overview of the fields in a packet, and where they are located. Please note, that some of the packet types do not contain all the fields, and the number of B_n-sub-fields varies with modulation type.

<table>
<tr><td colspan="12">Packet</td></tr>
<tr><td rowspan="4">S</td><td colspan="10">D</td><td rowspan="4">Z</td></tr>
<tr><td colspan="2">A</td><td colspan="8">B</td></tr>
<tr><td rowspan="2">Data</td><td rowspan="2">RA</td><td colspan="2">B_0</td><td colspan="2">B_1</td><td colspan="2">B_2</td><td colspan="2">B_3</td><td rowspan="2">X</td></tr>
<tr><td>Data</td><td>RB_0</td><td>Data</td><td>RB_1</td><td>Data</td><td>RB_2</td><td>Data</td><td>RB_3</td></tr>
</table>

NOTE: The field structure for the basic physical packet P32 is shown with protected data and including the optional X-field.

Figure B.4: Packet field structure

The basic physical packet P32, used in the most common types of connection (e.g. telephony), consists of 420 or 424 data bits.

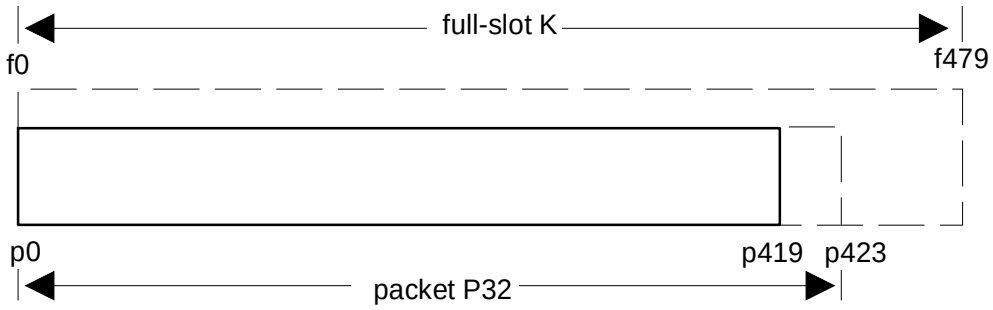


Figure B.5: Basic packet P32

B.2.2.2 Synchronization field S

The synchronization field S may be used by the receiver for clock and packet synchronization of the radio link. The first 16 bits are a preamble, and the last 16 bits are the packet synchronization word.

The field contains 32 bits denoted s0 to s31 and is transmitted in bits p0 to p31.

B.2.2.3 D-field

The D-field is the data field carrying user information.

B.2.2.4 Physical packet P32

The D-field contains 388 bits denoted d0 to d387 and is transmitted in bits p32 to p419 (see figure B.6).

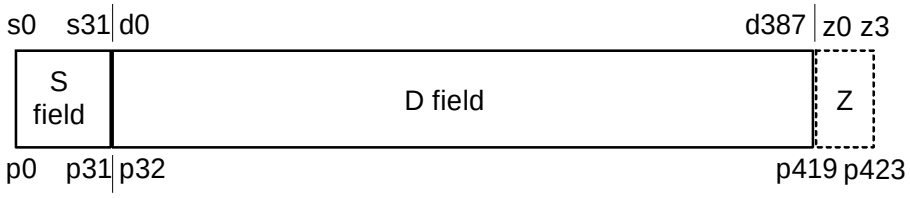


Figure B.6: Packet P32

B.2.2.5 Z-field

The Z-field may be used by the receiver for early detection of an unsynchronized interference sliding into the end of the physical packet.

The Z-field contains 4 bits, z0 to z3, immediately following the last bit of the D-field.

The bits z0 to z3 shall be set equal to the 4 last bits of the D-field. These last 4 bits of the D-field are the X-field.

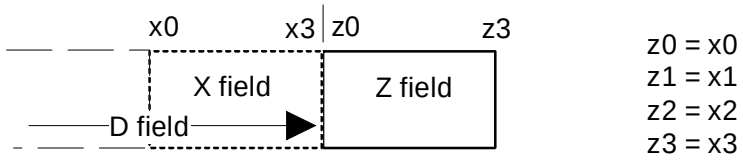


Figure B.7: The Z-field

B.2.2.6 A-, and B-fields

The D-fields are divided into two fields:

- the A-field; and
- the B-field.

Field A contains 64 bits numbered from a_0 to a_{63} where a_0 occurs earlier than a_1. The B-field occupies the rest of the D-field and varies in size between full slots and half slots.

In the D32 field the B-field contains 324 bits which are numbered from b_0 to b_{323} where b_0 occurs earlier than b_1.

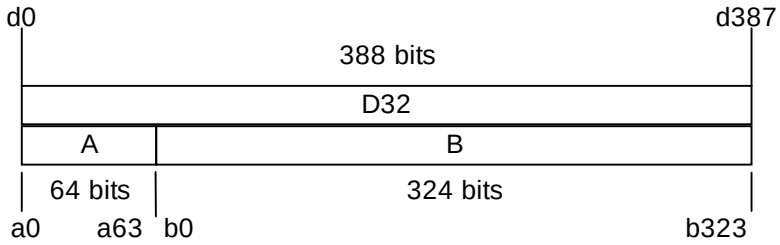


Figure B.8: A-field and B-field in the D32 field (full slot, 2 level modulation)

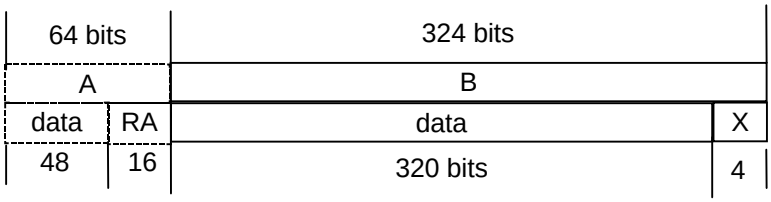


Figure B.9: Unprotected D32 B-field format (full slot, 2 level modulation)

64		324 bits								
A		B								
		B0		B1		B2		B3		X
data	RA	data	RB0	data	RB1	data	RB2	data	RB3	x
48	16	64	16	64	16	64	16	64	16	4

Figure B.10: Protected B-field format D32 (full slot, 2 level modulation)

B.2.2.7 X-field

The X-field contains redundancy bits calculated based on the total B-field content.

B.3 Dynamic Channel Selection

Within the designated DECT radio frequency band several radio frequencies are defined. Each radio frequency is divided into time slots, usually 24 on each frequency, where each DECT channel usually uses two, one in each direction (TDMA). This allows for 120 channels in the case of 10 frequencies with the basic channel definition in Europe (1 880 MHz to 1 900 MHz). These channels are the DECT radio resource, where all DECT communication occurs. Some DECT applications use more than one time slot in each direction with some impact on the number of available channels. The DECT standard has provisions for other channel definitions (different carrier spacing, bandwidth and timeslot length) if so desired in future developments.

The mandatory real time Dynamic Channel Selection messages and procedures provide effective coexistence of uncoordinated private and public systems on the common designated DECT frequency band. Each device has access to all channels (time/frequency combinations). When a connection is needed, a channel is selected so that, at that instant and locality, minimum interference of all the common access channels is caused. This avoids any need for traditional frequency planning, and greatly simplifies the installations. This procedure also provides higher and higher capacity by closer and closer base station installations, while maintaining a high radio link quality. Not needing to split the frequency resource between different services or users gives a very efficient use of the allocated spectrum. See TR 101 310 [101] for a detailed description of DECT traffic capacity and spectrum requirements.

B.4 DECT carrier numbers and carrier positions in the range 1 880 MHz to 1 978 MHz and 2 010 MHz to 2 025 MHz (RF band 00001)

DECT carriers are specified for the whole frequency range 1 880 MHz to 1 980 MHz and 2 010 MHz to 2 025 MHz. Carrier positions in the 902 MHz to 928 MHz ISM band and the 2 400 MHz to 2 483,5 MHz ISM band have been defined for the US market [138].

DECT is also an IMT-2000 [139] family member, called IMT-FT, the only member that provides for uncoordinated installations on an unlicensed spectrum. RF carriers for IMT-FT applications of DECT are placed within the parts of the European UMTS spectrum applicable for TDD operation (see ERC/DEC/(99)25 [143], ERC/DEC/(00)01 [144]) e.g. within 1 900 MHz to 1 920 MHz, 1 920 MHz to 1 980 MHz and/or 2 010 MHz to 2 025 MHz).

The most common spectrum allocation is 1 880 MHz to 1 900 MHz, but outside Europe spectrum is also available in 1 900 MHz to 1 920 MHz and in 1 910 MHz to 1 930 MHz (several countries).

Ten RF carriers are defined in the frequency band 1 880 MHz to 1 900 MHz with centre frequencies Fc given by:

$$Fc = F0 - c \times 1{,}728 \text{ MHz}$$

where: F0 = 1 897,344 MHz; and

c = 0, 1, ..., 9.

The frequency band between Fc - 1,728/2 MHz and Fc + 1,728/2 MHz shall be designated RF channel c.

NOTE: A nominal DECT RF carrier is one whose centre frequency is generated by the formula: Fg = F0 - g X 1,728 MHz, where g is any integer.

All DECT equipment should when allowed be capable of working on all 10 RF channels, c = 0, 1, ..., 9.

RF-band number = 00001 defines 54 additional carriers from 1 880 MHz to 1 979 MHz and 2 010 MHz to 2 025 MHz. The carrier frequencies are defined by:

$$Fc = F9 + c \times 1{,}728 \text{ MHz}$$

where:

F9 = 1 881,792 MHz;

and c = 10, 11, 12, ..., 32, …., 63.

Note that for carriers up to and including carrier c = 32 (the 33 first carriers) the Extended RF carrier information part 1 message is sufficient to define the carriers in use. For carriers c > 32 also the Extended RF carrier information part 2 message has to be used. See EN 300 175-3 [3], clauses 7.2.3.3 and 7.2.3.9.

The above carrier frequencies are explicitly given in table B.2.

Table B.2: Carrier numbers and carrier positions

Carrier number c	Rf-band number	Carrier freq. MHz	Carrier number c	Rf-band number	Carrier freq. MHz
9	-	1 881,792	32	00001	1 937,088
8	-	1 883,520	33	00001	1 938,816
7	-	1 885,248	34	00001	1 940,544 (see note)
6	-	1 886,876	35	00001	1 942,272
5	-	1 888,704	36	00001	1 944,000 (see note)
4	-	1 890,432	37	00001	1 945,728 (see note)
3	-	1 892,160	38	00001	1 947,456
2	-	1 893,888	39	00001	1 949,184 (see note)
1	-	1 895,616	40	00001	1 950,912 (see note)
0	-	1 897,344	41	00001	1 952,640
10	00001	1 899,072	42	00001	1 954,368 (see note)
11	00001	1 900,800	43	00001	1 956,096 (see note)
12	00001	1 902,528	44	00001	1 957,824
13	00001	1 904,256 (see note)	45	00001	1 959,552 (see note)
14	00001	1 905,984 (see note)	46	00001	1 961,280
15	00001	1 907,712	47	00001	1 963,008
16	00001	1 909,440 (see note)	48	00001	1 964,736 (see note)
17	00001	1 911,168 (see note)	49	00001	1 966,464
18	00001	1 912,896	50	00001	1 968,192
19	00001	1 914,624 (see note)	51	00001	1 969,920 (see note)
20	00001	1 916,352	52	00001	1 971,648
21	00001	1 918,080	53	00001	1 973,376
22	00001	1 919,808 (see note)	54	00001	1 975,104 (see note)
23	00001	1 921,536	55	00001	1 976,832
24	00001	1 923,264	56	00001	2 011,392
25	00001	1 924,992 (see note)	57	00001	2 013,120
26	00001	1 926,720	58	00001	2 014,848
27	00001	1 928,448	59	00001	2 016,576
28	00001	1 930,176 (see note)	60	00001	2 018,304
29	00001	1 931,904	61	00001	2 020,032
30	00001	1 933,632	62	00001	2 021,760
31	00001	1 935,360 (see note)	63	00001	2 023,488

NOTE: This carrier can normally not be used unless the adjacent 5 MHz spectrum block belongs to the same operator. The spectrum block border frequencies coincide with a frequency n x 5 MHz, where n is an integer.

Above this band, additional carriers are defined in EN 300 175-2 [2].

New or modified carrier positions and/or frequency bands can (locally) be defined when needed by utilizing reserved RF band numbers.

Annex C: Bibliography

ETSI EN 301 138: "Cordless Terminal Mobility (CTM); Application of an information model to Core INAP CS-2; CTM Phase 1 specification".

ETSI EN 301 175: "Cordless Terminal Mobility (CTM); Phase 1; Service description".

ETSI EN 301 193: "Digital Video Broadcasting (DVB); Interaction channel through the Digital Enhanced Cordless Telecommunications (DECT)".

ETSI EN 301 273: "Cordless Terminal Mobility (CTM); Phase 2; Service description".

ETSI Handbook: "Making Better Standards - practical ways to greater efficiency and success".

ITU-T Recommendation V-Series: "Data communication over the telephone network".

Directive 98/13/EC of the European Parliament and of the Council of 12 February 1998 relating to telecommunications terminal equipment and satellite earth station equipment, including the mutual recognition of their conformity.

Council Directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits.

IEEE 802.11b-1999/Cor1-2001: "IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications - Amendment 2: Higher-speed Physical Layer (PHY) extension in the 2,4 GHz band - Corrigendum 1".

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