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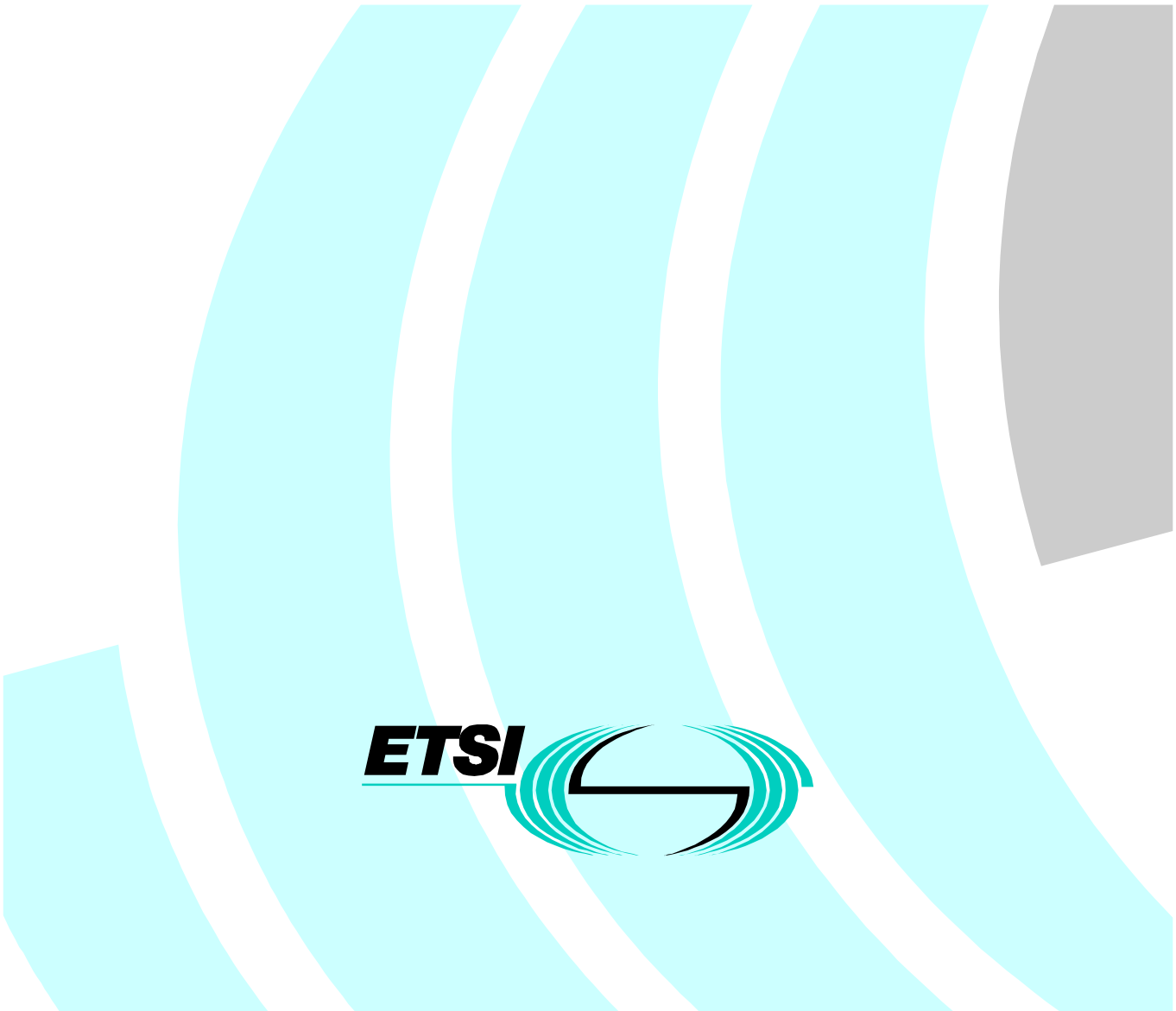
Technical Report

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



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Contents

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Foreword

This ETSI 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a rapidly changing area, and it is possible that some of the information contained in the present document may become outdated or incomplete within relatively short time-scales.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

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

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

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

[13] ETSI ETS 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 ETS 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); Approval test specification; Part 1: Radio".

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

[17] ETSI ETS 300 329: "Digital Enhanced Cordless Telecommunications (DECT); Electro-Magnetic Compatibility (EMC) for 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 ETS 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 ETS 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 ETS 300 434-2: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); DECT/ISDN interworking for end system configuration; Part 2: Access profile".

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

[25] ETSI ETS 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 ETS 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 ETS 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 300 755: "Digital Enhanced Cordless Telecommunications (DECT); Data Services Profile (DSP); Multimedia Messaging Service (MMS) with specific provision for facsimile services (service type F, class 2)".

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

[58] ETSI ETS 300 757: "Digital Enhanced Cordless Telecommunications (DECT); Data Services Profile (DSP); Low rate messaging service (service type E, class 2)".

[59] 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".

[60] 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)".

[61] 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)".

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

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

[64] 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".

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

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

[67] 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".

[68] 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".

[69] 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".

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

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

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

[73] 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)".

[74] 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)".

[75] ETSI EN 301 240: "Digital Enhanced Cordless Telecommunications (DECT); Data Services Profile (DSP); Point-to-Point Protocol (PPP) interworking for Internet access and general multi-protocol datagram transport".

[76] 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)".

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

[78] 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".

[79] 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".

[80] 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".

[81] 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)".

[82] 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)".

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

[84] 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".

[85] 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".

[86] 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)".

[87] 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)".

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

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

[90] ETSI ETR 015: "Digital Enhanced Cordless Telecommunications (DECT); Reference document".

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

[92] ETSI ETR 042: "Digital Enhanced Cordless Telecommunications (DECT); A guide to DECT features that influence the traffic capacity and the maintenance of high radio link transmission quality, including the results of simulations".

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

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

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

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

[97] ETSI ETR 183: "Digital Enhanced Cordless Telecommunications (DECT); Conformance testing on DECT equipment".

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

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

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

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

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

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

[104] 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".

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

[106] CTR 006: "Commission Decision of 9 July 1997 on a common technical regulation for the general terminal attachment requirements for digital enhanced cordless telecommunications (DECT) (edition 2) (97/523/EC) (DECT Access)".

[107] CTR 010: "Commission Decision of 9 July 1997 on a common technical regulation for the telephony application requirements for the digital enhanced cordless telecommunications (DECT) (edition 2) (Text with EEA relevance) (97/524/EC) (DECT Telephony)".

[108] 89/336/EEC: "Council Directive 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.

[109] 98/13/EC: "Directive 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".

[110] 91/287/EEC: "Council Directive of 3 June 1991 on the frequency band to be designated for the co-ordinated introduction of digital European cordless telecommunications (DECT) into the Community".

[111] 91/288/EEC: "Council Directive of 3 June 1991 on the co-ordinated introduction of digital European cordless telecommunications (DECT) into the Community".

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

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

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

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

[116] ETSI EN 301 678: "Digital Enhanced Cordless Telecommunications (DECT); Cordless Terminal Mobility (CTM); Feature Package 2 (FP2); Short Message Service (SMS) Profile Point to Point (PP)".

[117] 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)".

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

[119] 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".

[120] 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".

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

[122] ETSI TR 101 178: "Digital Enhanced Cordless Telecommunications (DECT); A High Level Guide to the DECT Standardization".

[123] ETSI TBR 022: "Radio Equipment and Systems (RES); Attachment requirements for terminal equipment for Digital Enhanced Cordless Telecommunications (DECT) Generic Access Profile (GAP) applications".

[124] ETSI TBR 006: "Digital Enhanced Cordless Telecommunications (DECT); General terminal attachment requirements".

[125] ETSI TBR 010: "Digital Enhanced Cordless Telecommunications (DECT); General Terminal Attachment Requirements; Telephony Applications".

[126] 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".

[127] ETSI TBR 040: "Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); Attachment requirements for terminal equipment for DECT/ISDN interworking profile applications".

[128] ETSI ETS 300 435: "Digital Enhanced Cordless Telecommunications (DECT); Data Services Profile (DSP); Base standard including interworking to connectionless networks (service types A and B, class 1)".

[129] ETSI ETS 300 701: "Digital Enhanced Cordless Telecommunications (DECT); Data Services Profile (DSP); Generic frame relay service with mobility (service types A and B, class 2)".

[130] ETSI ETS 300 699: "Digital Enhanced Cordless Telecommunications (DECT); Data Services Profile (DSP); Generic data link service for closed user groups (service type C, class 1)".

[131] ETSI ETS 300 651: "Digital Enhanced Cordless Telecommunications (DECT); Data Services Profile (DSP); Generic data link service (service type C, class 2)".

[132] ETSI EN 300 757: "Digital Enhanced Cordless Telecommunications (DECT); Data Services Profile (DSP); Low rate messaging service (service type E, class 2)".

[133] 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".

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

[135] CTR 022: "Radio Equipment and Systems (RES); Attachment requirements for terminal equipment for Digital Enhanced Cordless Telecommunications (DECT) Generic Access Profile (GAP) applications".

[136] CTR 040: Digital Enhanced Cordless Telecommunications (DECT); Integrated Services Digital Network (ISDN); Attachment requirements for terminal equipment for DECT/ISDN interworking profile applications".

[137] 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".

[138] 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)".

[139] 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)".

[140] 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".

[141] 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)".

[142] 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)".

[143] 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".

[144] 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)".

[145] 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)".

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

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
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 Regulation
D8PSK	Differential Octal Phase Shift Keying
DAM	DECT Authentication Module
DBPSK	Differential Binary Phase Shift Keying
DECT	Digital Enhanced Cordless Telecommunications
DMAP	DECT Multimedia Application Profile
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	Electro-Magnetic Compatibility
EN	European Norm (ETSI Technical Standard under the new ETSI regime)
ES	End System
FP	Fixed Part
FPLMTS	Future Public Land Mobile Telephone System
FT	Fixed Termination
FWA	Fixed Wireless Access
GAP	Generic Access Profile
GFSK	Gaussian Frequency Shift Keying
GSM	Global System for Mobile communication
ICS	Implementation Conformance Statements
IF	InterFace
IMT	International Mobile Telecommunications
IN	Intelligent Network
IS	Intermediate System
ISDN	Integrated Services Digital Network
ITU	International Telecommunications Union
IWP	Inter-Working Profile
IWU	Inter-Working Unit
LAN	Local Area Network
MC	Multi Carrier
MM	Mobility Management
MSC	Mobile services Switching Centre
NA	Network Aspects
NMT	Nordic Mobile Telephone
NTP	Network Termination Point
O&M	Operation and Maintenance
PARK	Portable Access Rights Key
PBX	Private Branch Exchange
PCS	Personal Communication Service

PICS	Protocol Implementation Conformance Statement
PLMN	Public Land Mobile Network
PP	Portable Part
PSTN	Public Switched Telephone Network
PT	Portable Termination
PWT	Personal Wireless Telecommunications
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
SMS	Short Message Service
TACS	Total Access Communications System
TBR	Technical Basis of Regulation
TCL	Test Case Library
TDD	Time Division Duplex
TDMA	Time-Division Multiple Access
TIA	Telecommunications Industry Association
TR	Technical Report
TRAC	Technical Regulations Application Committee
UMTS	Universal Mobile Telephone System
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 wide 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.

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.

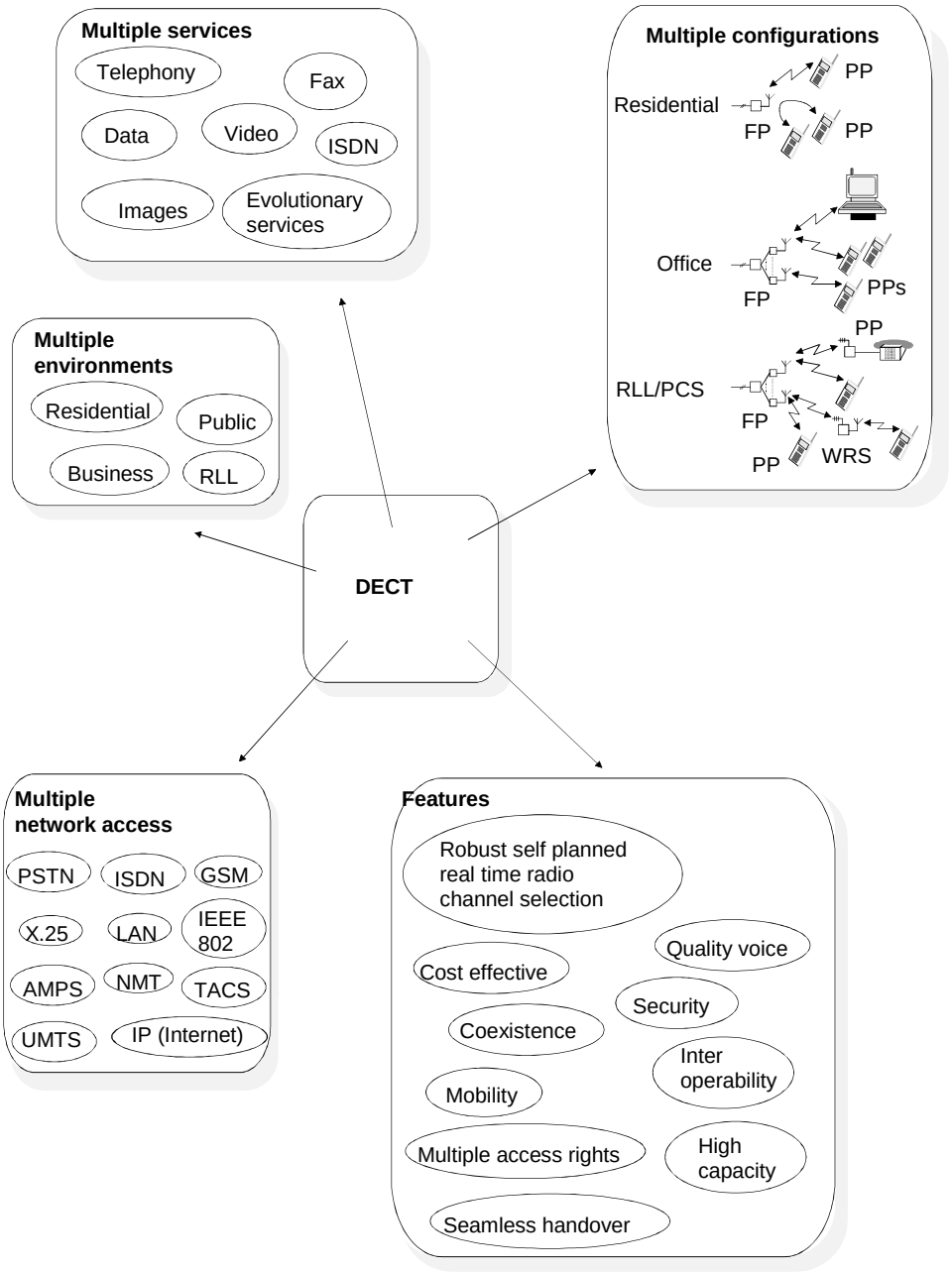


Figure 1: Overview of DECT applications and features

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 or GSM/DCS1800. 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.

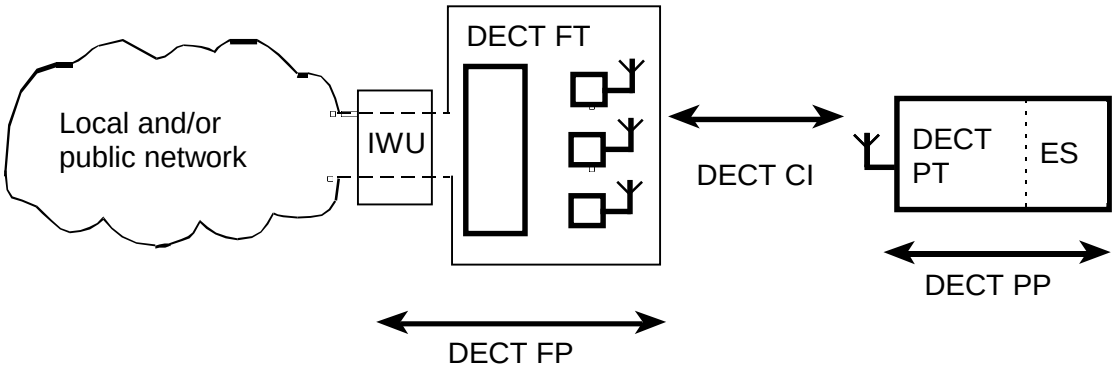


Figure 2: The DECT Common Interface (CI)

DECT covers, in principle, only the air interface between the DECT Fixed Part (FP) and Portable Part (PP). The Interworking 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 [93], "Digital Enhanced Cordless Telecommunications (DECT); 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 300 175-1 [1], EN 300 175-2 [2], EN 300 175 3 [3], EN 300 175-4 [4], EN 300 175-5 [5], EN 300 175-6 [6], EN 300 175-7 [7] and EN 300 175-8 [8], see subclause 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 [112] 32 kbit/s ADPCM speech codec and other speech transmission characteristics defined in part 8 of the DECT CI standard.

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 Continuos 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 Coexistence of uncoordinated installations on a common frequency band

The mandatory Instant Dynamic Channel Selection messages and procedures provide effective coexistence of uncoordinated private and public systems on the common designated DECT frequency band and avoids 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 base station 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 an ETSI Technical Report, TR 101 310 [104], by the ETSI DECT Project Radio and Speech Experts Working Party. TR 101 310 [104], 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 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 part 6 of the DECT CI standard.

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 Electro Magnetic 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 [108]. 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 ETS 300 329 [17]. This standard specifies both performance requirements and the methods to check conformance to the requirements.

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.

GSM networks, standardized in Special Mobile Group (SMG) already support mobility. There is therefore interest to re-use the mobility protocols of GSM networks in conjunction with the DECT air interface (this is DECT/GSM interworking). The work of SMG therefore is of relevance to the DECT standardization. Likewise the work at ETSI Project Universal Mobile Telecommunications System (EP UMTS) and Third Generation Partnership Project (3GPP) is of importance.

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).

The ETSI Project Telecommunications and Internet Protocol Harmonization Over Networks (EP TIPHON) is defining mobility support for Voice over Internet Protocol (VoIP) applications.

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 43 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 is the Approvals Committee for Terminal Equipment. It consists of representatives of telecommunications regulators from all EC countries.

DTAAB (DECT Type Approval Advisory Board) is a sub-group of the Technical Regulations Application Committee (TRAC). It includes representatives from test houses, operators, standardization bodies, type approval authorities, regulatory authorities and manufacturers. DTAAB meets on a regular basis to consider the resolution of problems in a harmonized way relating to the DECT area. The common understanding is 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.

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 TG8/1 has included the DECT parameters as one of the five radio interfaces in the recommendation that specifies the key parameters 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 large 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 European Standards (ENs and ETSs)

The European Standards 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 consist 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. New editions of ETSI European Standards are published as ENs.

ETSI Technical Basis for Regulations (TBRs)

TBRs contain technical requirements and test methods for use in the corresponding Common Technical Regulations (CTRs). 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 provide useful background information on the standards. A summary of DECT Technical Reports is given in clause 11.

NOTE 2: New editions of 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)

The base standard for DECT is the Common Interface (CI) EN 300 175 [1], [2], [3], [4], [5], [6], [7] and [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] does not specify which procedures are required in each particular application. To achieve interoperability of equipment other documents (profiles, see subclause 7) are required to specify more specific requirements for each applications.

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

Part 1: Overview

This is a general introduction to the other parts of EN 300 175 [1] to [8].

Part 2: Physical layer (PHL)

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 standard are applicable to all DECT products.

Part 3: Medium Access Control (MAC) layer

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

Part 4: Data Link Control (DLC) layer

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.

Part 5: Network (NWK) layer

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.

Part 6: Identities and addressing

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.

Part 7: Security aspects

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.

Part 8: Telephony

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.

6.2 Wireless Relay Station (WRS)

The WRS standard EN 300 700 [118] 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 3.

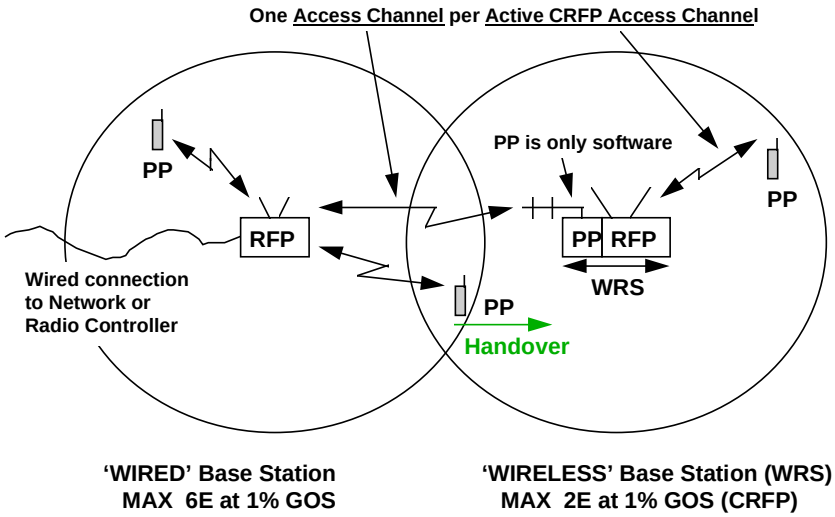


Figure 3: The DECT Wireless Relay Stations, WRS

EN 300 700 [118] 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.

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 4.

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 [99] provides more information on the application of WRS.

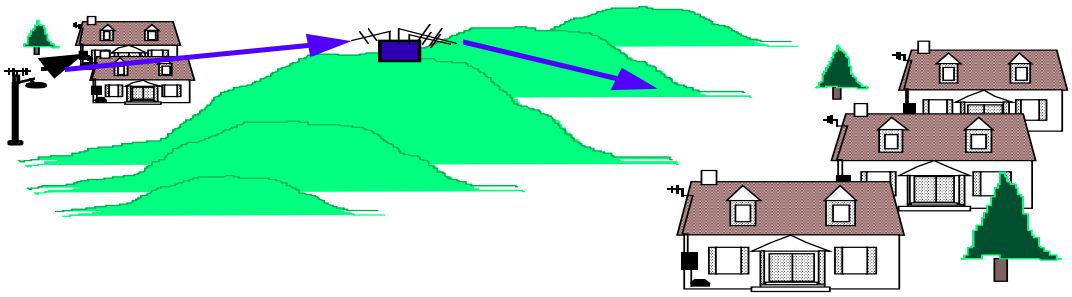


Figure 4: Typical WRS application

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 [72] 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.

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 or lacks some provision, this is clarified or added in the profile standard. All defined features are process mandatory. 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) and the DECT/GSM Interworking Profile (IWP).

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.

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 will become 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 will 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 categorized between Mobility Management (MM) and Call Control (CC).

The CC protocols are closely related to the provision of speech telephony services. The CC protocols of other speech telephony applications are based on GAP.

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

The protocol components of parts 3, 4, 5, 6, 7 of the base standard (EN 300 175-3 [3], EN 300 175-4 [4], EN 300 175 5 [5], EN 300 175-6 [6] and EN 300 175-7 [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 5.

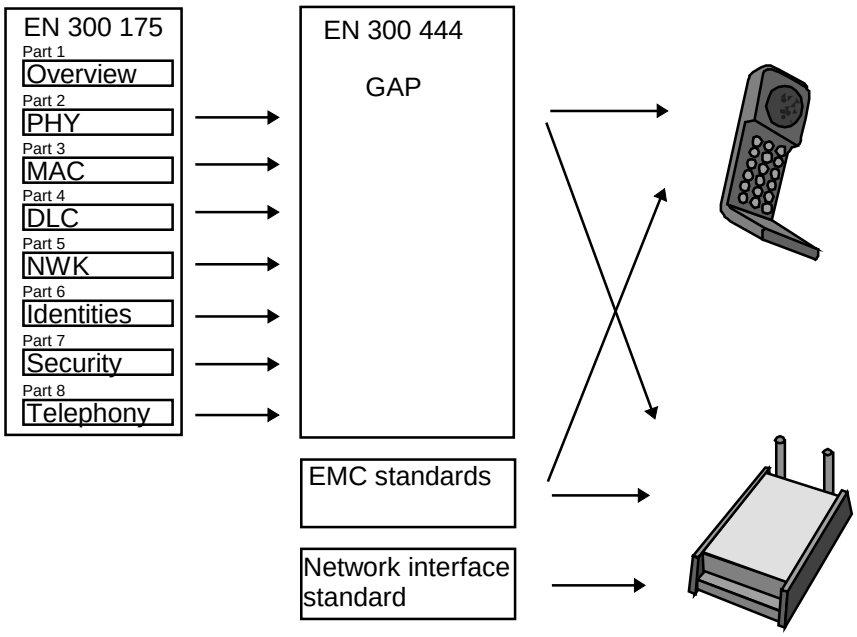


Figure 5: Standards relating to GAP

7.2 Data profiles

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. The different profiles are modular and generally based on DPRS [88], so that they may be economically and efficiently implemented. The data service types defined in different profiles are described in ETR 185 [98].

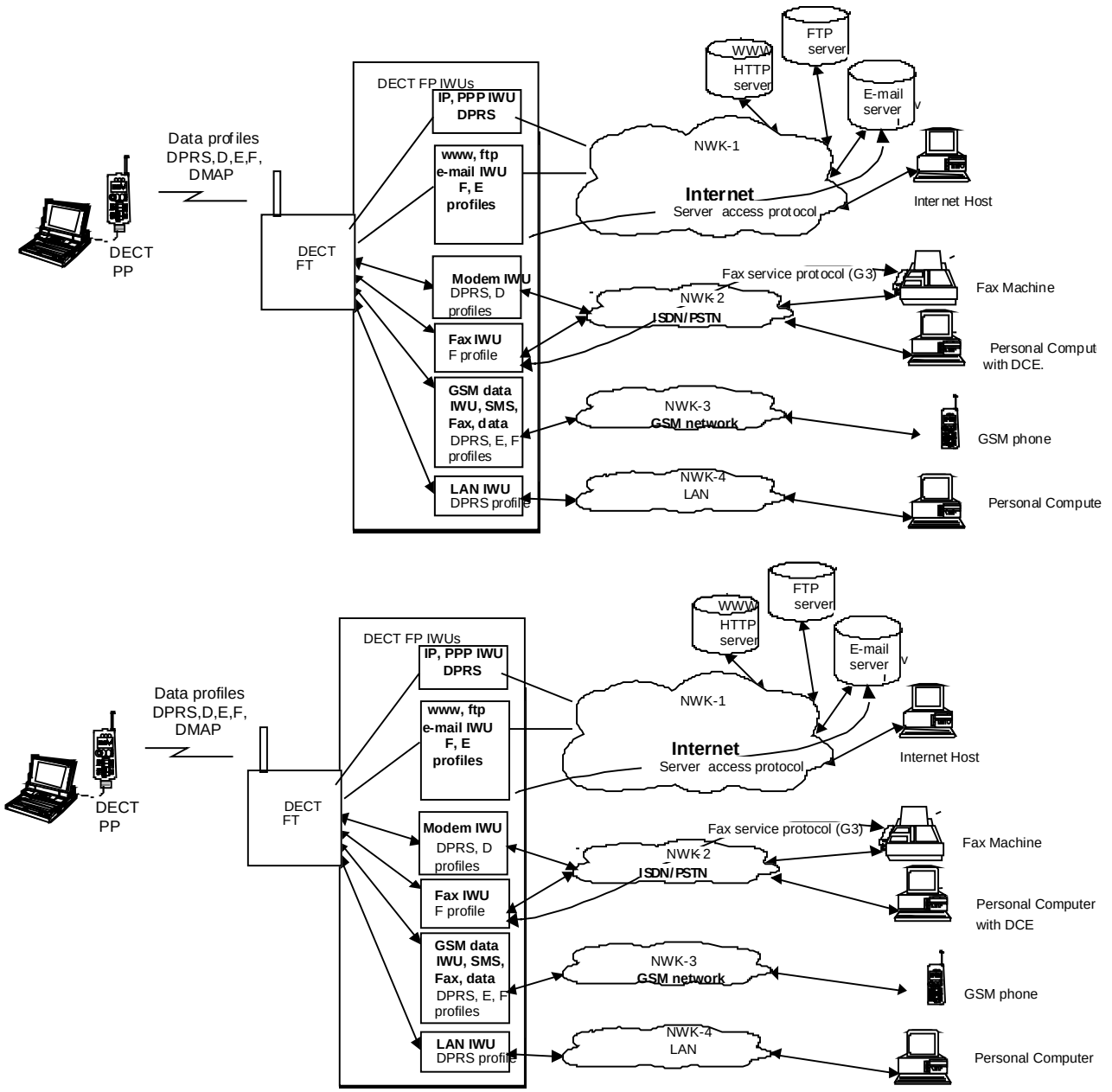


Figure 6: DECT data profiles

Due to DECT's advanced radio protocol it is able to offer widely varying bandwidths by combining multiple bearers into a single channel. DECT can support net data throughput of n x 24 kbit/s, up to 552 kbit/s (69 kbyte/s, 2-level modulation) or even higher with 4- and 8-level modulation options, where a rate of up to 2 Mbit/s can be achieved.

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 552 Kbit/s with 2-level modulation, higher with 4- and 8-level.

7.3 DECT Packet Radio Service (DPRS)

The DECT Packet Radio Service, DPRS, EN 301 649 [88] 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] functionality but only additional procedure support necessary for data applications.

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.

NOTE: The DPRS contains all requirements of, and replaces the earlier data profiles A/B.1, A/B.2, C.1, C.2 described in ETR 185 [98].

Interworkings with V.24 interfaces, Ethernet, Token Ring LANs, direct interworking with Internet Protocol (IP) and PPP 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.

It 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 by this standard. There are two types of services:

- Frame Relay Service include transport of protocols with user-delimited frames. DPRS version 1 defines the following frame-relay services:

  1 IEEE 802.3 [119] (Ethernet);

  2 IEEE 802.5 [120] (Token Ring);

  3 Internet Protocol (IP);

  4 Point to Point Protocol (PPP).

- Character Oriented service incorporates a packet assembling and disassembling (PAD) functionality to transport a stream data. DPRS version 1 incorporates the following Character Oriented services:

  - V.24 (asynchronous data).

The DECT packet radio Service is the core standard for all packet-data applications over DECT, and its main provisions are as listed here:

- High speed data transfer capabilities: max rate: 552 kb/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
- 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 handover intracell
  - Bearer handover intercell
  - Connection handover
  - External handover

Automatic allocation of dynamic operating parameters

Figure 7: DPRS key features

The relationship between the standards and DPRS is shown in figure 8.

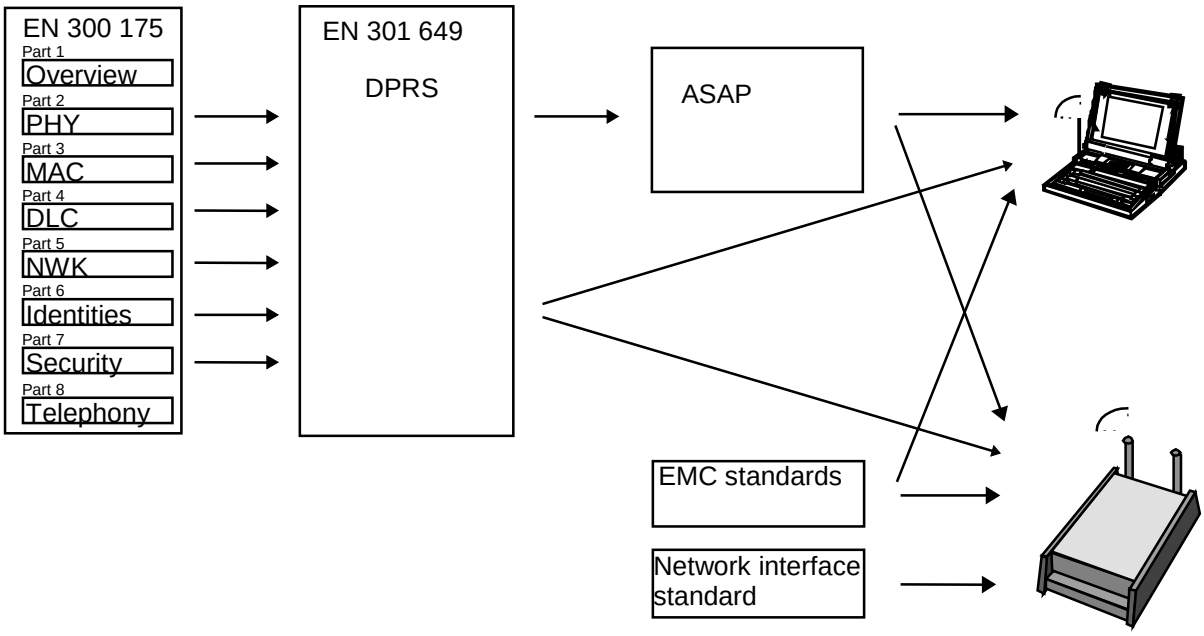


Figure 8: Standards relating to DPRS

7.4 ASAP

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

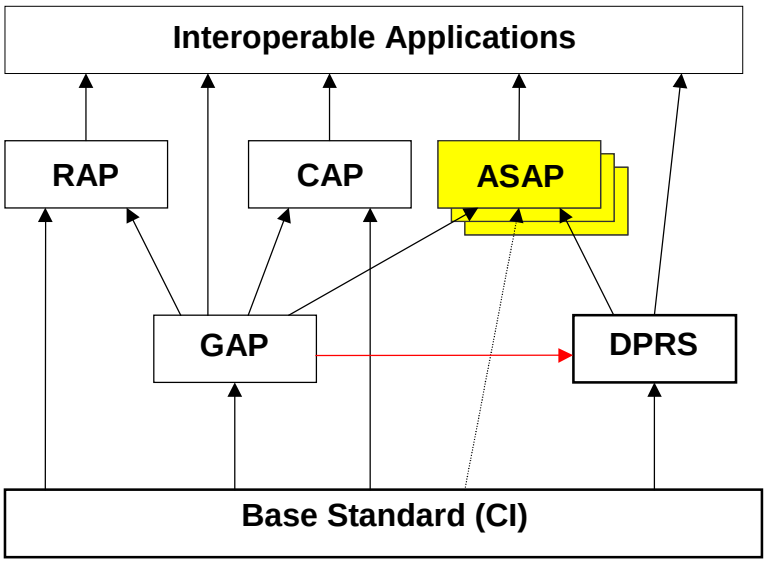


Figure 9: Relation between ASAPs and other DECT standards

7.5 DECT Multimedia Access Profile (DMAP)

The DECT Multimedia Access Profile (EN 301 650 [89]) defines a basic subset of functions and facilities from DPRS [88] and GAP [24].

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, fax and Internet services. It includes access to and between PCs and Lap-tops.

For data + voice applications, the multimedia access profile is expected to become a de-facto interoperability standard the same way as GAP is for voice applications. Figure 10 illustrates this.

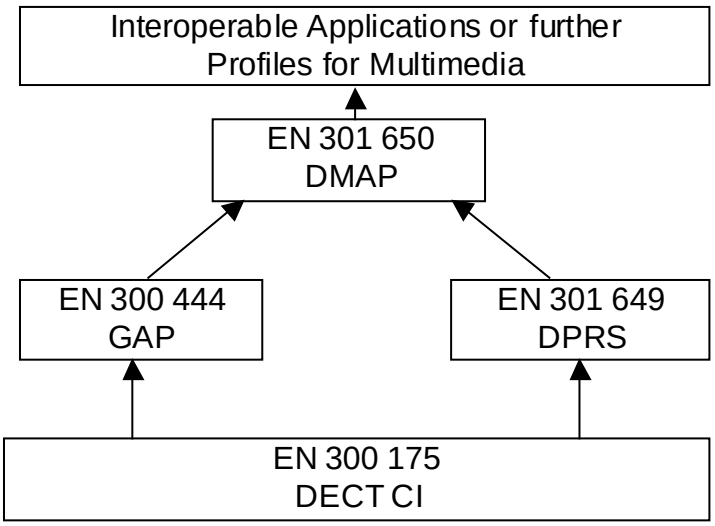


Figure 10: Dependencies of DMAP

7.6 Other Data Profiles

The family of Data Service Profiles comprises the following members in addition to the DPRS and DMAP standards mentioned above:

D.2 profile - EN 301 238 [73**]:**

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 [74**] :**

This profile provides the equivalent service to the D.2 profile for Closed User Groups.

E.2 profile - ETS 300 757 [58**]:**

This profile defines low rate messaging service 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 messaging through the signalling channels and uses the Multimedia Messaging Service (MMS) specified in F.2 profile, ETS 300 755 [56], and is therefore a subset of the MMS. This service may be used for private and public roaming messaging applications such as the GSM Short Message Service (SMS). Interworking description for GSM networks can be found in ETS 300 764 [64], while description of GSM SMS interworking within public and business DECT networks can be found in CTM Feature Package 2 profile (EN 301 678 [116]).

F.2 profile - ETS 300 755 [56**]:**

This profile defines Multimedia Messaging Service (MMS) with specific provision for facsimile services.

The profile creates high level inter-operability for a range of telematic services, including fax, through a multimedia file transfer mechanism built on the data stream service based on the DPRS profile, with full support for roaming and public services. One of the main applications of this profile is to provide interworking to public and private Group 3 fax services, E-mail, Group 4 fax services, WWW, SMS etc.

Further basic data profiles may be created to respond to market demand.

7.7 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 - ETS 300 434-1 [22**], ETS 300 434-2 [**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 11.

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.

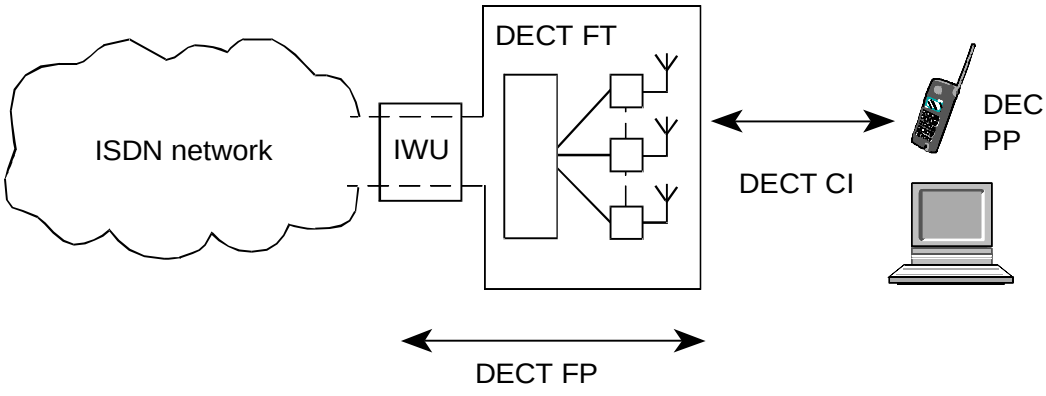


Figure 11: DECT ISDN end system

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 64kbit/s unrestricted digital information bearer service is possible via a suitable PP.

ETS 300 434-1 [22] and ETS 300 434-2 [23] does 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 subclause 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 3,1kHz 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 12.

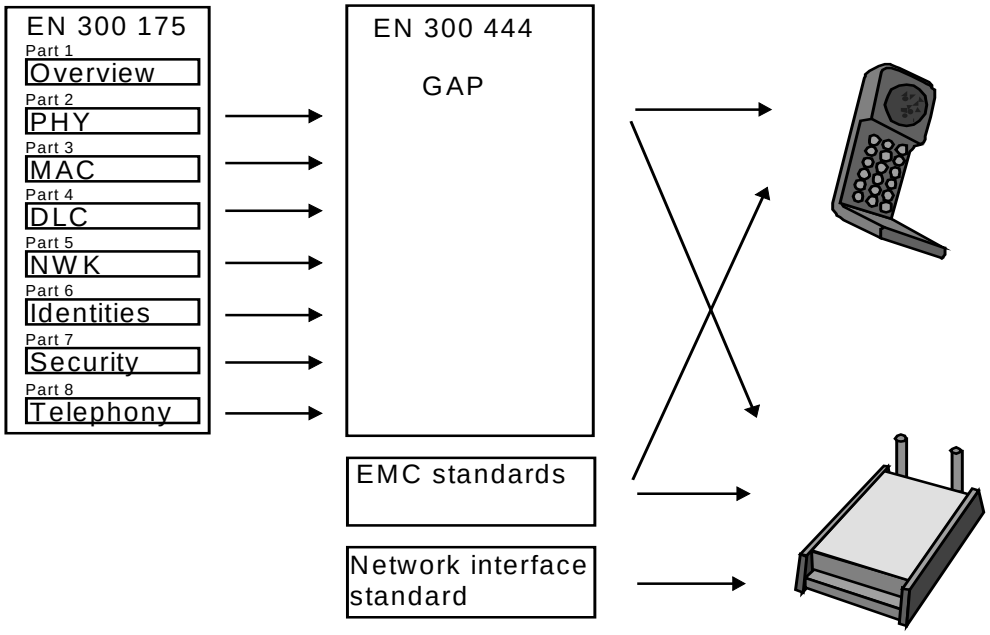


Figure 12: Standards relating to ISDN End System

ISDN Intermediate System profile - ETS 300 822 [70**]:**

The IS (see figure 13) 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.

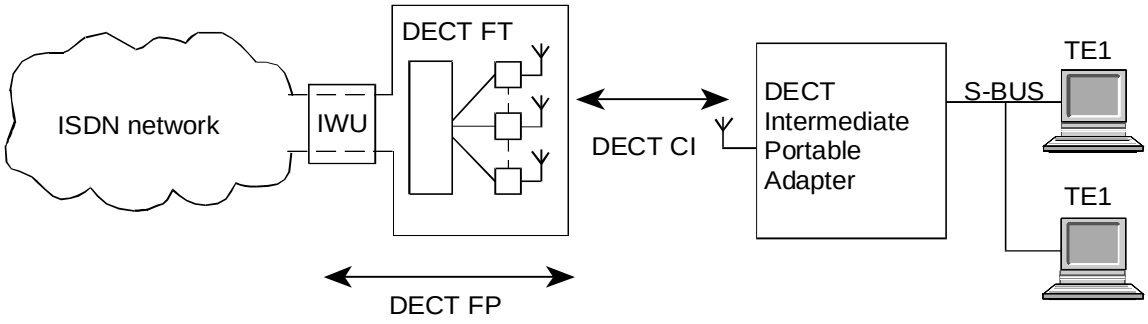


Figure 13: DECT ISDN intermediate system

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.

The relationship between the standards and ISDN IS products is shown in figure 14.

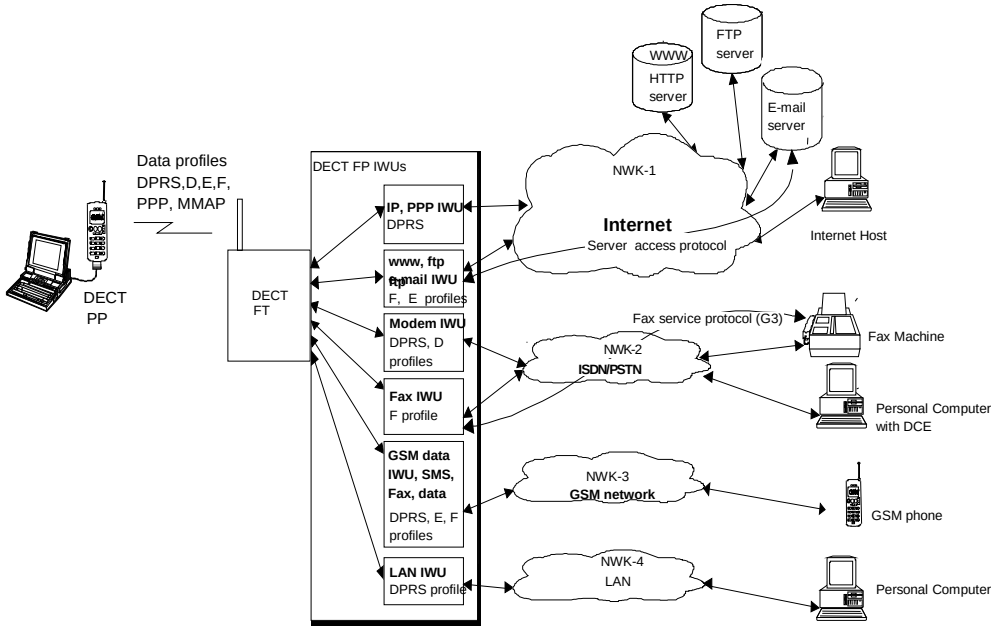


Figure 14: Standards relating to DECT ISDN intermediate system

Broadband ISDN (B-ISDN) interworking for DECT is specified in Technical Specification TS 101 679 [121]. This specification is aimed at interoperability between DECT implementations of direct interworking with B-ISDN high-capacity networks.

7.8 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) [71], 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 (see subclause 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 [78] 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 15.

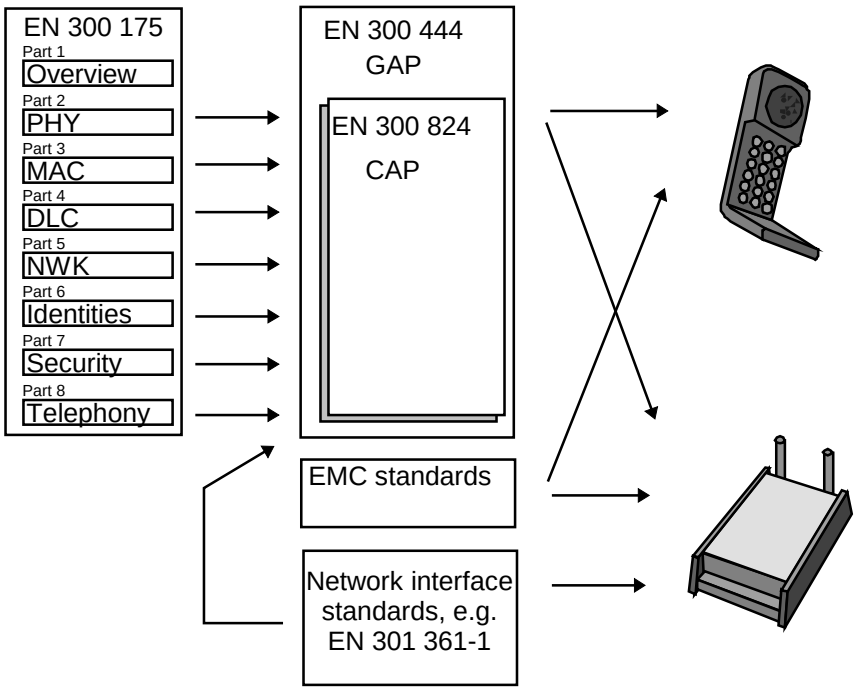


Figure 15: Standards relating to CAP

7.9 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 interworking profile (IWP) ETS 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 [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 [79] 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 [96] and ETR 341 [101].

The relationship between the standards and the DECT/GSM equipment is shown in figure 16.

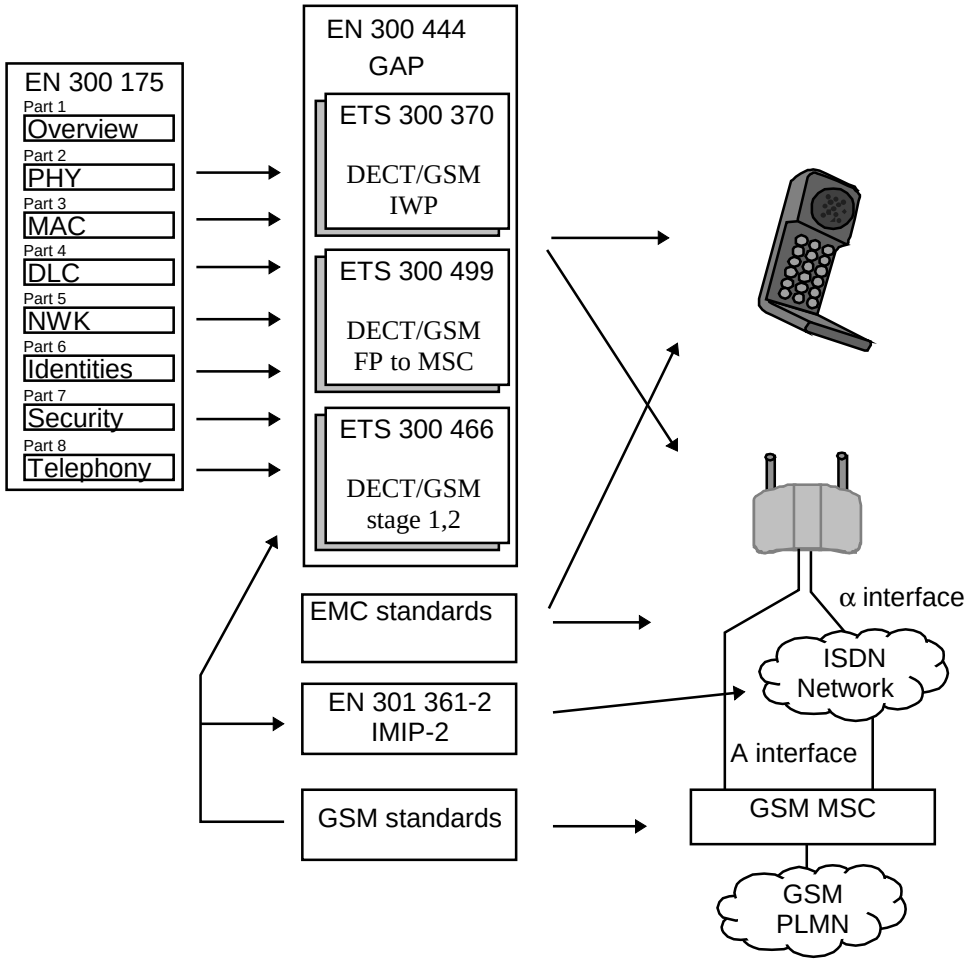


Figure 16: Documents relating to DECT/GSM interworking

7.10 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 [77] describes DECT/GSM integration based on dual-mode terminals.

7.11 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, ETS 300 765 [65] to [66], is divided into two parts:

RAP Part 1 (RAP-1) - ETS 300 765-1 [65]:

"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 [65] 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 17.

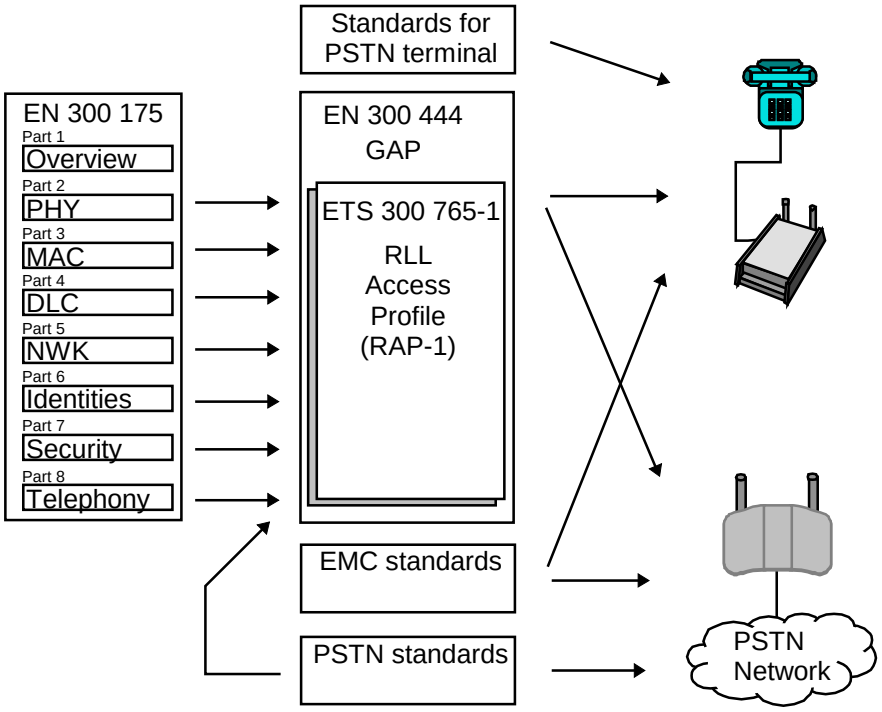


Figure 17: Documents relating to RLL (basic telephony via PSTN)

RAP Part 2 (RAP-2) - ETS 300 765-2 [146**] :**

"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 [66] refers completely to existing profiles for the optional provision of the services:

- DECT-ISDN intermediate system as defined in ETS 300 822 [70] 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 [88] for providing Internet access and modem support; and
  - as defined in F.2 [56] 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 18.

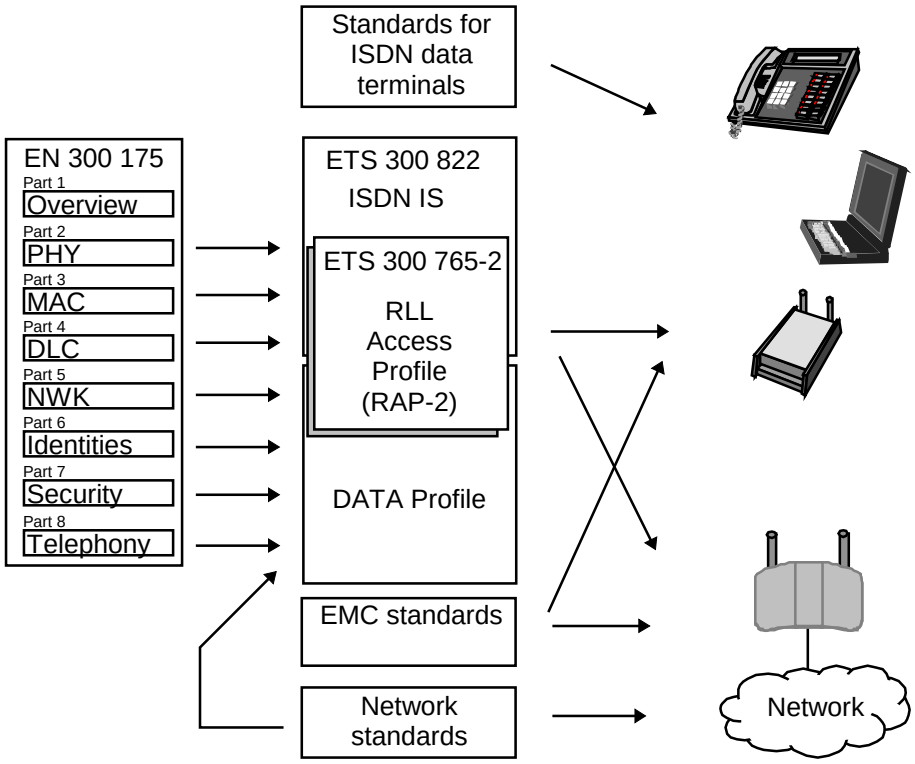


Figure 18: Documents relating to RLL (advanced telephony)

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 19.

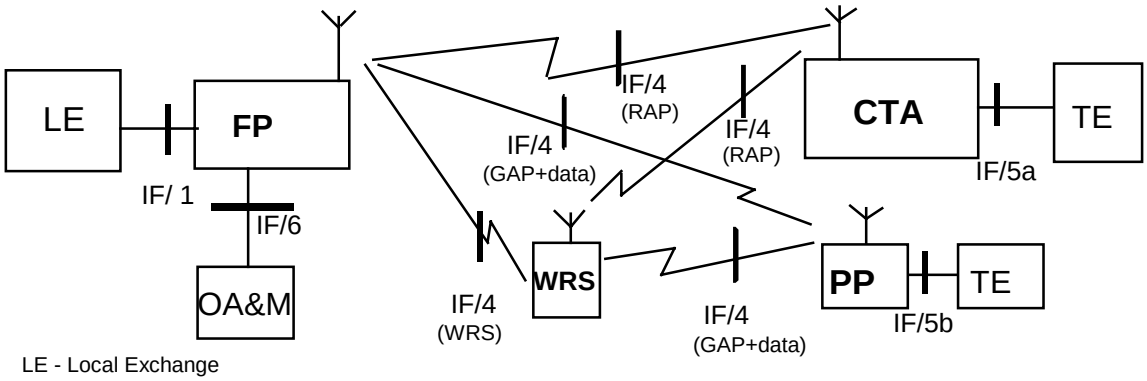


Figure 19: DECT RLL Reference Model

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. The services facilities and configurations (see ETR 308 [100]) 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 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 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 - 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 19) provides means for integration of fixed and mobile services, which will appear on the emerging deregulated telecommunications markets. For more information on the DECT fixed/mobile integration, see subclause 13.3.

The DECT RLL applications are supported by two 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 [100].

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 has been published as TR 101 310 [104].

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 a standard, and it may be required for a product to pass the tests defined in the relevant conformance test specification (or a sub set thereof) prior to being placed on the market (type approval).

Conformance testing of DECT products is addressed in clause 9.

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

9 Conformance testing

In this clause the specific documents related to the conformance 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].

9.1 Radio conformance testing

The relevant document describing the conformance testing of the DECT radio requirements is EN 300 176-1 [15]. This document 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]. This document 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 subclause describes briefly how the various conformance test documents relate to each other. More extensive information for DECT conformance testing may be found in ETR 183 [97].

9.3.1 The Protocol Implementation Conformance Statements (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]. This standard 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 [38] to [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. As GAP has been recognized as the basis for all speech applications the GAP tests have served as foundation for establishing the TCL. Currently mainly GAP tests are included into the TCL, however a small number of test purposes and test cases covering more than GAP requirements are incorporated as well.

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

9.3.3 The Profile Implementation Conformance Statements (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 [52] to [53] references to GAP ICS, ETS 300 474-1 [26] and ETS 300 474-2 [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 [54] to [55] references to ETS 300 052-1 [9], ETS 300 052-2 [10], ETS 300 052-3 [11], ETS 300 052 4 [12], ETS 300 052-5 [13] and ETS 300 052-6 [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 profile independent. The relevant documents for conformance testing of WRS equipment are given in figure 20.

Radio Aspects	EN 300 176 -1 [15] Approval test Specification Part 1: Radio
Telephony Aspects	No relevant specification
Protocol Aspects	* Wireless Relay Station Test Specification 2 Parts standard

NOTE: *: in preparation at the time of publication of the present document.

Figure 20: 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 [62], ETS 300 760 [63]).

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 21.

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
	ETS 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 21: 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 22.

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 [138] to [145] 9 parts DPRS Test Case Library
	* DPRS Profile ICS proforma 2 Parts standard

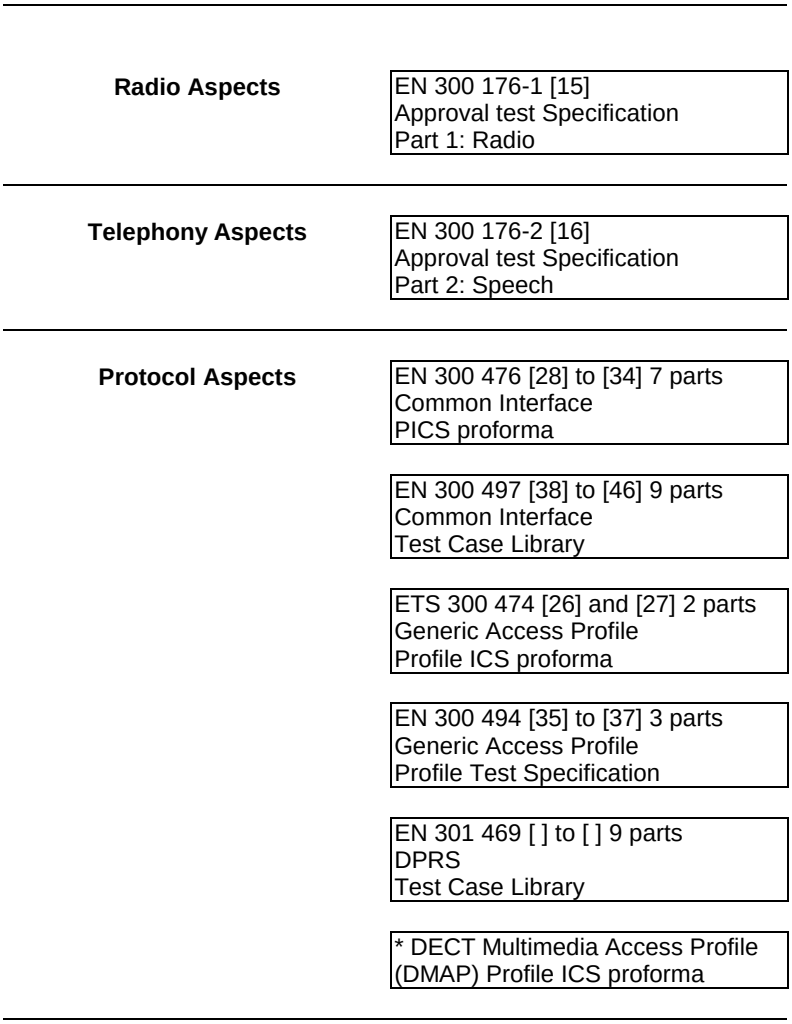
NOTE: *: in preparation at the time of publication of the present document.

Figure 22: Conformance testing documents related to DPRS

9.7.3 DMAP

Since DMAP refers to both GAP and DPRS this is also reflected in which conformance test specifications are needed.

The relevant documents for conformance testing of DMAP conform equipment are given in figure 23.



NOTE: *: in preparation at the time of publication of the present document.

Figure 23: Conformance testing documents related to DMAP

9.7.4 Data profiles

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 24.

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 [ ] to [ ] 9 parts DPRS Test Case Library
	* DPRS Profile ICS proforma 2 Parts standard
	* Service Type D, mobility class 2 Profile ICS proforma, Test specification
	* Service type E, class 2 Profile ICS proforma, Test specification
	** Service type F, class2 Profile ICS proforma, Test specification, see note
	** Point-to-Point Protocol (PPP) Profile ICS proforma, Test specification, see note

NOTE 1: *: in preparation at the time of publication of the present document.
NOTE 2: **: these profiles have been declared historic.

Figure 24: Conformance testing documents related to Data

9.7.5 ISDN End System

The relevant documents for conformance testing of ISDN ES equipment are given in figure 25. 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 [59] to [61] 3 parts ISDN ES Profile Test Specification
where 3,1 kHz voice telephony service is supported:	ETS 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 25: Conformance testing documents related to ISDN ES

9.7.6 ISDN Intermediate System

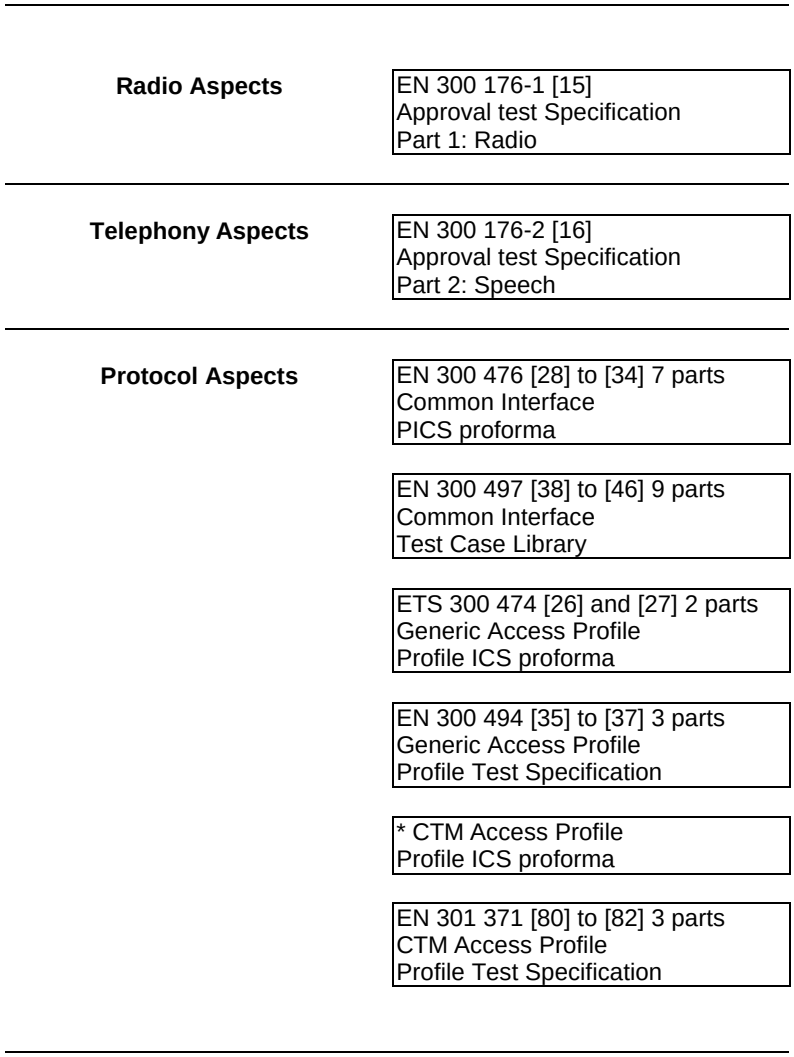
Where 3,1 kHz voice telephony is supported, EN 300 176-2 [16] applies to the FP. The 3,1 kHz telephony requirements for the PT have to be derived from EN 300 176-2 [16] and the terminal telephony parameters. EN 300 176-1 [15] applies for the radio aspects.

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 [76] - [] 2 parts ISDN IS Profile ICS proforma
	EN 300 614 [85] to [87] 3 parts ISDN IS Profile Test Specification
where 3,1 kHz voice telephony service is supported:	ETS 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 26: 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 27.



NOTE: *: in preparation at the time of publication of the present document.

Figure 27: 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 28.

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 ETS 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.

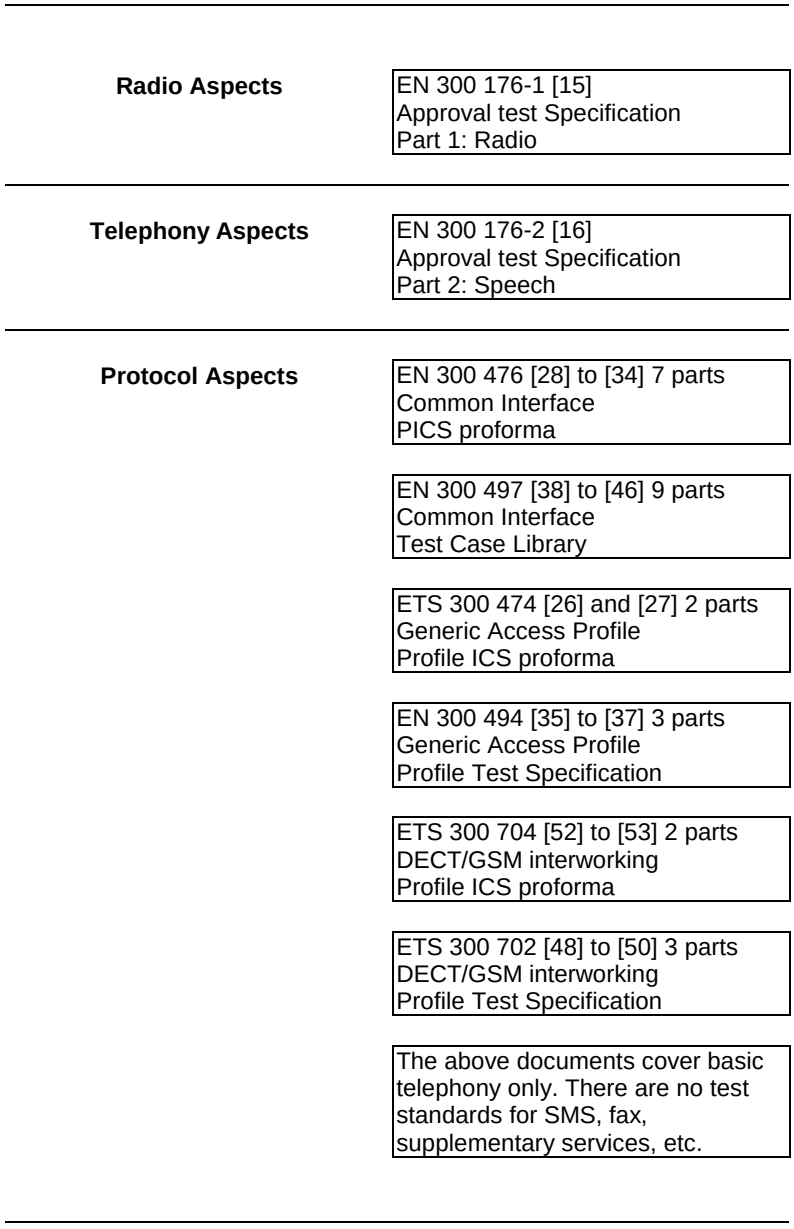


Figure 28: Conformance testing documents related to DECT/GSM

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 subclause 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 [102].

9.7.10 RLL Access Profile (RAP)

The relevant documents for conformance testing of RAP equipment are given in figure 29.

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.

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. (See text above)

Figure 29: Conformance testing documents related to RAP

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 document.

10.1 The Terminal Directive

At the time of publication of the present document the Terminal Directive, 98/13/EC [109] sets the background for the free movement and use of terminal equipment in the EU member states.

DECT equipment is (in general) covered by the Terminal Directive when it is capable of accessing a public network directly or indirectly. The Terminal Directive specifies (in very general terms) the essential requirements which shall be met for terminal equipment to have pan-European type approval. The essential requirements are generally limited to protection of spectrum, protection of the network, safety issues, interworking with the network and interworking through the network (for voice telephony only).

Conformance to Directive 98/13/EC [109] is demonstrated by conformance to the relevant CTR (Common Technical Regulation). These EU legal requirements refer to an associated TBR (Technical Basis for Regulation) for their technical content. A TBR is a special type of ETSI deliverable, identifying the essential requirements which shall be tested and the tests to be performed in order to ensure compliance to the terminals directive.

In early 2000 a new Terminal Directive (R&TTE Directive) will come into force which will consider substantially less requirements to be essential than Directive 98/13/EC [109] and those will be limited to the avoidance of harm or interference to third parties. Conformity to the essential requirements of the R&TTED is by supplier's declaration, and may be based on Harmonized Standards, or other means.

The most significant aspect of the R&TTE Directive is that it conforms to the "New Approach to technical harmonization". This introduces a market-led approach into the Radio and Telecommunications Terminal Equipment sector, and removes the regime of type approvals. Conformity to the essential requirements in Article 3 of the R&TTE Directive is by supplier's declaration, and may be based on Harmonized Standards, or other means.

The Directive contains essential requirements that are to be met.

For the products within its scope, the R&TTE Directive covers all aspects of placing on the market and putting into service, except for licensing of RE, which remains a national matter. The aspects of safety and EMC covered in other Directives are taken over into the R&TTE Directive, although the supplier has the option of using the procedures in these earlier Directives, for equipment which falls within their scope (R&TTE Directive Article 10.2), as a means to demonstrate conformity to the requirements of article 3.1a and 3.1b in the R&TTE Directive.

Where CTRs exist under Directive 98/13/EC [109], these can be used in a transition period to provide a presumption of conformity with the R&TTE Directive. However in the long term development of Harmonized Standards is necessary which will contain conformance requirements in accordance with the new minimum essential requirements.

In the following subclauses the DECT relevant CTRs/TBRs are described. They will form the base of Harmonized Standards which will be developed later by EP DECT. It should be expected that many of the requirements of existing standards will not be necessary to achieve a presumption of conformity to the new Terminal Directive.

The Terminal Directive is only applicable to terminals. It is not applicable to equipment, which is part of a network. The location of the network termination point (NTP) is therefore very important. If the DECT FP is connected to the NTP then the FT is a terminal equipment and subject to the Terminal Directive. If the NTP is the air interface then the FT shall be part of the network and not subject to the Terminal Directive. In general a PP is always a terminal. However, in the case of ISDN IS or the RAP profiles the NTP may be considered as the replicated network interface at the PP if the PP is supplied by the network operator. In this case the PP may not be a terminal equipment.

10.2 The EMC directive

The EMC directive, 89/336/EEC [108] sets the background for harmonization of the EMC requirements in the EU member states. Such requirements have become identical in all EU countries. All electrical and electronic equipment to be marketed in the EU shall fulfil the requirements of the EMC directive.

The EMC requirements for radio in general are described in EN 300 339 [19] and the specific requirements for DECT are found in ETS 300 329 [17]. ETS 300 329 [17] may be used to demonstrate compliance to the EMC directive.

10.3 DECT CTRs

For rapid introduction on a European wide basis, Council Directive 91/287/EEC [110] and Council Recommendation 91/288/EEC [111] refer to the Terminal Directive (currently 98/13/EC [109]) for mutual recognition between countries of conformity. For this purpose Common Technical Regulations (CTRs) have been established for DECT relating to harmonized DECT TBRs and ENs. Approval to the relevant DECT CTRs gives full access to the single European market.

Further information on Council Directive 91/263/EEC [109] and its application can be found in TRAC's "Handbook on CTRs" [113] and "Procedure for the Production of CTRs" [114].

Where the network interface of a DECT FP is territory specific, which is in general the case for PSTN connection, there may be territory specific type approval requirements for the network interface.

10.3.1 CTR 006

Conformance to CTR 006 [106] is mandatory for all DECT equipment.

CTR 006 [106] references TBR 006 [124] for its technical contents.

TBR 006 [124] contains radio parameters and procedures required for the effective co-existence of uncoordinated private and public systems on the common designated DECT frequency band.

NOTE: TBR 006 [124] is in its technical content identical to EN 300 176-1 [15].

TBR 006 [124] is expected to be converted in full to a Harmonized Standard, which will apply to all DECT terminal equipment.

10.3.2 CTR 010

Conformance to CTR 010 [107] is mandatory for all DECT terminal equipment supporting a 3,1 kHz telephony teleservice capable of direct or indirect interworking via the public PSTN/ISDN.

CTR 010 [107] references TBR 010 [125] for its technical content.

TBR 010 [125] contains the speech coding and speech transmission requirements.

For all equipment where PPs are allowed to be tested as separate items under CTR 010 [107], the required speech characteristics are uniform. If a connection attempt between a separately approved PP and FP succeeds (related ARI and PARK), then the end-to-end speech characteristics and echo control requirements are met, independently of which access protocol was used. This is an essential feature for DECT as a general radio access technology, since a multitude of access protocols are supported.

NOTE: TBR 010 [125] is in its technical content identical to EN 300 176-2 [16].

Key requirements of TBR 010 [125] are expected to be included in the forthcoming Harmonized Standard for DECT terminal equipment.

10.3.3 CTR 022

CTR 022 [135] is mandatory for all DECT equipment that have to conform to CTR 010.

CTR 022 [135] references TBR 022, which in turn references the essential requirements of the GAP conformance requirements documents (see figure 21).

Key requirements of TBR 022 may be included in the forthcoming Harmonized Standard for DECT terminal equipment.

10.3.4 CTR 040

CTR 040 [136], referring to TBR 040, provides the essential requirements for DECT ISDN interworking, covering both the End System Configuration and the Intermediate System Configuration. CTR 040 [136] is published as a Harmonized Standard applicable to the new Terminal Directive.

10.3.5 EN 301 439

EN 301 439 [83] is published as a Harmonized Standard and provides the essential requirements for DECT/GSM Dual Mode Portable Parts/Mobile equipment.

10.4 Licensing

DECT equipment for private applications is exempt from licence requirements in the CEPT countries. Operation of a public DECT system may be subject to national regulation.

10.5 Type approval

Compliance with the Terminal Directive (demonstrated by compliance with the relevant CTRs) generally provides pan-European type approval. Where the equipment is not subject to the Terminal Directive, national type approval requirements may apply. National type approval may also apply when terminals are intended for connection to networks which have territory specific requirements (e.g. this is the situation with PSTN at present).

From early 2000 the new Terminal Directive (R&TTE Directive) will introduce a market-led approach into the Telecommunications Terminal Equipment (TTE) sector and removes the regime of type approvals. Conformity to the essential requirements of the R&TTE Directive is by supplier's declaration, and may be based on Harmonized Standards, or other means.

10.6 Application to specific profiles

This subclause identifies the regulatory requirements that apply to each profile. This subclause is provided for information but cannot be regarded as a definitive source of information on this issue. Regulatory issues are not within the responsibility of ETSI.

Table 1: Applicability of CTRs to DECT applications

Profile	Radio	Telephony	Protocol	EMC	Safety	Network IF
GAP	CTR 006 [106]	CTR 010 [107]	CTR 022 [135]	ETS 300 329 [17]	note 2	note 2
Data profiles	CTR 006 [106]			ETS 300 329 [17]	note 2	note 2
ISDN ES	CTR 006 [106]	CTR 010 [107]	CTR 022 [135] CTR 040 [136]	ETS 300 329 [17]	note 2	note 2
ISDN IS	CTR 006 [106]	note 1	CTR 040 [136]	ETS 300 329 [17]	note 2	note 2
CTM	CTR 006 [106]	CTR 010 [107]	CTR 022 [135]	ETS 300 329 [17]	note 2	note 2
GSM interworking	CTR 006 [106]	CTR 010 [107]	CTR 022 [135]	ETS 300 329 [17]	note 2	note 2
DECT/GSM Dual Mode Terminal (4)	EN 301 439 [83]	EN 301 439 [83]	EN 301 439 [83]	ETS 300 329 [17]	note 2	note 2
RLL	CTR 006 [106]	note 1		ETS 300 329 [17]	note 2	note 2
WRS	CTR 006 [106]			ETS 300 329 [17]	note 2	note 2
NOTE 1: Equipment could be tested in combination with associated wired terminal to CTR 010. NOTE 2: Further regulatory requirements regarding safety and network interfaces may apply. NOTE 4: For DECT/GSM Dual Mode Terminal no CTRs exist. NOTE 5: CTRs are only applicable when the equipment is a terminal.						

11 Summary of the DECT Technical Reports

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

11.1 ETR 015 : DECT reference document

ETR 015 [90] provides a rather detailed description of services and features in DECT. The document was published in 1991 and the latest developments in DECT are not covered. This document is now obsolete as updated information is available in the present document and TR 101 310 [104], and has been declared historic.

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

ETR 041 [91] 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).

11.3 ETR 042 : Traffic capacity aspects

The radio aspects are further described in ETR 042 [92]. This ETR was published in 1992, and does not include requirements or simulations for Radio Local Loop (RLL) and outdoor Personal Communications Network (PCN) applications. ETR 042 [92] is obsolete and has been declared historic. Up to date information is found in TR 101 310 [104].

11.4 ETR 043 : DECT services and facilities

ETR 043 [93] 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.

11.5 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 [94]. 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 [94] 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.

11.6 ETR 139 : Radio in the Local Loop

ETR 139 [95] is not specifically related to DECT. It examines technologies in use or under development in Europe for Radio in the Local Loop. ETR 139 [95] 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 [100], TR 101 310 [104] and TR 101 370 [105] relate specifically to DECT RLL.

11.7 ETR 159 : DECT wide area mobility using GSM

ETR 159 [96] describes the possible requirements when a DECT system is attached to a GSM fixed network. ETR 159 [96] 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.

11.8 ETR 183 : DECT Conformance testing on DECT equipment

ETR 183 [97] 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.

ETR 183 [97] contains an abstract of the DECT standard, the ISO/IEC 9646 [115] standard and the resulting issues from applying the requirements and techniques of ISO/IEC 9646 [115] 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.

11.9 ETR 185 : DECT Data Services Profile; overview

ETR 185 [98] 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.

ETR 185 [98] also describes possible user scenarios in wireless computing. These scenarios have formed the guidelines of the DECT Data Services Profiles.

11.10 ETR 246 : DECT Wireless Relay Stations

An overall description of Wireless Relay Stations (WRS) is provided in ETR 246 [99]. WRS is an additional building block for the DECT fixed network. It is suitable to provide cost effective infrastructures for low traffic density applications.

11.11 ETR 308 : DECT Services and configurations for RAP

ETR 308 [100] 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 [100] 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".

11.12 ETR 341 : DECT/GSM interworking profile overview

ETR 341 [101] gives an overview and description of the standards within the DECT/GSM Interworking Profile (IWP).

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

TR 101 072 [102] investigates radio and network aspects and clarifies the possibilities as well as the problems related to dual-mode terminals.

This document 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.

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

TR 101 159 [103] is a guide how to implement and test DECT systems operating at frequencies outside the frequency-bands described in TBR 006. 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 to 1 900 MHz DECT frequency band.

11.15 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.

11.16 TR 101 310 : DECT Traffic capacity and spectrum requirements

TR 101 310 [104] 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.

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

TR 101 370 [105] is a guide how to implement and test DECT FWA (WLL) systems operating at frequencies outside the frequency-bands described in TBR 006. 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 not only the radio frequency band around 1,9 GHz, as stated in TR 101 159 [103], but also 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.

11.18 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

The DECT standard is accepted within whole Europe and also in many other countries, totally about 80 countries (information from DECT Forum).

General on frequency band versions for DECT:

- 1 880 - 1 900 MHz Basic DECT allocation;
- 1 910 - 1 930 MHz for Latin America;
- 1 900 - 1 920 MHz for main land China.

The exact DECT carrier positions can be found in Annex B.3. TR 101 159 [103] gives guidance to the implementation of DECT in an arbitrary spectrum allocation.

12.2 System Types

The majority DECT shipments are in residential and small business applications in Europe. DECT has proved to be cost effective for the low end consumer market, having potential for further cost reductions. (Example of low end equipment user prices in Germany 1998): *Residential Base Station* with handset to handset intercom functionality 50 EURO, *Handset* 50 EURO).

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.

A large number of public DECT WLL commercial installations are in operation all over the world, mainly addressing the teledensity market in developing countries. In Europe, most systems are in Eastern Europe.

Public pedestrian DECT systems have had a slow development. There is one large public system operating since early 1998 in Italy. The system provides a high quality speech service and seamless coverage of streets, other public places and shopping mall in 31 cities with a total of more than 130.000 subscribers. With the success of GSM and heavy investment in mobile telephony, there is in general a reserved attitude towards the needs for public pedestrian DECT applications.

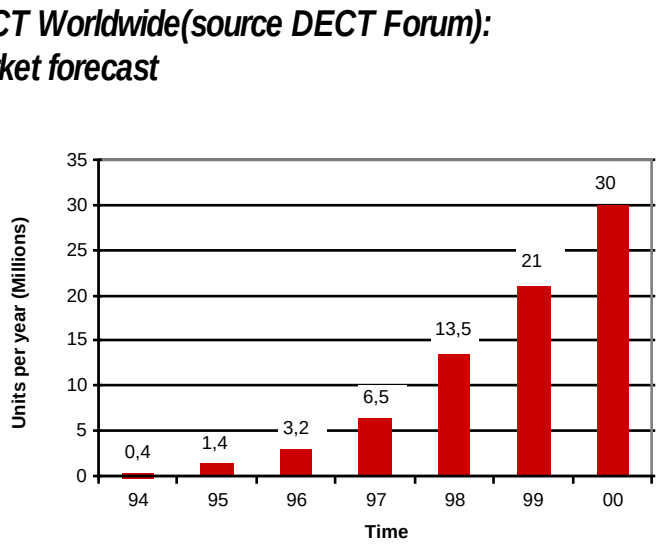


Figure 30: DECT fixed/mobile integration

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 band 1920 - 1930 MHz. PWT-E is an extension into the licensed bands 1850 - 1910 MHz and 1930 - 1990 MHz. These standards may also be spread to some countries in Latin America, where some countries already have allocated spectrum for DECT services. PWT, PWT-E and DECT do however coexist very well on a common spectrum allocation, due to the common frame structure (see TR 101 310 [104]).

13 New developments of DECT

The DECT standard is a very complete radio access standard, **and it exists today.** Together with DECT/GSM/DCS 1 800 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. Modulation options providing bit rates up to 2 Mbit/s have been defined. See subclause 13.1.

As one of the latest extensions EP DECT in working on the definition of DECT/IP Interworking for Voice over IP (VoIP) services.

13.1 The DECT 4- and 8-level modulation options

The latest version of the DECT base standard includes backwards compatible 4- and 8-level modulation options, which provides 2 Mbit/s data services via a single DECT radio.

The 4-level modulation is π/4-DQPSK and the 8-level modulation π/8-D8PSK. The 2- level modulation is π/2-DPSK for slots with 4- or 8-level modulation. The shaping filter shall be root-raised cosine with Ts = 1/1152000 s (Ts = symbol duration) and roll-off (α) = 0,5 for all three types of modulation. π/2-DPSK may be generally used as 2-level modulation instead of the GFSK modulation.

This will increase the bit rate of single radio DECT equipment by a factor 2 or 3 with retained transmitter bandwidth, carrier spacing and slot structure.

It is only allowed to use 4-level and/or 8-level modulation in the B + Z or the A + B + Z fields [3], whereby the S + A or the S field respectively shall use the π/2-DBPSK 2-level 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	Raw B-field Data Rate
1a	GFSK	GFSK	GFSK	Full slot: 32 kbit/s Double slot: 80 kbit/s
1b	π/2-DBPSK	π/2-DBPSK	π/2-DBPSK	Full slot: 32 kbit/s Double slot: 80 kbit/s
2	π/2-DBPSK	π/2-DBPSK	π/4-DQPSK	Full slot: 64 kbit/s Double slot: 160 kbit/s
3	π/2-DBPSK	π/2-DBPSK	π/8-D8PSK	Full slot: 96 kbit/s Double slot: 240 kbit/s
4a	π/2-DBPSK	π/4-DQPSK	π/4-DQPSK	Full slot: 64 kbit/s Double slot: 160 kbit/s
4b	π/2-DBPSK	π/8-D8PSK	π/8-D8PSK	Full slot: 96 kbit/s Double slot: 240 kbit/s

Configuration 1a is the basic DECT modulation scheme. Configurations 2 and 3 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 or 3 is used.

The modulation accuracy for configurations 1b, 2, 3, 4a and 4b 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.

Asymmetric DECT data services combine in a single radio up to 23 full slots or 11 double slots in one direction of a connection. Bit rates beyond 2 Mbit/s can be provided. For example, the asymmetric double-slot service with modulation configuration 3 will provide up to 2,640 Mbit/s B-field data rate and up to 2,112 Mbit/s data rate in a protected (LU7) type application, as indicated in the following table.

Table 3: Maximum gross- and user bit rates

Type of transmission	2-level	4-level	8-level
Gross bit rate	1 152	2 304	3 456
User bit rate, Unprotected Asymm. conn., Full Slot (23 + 1)	736 + 32	1 472 + 64	2 208 + 96
User bit rate, Unprotected Asymm. conn., Double Slot (11 + 1)	880 + 80	1 760 + 160	2 640 + 240
User bit rate, DPRS, Asymm. Conn., Full Slot (23 + 1) protected with CRC sub-fields protected with a single CRC field	 552 + 24 662,4 + 28,8	 1 140,8 + 49,6 1 361,6 + 59,2	 1 729,6 + 75,2 2 097,6 + 91,2
User bit rate, DPRS, Symmetric Conn., Full Slot (12 + 12) protected with CRC sub-fields protected with a single CRC field	 288 + 288 345,6 + 345,6	 595,2 + 559,2 710,4 + 710,4	 902,4 + 902,4 1 094,4 + 1 094,4

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.

13.2 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 1880 - 1937 MHz in EN 300 175 [1] to [8] and TBR 006. This allows for expansion of the basic DECT allocation or allows DECT services to be introduced in countries where the basic DECT frequencies 1880 - 1900 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.

13.3 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 31a, 31b and 31c give an overview of possible scenarios.

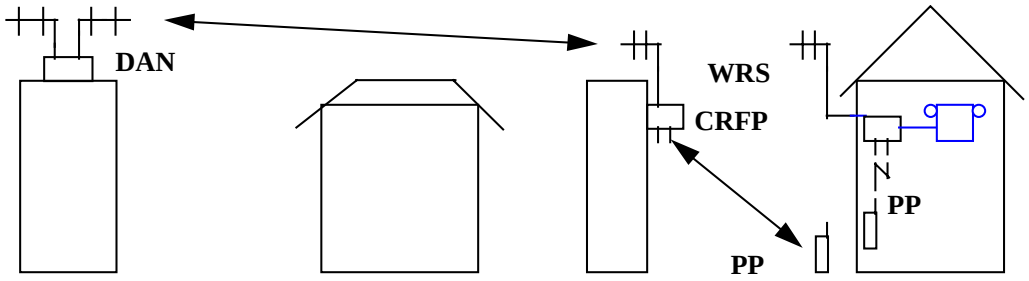


Figure 31a: DECT fixed/mobile integration

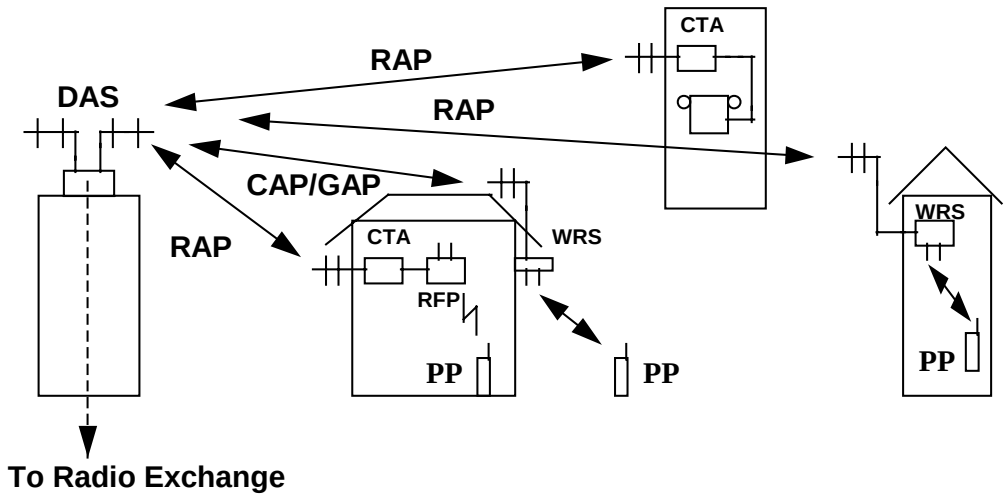


Figure 31b: DECT fixed/mobile integration

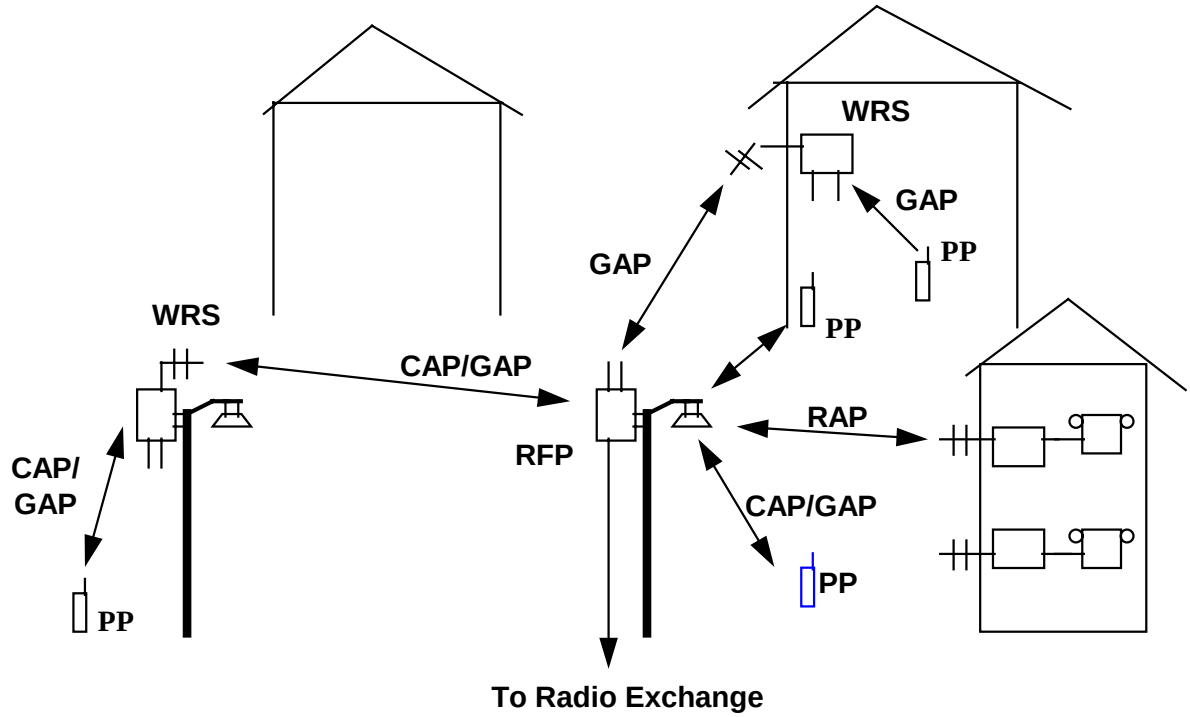


Figure 31c: DECT fixed/mobile integration

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.

13.4 IMT-2000/FPLMTS

Several different radio interfaces have been accepted in IMT-2000/FPLMTS. DECT is also seen as an element for the technical development of this system family, utilizing the ability of DECT to access different networks. Examples are PSTN, ISDM, GSM and UMTS.

Together with DECT/GSM/DCS 1800 interworking and dual (triple mode) mode handsets, evolving products will provide 3rd generation mobile radio services. Figure 32 gives a high level graphic overview of DECT services and applications. Protected asymmetric links with bit rates beyond 2 Mbit/s are possible if needed, for example by having multiple radio circuits in a subscriber unit.

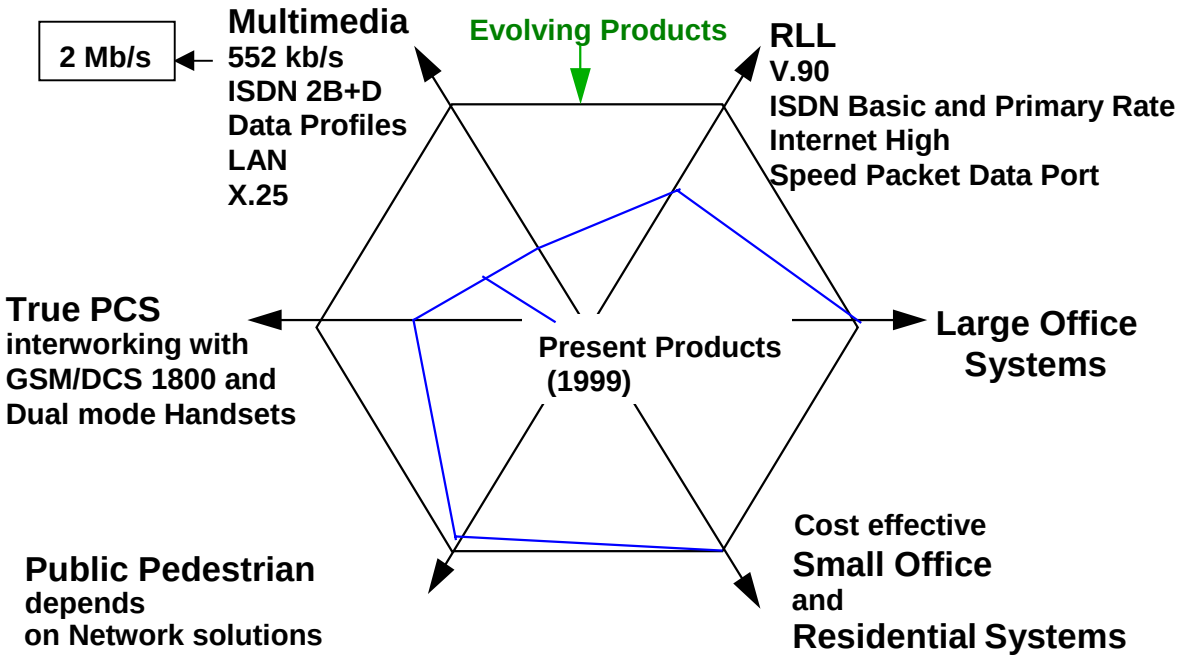


Figure 32: Graphic high level overview of DECT services and applications

13.5 Coexistence with third generation technologies

DECT instantaneous Dynamic Channel Selection (iDCS) provides co-existence between 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 third generation 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.

Annex A (normative): Summary table of DECT standards

The following table lists the DECT deliverables as of 3rd October 1999.

A.1 Regulatory documents

TBR	TBR 022 [123]	Attachment requirements for terminal equipment for Digital Enhanced Cordless Telecommunications (DECT) Generic Access Profile (GAP) applications	Published
TBR	TBR 006 [124]	General terminal attachment requirements	Published
TBR	TBR 010 [125]	General terminal attachment requirements: Telephony applications	Published
TBR	TBR 036 [126]	Global System for Mobile communications (GSM); DECT access to GSM Public Land Mobile Networks (PLMNs) for 3,1 kHz speech applications	Published
TBR	TBR 040 [127]	Integrated Services Digital Network (ISDN); Attachment requirements for terminal equipment for DECT/ISDN interworking profile applications	Published

EN	DEN/DECT-040165	Harmonized standard for type approval	Under preparation

A.2 Common Interface documents

ETR	ETR 043 [93]	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 [71]	CTM Access Profile (CAP)	Published
EN	EN 301 371 [80] to [82] 3 parts	CTM Access Profile (CAP); Profile Test Specification (PTS);	Published
EN	EN 302 096 [117]	Feature Package 1 (FP1); CTM circuit-switched data profile, 32 kbit/s and 64 kbit/s Unrestricted Digital Information (UDI)	Published
EN	EN 301 678 [116]	Feature Package 2 (FP2); Short Message Service (SMS) Profile Point to Point (PP)	In approval
EN	DEN/DECT-040121-1,2	CTM Access Profile (CAP); Profile requirement list and profile specific Implementation Conformance Statement (ICS) proforma;	Under preparation

A.4 DECT DATA documents

ETR	ETR 185 [98]	Profile overview	Published
EN	EN 301 649 [88]	DECT Packet Radio Services (DPRS)	In approval
EN	EN 301 650 [89]	DECT Multimedia Access Profile (DMAP)	In approval
EN	ETS 300 435 [128]	Base standard including interworking to connectionless networks (service types A and B, class 1)	Historic
EN	ETS 300 701 [129]	Generic frame relay service with mobility (service types A and B, class 2)	Historic
ETS	ETS 300 699 [130]	Generic data link service for closed user groups (service type C, class 1)	Historic
ETS	ETS 300 651 [131]	Generic data link service (service type C, class 2)	Historic
EN	EN 301 239 [74]	Isochronous data bearer services for closed user groups (service type D, mobility class 1)	Published
EN	EN 301 238 [73]	Isochronous data bearer services with roaming capability (Service Type D, mobility class 2)	Published
EN	EN 300 757 [132]	Low rate messaging service (service type E, class 2)	Published
ETS	ETS 300 755 [56]	Multimedia Messaging Service (MMS) with specific provision for facsimile services (service type F, class 2)	Historic
EN	EN 301 240 [75]	Point-to-Point Protocol (PPP) interworking for internet access and general multi-protocol datagram transport	Historic
EN	DEN/DECT-040148-1,2	DECT Multimedia Access Profile (DMAP); Profile Implementation Conformance Statement (ICS);	In preparation
EN	DEN/DECT-040142-1,2,3	DECT Multimedia Access Profile (DMAP); Profile Test Specification (PTS);	In preparation
EN	DEN/DECT-040157	DECT Packet Radio Services; Profile requirement list and profile specific Implementation Conformance Statement (ICS) proforma	In preparation
EN	DEN/DECT-040164	Isochronous data bearer services with roaming capability (Service Type D, mobility class 2); Profile Specific Test Specification (PSTS))	In preparation
EN	EN 301 469-1 [137] to [145]	Test Case Library (TCL); Part 1 to 9	In approval

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
EN	ETS 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 [133]	DECT/GSM advanced integration of DECT/GSM dual-mode terminal equipment	Published
TR	TR 101 072 [102]	DECT/GSM integration based on dual-mode terminals	Published
ETR	ETR 341 [101]	DECT/GSM Interworking Profile (IWP); Profile overview	Published
ETR	ETR 159 [96]	Wide area mobility using GSM	Published
EN	EN 301 439 [83]	Attachment requirements for DECT/GSM dual-mode terminal equipment	Published
EN	EN 301 242 [77]	DECT/GSM integration based on dual-mode terminals	Published
ETS	ETS 300 370 [20]	DECT/GSM Interworking Profile (IWP); Access and mapping (protocol/procedure description for 3,1 kHz speech service)	Published
ETS	ETS 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 [57]	DECT/GSM Interworking Profile (IWP); Implementation of bearer services	Published
ETS	ETS 300 792 [69]	DECT/GSM Interworking Profile (IWP); Implementation of facsimile group 3	Published
ETS	ETS 300 764 [64]	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 [67]	Integrated Services Digital Network (ISDN); DECT access to GSM via ISDN; General description of service requirements	Published
ETS	ETS 300 788 [68]	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 [84]	Attachment requirements for terminal equipment for DECT/ISDN interworking profile applications	Published
ETS	ETS 300 434-1 [22]	DECT/ISDN interworking for end system configuration; Part 1: Interworking specification	Published
ETS	ETS 300 434-2 [23]	DECT/ISDN interworking for end system configuration; Part 2: Access profile	Published
EN	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 [59] to [61] 3 parts	DECT/ISDN interworking for end system configuration; Profile Test Specification (PTS);	Published
ETS	ETS 300 822 [70]	DECT/ISDN interworking for intermediate system configuration; Interworking and profile specification	Published
EN	EN 300 614 [85] to [87] 3 parts	DECT/ISDN interworking for intermediate system configuration;	Published
EN	EN 301 241-1 [76],2	DECT/ISDN interworking for intermediate system configuration; Profile Implementation Conformance Statement (ICS);	Published
EN	EN 301 361-1 [78]	ISDN Mobility protocol Interworking specification Profile (IMIP); Part 1: DECT/ISDN interworking for Cordless Terminal Mobility (CTM) support	Published
EN	EN 301 361-2 [79]	ISDN Mobility protocol Interworking specification Profile (IMIP); Part 2: DECT/ISDN Interworking for Global System for Mobile communications (GSM) support	In approval

A.8 Wireless Relay Station (WRS)

ETR	ETR 246 [99]	Application of DECT Wireless Relay Stations (WRS)	Published
EN	EN 300 700 [118]	Wireless Relay Station (WRS)	Published

A.9 General DECT reports

TR	TR 101 178 [122]	A High Level Guide to the DECT Standardization.	Published
ETR	ETR 042 [92]	A guide to DECT features that influence the traffic capacity and the maintenance of high radio link transmission quality, including the results of simulations	Historic
ETR	ETR 183 [97]	Conformance testing on DECT equipment	Published
ETR	ETR 041 [91]	Digital European Cordless Telecommunications (DECT); Transmission aspects 3,1 kHz telephony Interworking with other networks	Published
ETR	ETR 015 [90]	Reference document	Historic
ETR	ETR 056 [94]	System description document	Published
TR	TR 101 159 [103]	Implementing DECT in an arbitrary spectrum allocation	Published
TR	TR 101 310 [104]	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 [72]	3 Volt DECT Authentication Module (DAM)	Published
ETS	ETS 300 759 [62]	DECT Authentication Module (DAM); Test specification for DAM	Published
ETS	ETS 300 760 [63]	DECT Authentication Module (DAM); Implementation Conformance Statement (ICS) proforma specification	Published

A.11 EMC standards for DECT

ETS	ETS 300 329 [17]	ElectroMagnetic Compatibility (EMC) for Digital Enhanced Cordless Telecommunications (DECT) equipment	Published

A.12 Radio in the Local Loop (RLL)

ETR	ETR 308 [100]	Services, facilities and configurations for DECT in the local loop	Published
TR	TR 101 370 [105]	Implementing DECT Fixed Wireless Access (FWA) in an arbitrary spectrum allocation	Published
ETS	ETS 300 765-1 [65]	Radio in the local loop (RLL) Access Profile (RAP); Part 1: Basic telephony services	Published
ETS	ETS 300 765-2 [146]	Radio in the Local Loop (RLL) Access Profile (RAP); Part 2: Advanced telephony services	Published

A.13 Broadband ISDN

ETR	ETR 337 [134]	Mobile networks requirements on B-ISDN	Published
TS	TS 101 679 [121]	Broadband Integrated Services Digital Network (B-ISDN); DECT/B-ISDN interworking	Published

A.14 IMT-2000 support standards

TS	DTS/DECT-000156	Support of IMT-2000 Signalling.	In preparation

A.15 DECT in ISM bands

EN	DEN/DECT-CI0169	DECT in ISM Bands	In preparation

Annex B (normative): Technical characteristics for DECT

B.1 Basic Technical Data for DECT

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

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

System	DECT
Frequency band	(1 880 to 1 900 MHz)
Access technique	MC/TDMA/TDD
Bit rate	1 152 kb/s
Carrier spacing	1 728 MHz
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)
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)
Basic link budget	110 dBm (Typ.114 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 2 Mbit/s user data rate with the higher level modulation options.
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

B.2 Slot and Frame Structure

In this subclause, 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).

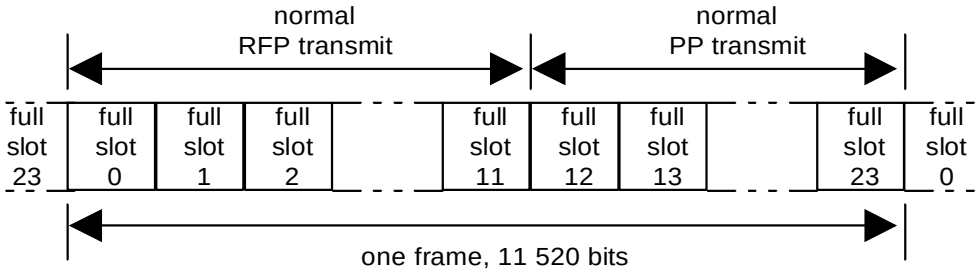


Figure B.1: Full slot format

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

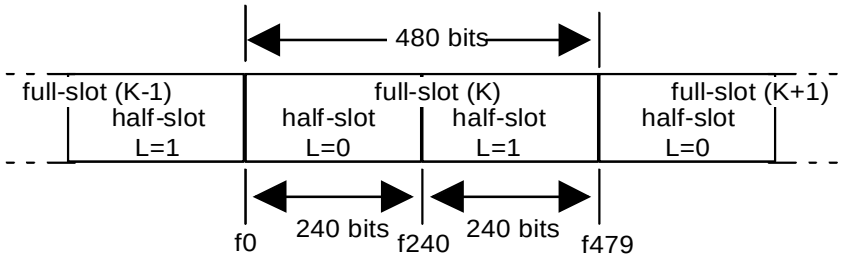


Figure B.2: Half-slot format

Two full slots can be merged into one double slot:

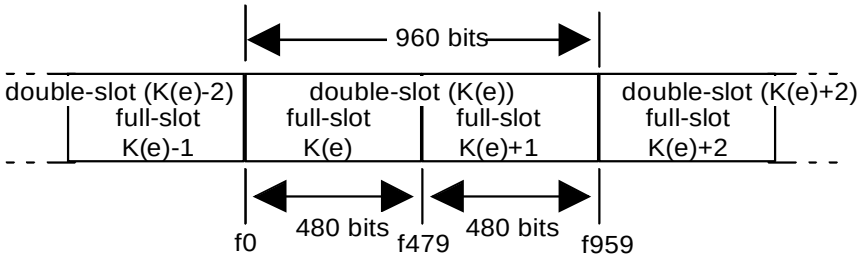


Figure B.3: Double slot format

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. The following figure 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="11">Packet</td></tr>
<tr><td rowspan="3">S</td><td colspan="9">D</td><td rowspan="3">Z</td></tr>
<tr><td colspan="2">A</td><td colspan="7">B</td></tr>
<tr><td>Data</td><td>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>X</td></tr>
<tr><td></td><td></td><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><td></td><td></td></tr>
</table>

Figure B.4: Packet field structure

NOTE: In figure B.4, the field structure for the basic physical packet P32 is shown with protected data and including the optional X-field.

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

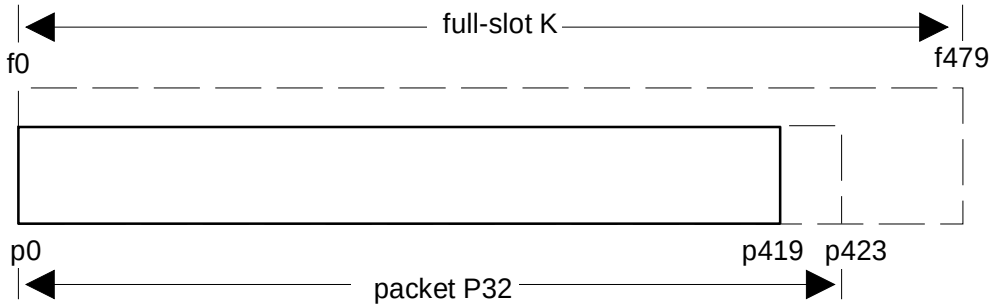


Figure B.5: Basic packet P32

B.2.2.3 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.2.2.4 D-field

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

B.2.2.4A 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).

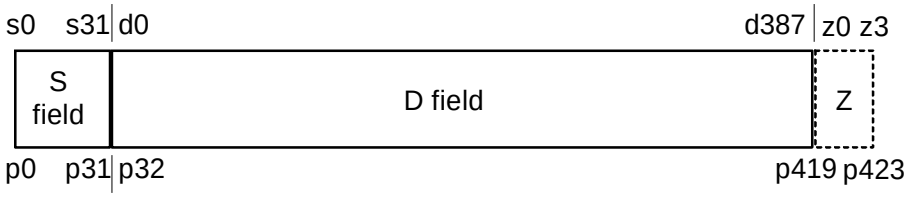


Figure B.6: Packet P32

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.

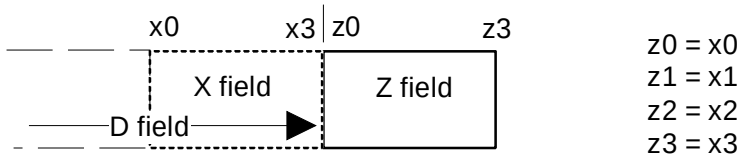


Figure B.7: The Z-field

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.

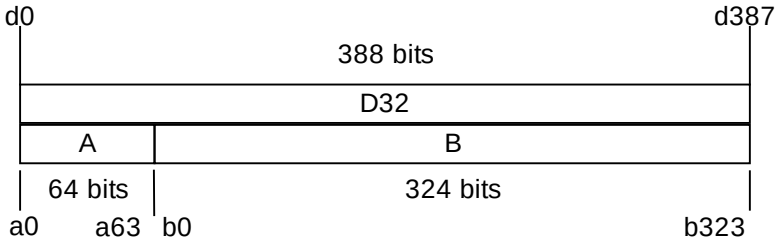


Figure B.8: A-field and B-field in the D32 field (full slot, 2 level modulation)

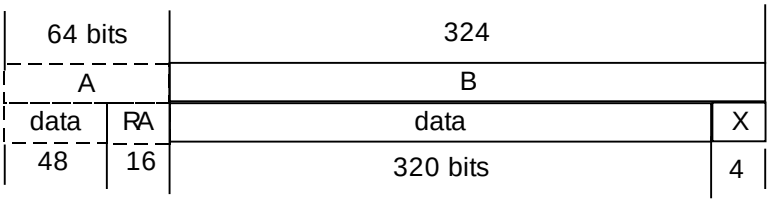


Figure B.9: Unprotected D32 B-field format (full slot, 2 level modulation)

64		324								
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.2 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 [104] for a detailed description of DECT traffic capacity and spectrum requirements.

B.3 DECT carrier numbers and carrier positions in the range 1 880 MHz to 1 938 MHz

DECT is specified for the whole frequency range 1 880 MHz to 1 938 MHz.

For the frequency band 1 880 MHz to 1 900 MHz 10 RF-carriers with centre frequencies Fc are given by:

- $Fc = F0 - c \times 1{,}728$ MHz, where: $F0 = 1\,897{,}344$ MHz
- $c = 0, 1, 2, ..., 9$

For carriers from 1 899,072 MHz to 1 937,088 MHz the carrier frequencies are defined by:

- $Fc = F9 + c \times 1{,}728$ MHz, where: $F9 = 1\,881{,}792$ MHz
- $c = 10, 11, 12, ..., 32$

RF-band number = 00001 (see EN 300 175-2 [2], 4.1.1 and EN 300 175-3 [3], 7.2.3.3.1).

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

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	17	00001	1 911,168
8	-	1 883,520	18	00001	1 912,896
7	-	1 885,248	19	00001	1 914,624
6	-	1 886,876	20	00001	1 916,352
5	-	1 888,704	21	00001	1 918,080
4	-	1 890,432	22	00001	1 919,808
3	-	1 892,160	23	00001	1 921,536
2	-	1 893,888	24	00001	1 923,264
1	-	1 895,616	25	00001	1 924,992
0	-	1 897,344	26	00001	1 926,720
10	00001	1 899,072	27	00001	1 928,448
11	00001	1 900,800	28	00001	1 930,176
12	00001	1 902,528	29	00001	1 931,904
13	00001	1 904,256	30	00001	1 933,632
14	00001	1 905,984	31	00001	1 935,360
15	00001	1 907,712	32	00001	1 937,088
16	00001	1 909,440			

Examples of current spectrum allocations for DECT in different parts of the world are:

- 1 880 MHz to 1900 MHz, 1 900 MHz to 1 920 MHz and 1 910 MHz to 1 930 MHz.

The DECT Fixed Part (Base Station) broadcast messages indicate the locally relevant carrier to ensure that portables and WLL subscriber units set up calls only within the locally allocated band.

New or modified bands can locally be defined when needed.

Bibliography

The following material, though not specifically referenced in the body of the present document (or not publicly available), gives supporting information.

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 301 241-2: "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)".

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

ETSI TBR 005: "European digital cellular telecommunications system; Attachment requirements for Global System for Mobile communications (GSM) mobile stations; Access".

ETSI TBR 009: "European digital cellular telecommunications system; Attachment requirements for Global System for Mobile communications (GSM) mobile stations; Telephony".

ETSI TBR 019: "European digital cellular telecommunications system (Phase 2); Attachment requirements for Global System for Mobile communications (GSM) mobile stations; Access".

ETSI TBR 020: "European digital cellular telecommunications system (Phase 2); Attachment requirements for Global System for Mobile communications (GSM) mobile stations; Telephony".

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

History

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