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Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 1: Overview

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Foreword

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

The present document is part 1 of a multi-part deliverable covering the Common Interface (CI) for the Digital Enhanced Cordless Telecommunications (DECT), as identified below:

Part 1: **"Overview";**

Part 2: "Physical Layer (PHL)";

Part 3: "Medium Access Control (MAC) layer";

Part 4: "Data Link Control (DLC) layer";

Part 5: "Network (NWK) layer";

Part 6: "Identities and Addressing";

Part 7: "Security Features";

Part 8: "Speech Coding and Transmission".

The following aspects of the present document are subject to controlled distribution:

a) DECT identities, as defined in EN 300 175-6 [4];

b) DECT cryptographic algorithms.

The cryptographic algorithms specify the details of the DECT standard authentication algorithm and the DECT standard cipher.

These aspects are distributed on an individual basis. Further information and details of the current distribution procedures can be obtained from the ETSI Secretariat at the address on the second page of the present document.

Further details of the DECT system may be found in TR 101 178 [7], ETR 043 [9] and TR 102 185 [10].

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

1 Scope

The present document gives an introduction and overview of the complete Digital Enhanced Cordless Telecommunications (DECT) Common Interface (CI).

This part of the DECT CI contains an abstract of the other parts of the DECT standard together with a general description of:

- the objectives of the present document;

- the DECT Common Interface;

- the protocol architecture of DECT.

The present document also provides an extensive vocabulary; in particular it contains the common definitions of all the technical terms used in different parts of the present document.

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 and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies.

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

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

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

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

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

[6]   ETSI EN 300 176: "Digital Enhanced Cordless Telecommunications (DECT); Approval test specification; (Part 1: Radio; Part 2: Speech)".

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

[8]   ETSI ETR 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".

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

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

[11]   ETSI EN 300 403-1: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Signalling network layer for circuit-mode basic call control; Part 1: Protocol specification [ITU-T Recommendation Q.931 (1993), modified]".

[12]   ITU-R Recommendation SM.1046-1 (1997): "Definition of spectrum use and efficiency of a radio system".

[13]   ITU-R Recommendation M.816-1 (1997): "Framework for services supported on International Mobile Telecommunications-2000 (IMT-2000)".

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

[15]   ITU-T Recommendation X.25: "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".

3   Definitions and abbreviations

3.1   Definitions

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

Access Rights Class (ARC): type of access to a DECT network, such as public, residential or private

Access Rights Details (ARD): unique number within one ARC

Access Rights Identity (ARI): globally unique identity that shows the access rights related to a service provider

> NOTE 0a: The ARI consists of an ARC and an ARD. There are three categories of ARIs:
>
>> PARI =   Primary ARI;
>>
>> SARI =   Secondary ARI;
>>
>> TARI =   Tertiary ARI.

algorithm: mathematical process or function that transforms an input into an output

> NOTE 0b: In cryptographic applications an algorithm is a process used for encipherment, decipherment or non-reversible encipherment under control of a key.

algorithm identifier: designator to show which algorithm is in use, so that the correct one may be chosen

antenna diversity: diversity implies that the Radio Fixed Part (RFP) for each bearer independently can select different antenna properties such as gain, polarization, coverage patterns, and other features that may effect the practical coverage. A typical example is space diversity, provided by two vertically polarized antennas separated by 10 - 20 cm.

asymmetric algorithm: See public key algorithm.

attach: process whereby a Portable Part (PP) within the coverage area of a Fixed Part (FP) to which it has access rights, notifies the FP that it is operative

> NOTE 1: The reverse process is detach, which reports the PP as inoperative.

> NOTE 2: An operative PP is assumed to be ready to receive calls.

authentication: corroboration that an entity is the one that is claimed

authentication of FT: process whereby the identity of an FT is verified to a DECT PT

authentication of PT: process whereby a DECT PT is positively verified to be a legitimate user of a particular FP

authentication (of a subscriber): process whereby a DECT subscriber is positively verified to be a legitimate user of a particular FP

> NOTE 3: Authentication is generally performed at call set-up, but may also be done at any other time (e.g. during a call).

authentication of user: process whereby a DECT user is positively verified to be a legitimate user of a particular FP

> NOTE 4: Authentication is generally performed at call setup, but may also be done at any other time (e.g. during a call).

bearer: See Medium Access Control (MAC) bearer or bearer service.

bearer handover: internal handover process provided by the MAC layer, whereby one MAC connection can modify its underlying bearers while maintaining the service provided to the Data Link Control (DLC) layer

> NOTE 5: Bearer handover is slot based.

bearer service: type of telecommunication service that provides a defined capability for the transmission of signals between user-network interfaces

> NOTE 6: The DECT user-network interface corresponds to the top of the DECT network layer (layer 3).

broadcast: simplex point-to-multipoint mode of transmission

> NOTE 7: The transmitter may disregard the presence or absence of receivers.

C-plane: control plane of the DECT protocol stacks, which contains all of the internal DECT protocol control, but may also include some external user information

> NOTE 8: The C-plane stack always contains protocol entities up to and including the network layer.

call: all of the Network (NWK) layer processes involved in one NWK layer peer-to-peer association

> NOTE 9: Call may sometimes be used to refer to processes of all layers, since lower layer processes are implicitly required.

cell: domain served by a single antenna(e) system (including a leaky feeder) of one FP

> NOTE 10:A cell may include more than one source of radiated Radio Frequency (RF) energy (i.e. more than one radio end point).

Central Control Fixed Part (CCFP): physical grouping that contains the central elements of a FP

> NOTE 11:A FP contains a maximum of one CCFP; a CCFP controls one or more RFPs.

centrex: implementation of a private telecommunication network exchange that is not located on the premises of the private network operator

> NOTE 12:It may be co-located with, or physically a part of a public exchange.

Cipher Key (CK): value that is used to determine the transformation of plaintext to ciphertext in a cryptographic algorithm

Cipher Key (CK) generation: process for generating cryptographic keys

ciphertext: output of a cryptographic algorithm

> NOTE 13:Ciphertext is not intelligible unless (in a reversible algorithm) the reverse transformation is performed.

channel: See "physical channel".

cluster: logical grouping of one or more cells between which bearer handover is possible

> NOTE 14:A Cluster Control Function (CCF) controls one cluster.

> NOTE 15:Internal handover to a cell which is not part of the same cluster can only be done by connection handover.

confidentiality: rendering information secret as ciphertext unless the capability is possessed to recover the plaintext from ciphertext

connection: See "MAC connection".

connection handover: internal handover process provided by the DLC layer, whereby one set of DLC entities (C-plane and U-plane) can re-route data from one MAC connection to a second new MAC connection, while maintaining the service provided to the NWK layer

    NOTE 16: Connection handover is DLC frame based.

Connectionless mode (C/L): transmission mode that transfers one packet (one self contained unit) of data from one source point to one (or more) destination points in a single phase

    NOTE 17:Connectionless transmissions require the peer-to-peer associations to be prearranged, and the transmission is unacknowledged at that layer.

Connection Oriented mode (C/O): transmission mode that transfers data from one source point to one or more destination points using a protocol based on three phases: "Set-up", "Data transfer" and "Release"

    NOTE 18:C/O mode requires no prearranged associations between peer entities (unlike C/L mode).

Cordless Radio Fixed Part (CRFP): Wireless Relay Station (WRS) that provides independent bearer control to a PT and FT for relayed connections

countermeasure: device, instrument or procedure used to counteract or defend against a threat

coverage area: area over which reliable communication can be established and maintained

cryptography: secret writing

    NOTE 19:Used to describe the hiding of information

Data Encryption Standard (DES): United States Federal data encryption standard

Data Link Control (DLC): layer 2b of the DECT protocol stack

decipherment: rendering of ciphertext into plaintext

DECT Network (DNW): network that uses the DECT air interface to interconnect a local network to one or more portable applications

    NOTE 20:The logical boundaries of the DECT network are defined to be at the top of the DECT NWK layer. A DNW is a logical grouping that contains one or more Fixed radio Terminations (FTs) plus their associated Portable radio Termination (PT). The boundaries of the DECT network are not physical boundaries.

DECT Standard Authentication Algorithm (DSAA): algorithm used for authentication in DECT

DECT Standard Cipher (DSC): algorithm used for data encryption in DECT

Distributed Communication: the ability of a DECT terminal to provide means for or assist direct communication between any two terminals, members of a "closed" local DECT network

    NOTE 21:Such terminals may be of type HyP, or, of type PP or FP (when additional specific procedures are provided).

DLC broadcast: simplex "connectionless" mode of transmission from the DLC broadcast entity of one FT to the DLC broadcast entities in one or more PT

    NOTE 22:The transmitter may disregard the presence or absence of receivers.

DLC data link (DLC link): association between two DLC layer entities

    NOTE 23:This can either be one C-plane association or one U-plane association. This is not the same as a MAC connection.

DLC frame: format used to structure all messages that are exchanged between DLC layer peer entities

> NOTE 24: Different DLC frames are used in the C-plane and the U-plane, and there is more than one format of DLC frame in each plane.

double duplex bearer: use of two duplex bearers (see duplex bearer) which refer to the same MAC connection, sharing their simplex bearers (see simplex bearer) for the information flow

double-simplex bearer: use of two simplex bearers operating in the same direction on two physical channels

> NOTE 25: These pairs of channels always use the same RF carrier and always use evenly spaced slots (i.e. separated by 0,5 Time Division Multiple Access (TDMA) frame).

> NOTE 26: A double-simplex bearer only exists as part of a multibearer MAC connection.

double slot: one 12th of a TDMA frame which is used to support one high capacity physical channel

down-link: transmission in the direction FT to PT

duplex bearer: use of two simplex bearers operating in opposite directions on two physical channels

> NOTE 27: These pairs of channels always use the same RF carrier and always use evenly spaced slots (i.e. separated by 0,5 TDMA frame).

encipherment: rendering of plaintext into ciphertext

End System (ES): logical grouping that contains application processes and supports telecommunication services

> NOTE 28: From the OSI point of view, end systems are considered as sources and sinks of information.

Extended MAC control messages: MAC messages of the B-field connection control set

external handover: process of switching a call in progress from one FP to another FP

FEAL algorithm: Fast Encryption Algorithm; a particular encryption algorithm in the public domain

field: continuous region of data (i.e. adjacent bits) that jointly convey information

> NOTE 29: Typically, a message will contain several fields. If data is not continuous then it is defined as two (or more) fields.

fixed geometry Portable Part (PP): PP in which the electro-acoustic transducers and their associated acoustic components are held in fixed relative positions and/or orientations during all on-line conditions and test conditions of the PP

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

> NOTE 30: A DECT FP contains the logical elements of at least one FT, plus additional implementation specific elements.

Fixed radio Termination (FT): logical group of functions that contains all of the DECT processes and procedures on the fixed side of the DECT air interface

> NOTE 31: A FT only includes elements that are defined in EN 300 175 parts 1 to 8. This includes radio transmission elements (layer 1) together with a selection of layer 2 and layer 3 elements.

flow control: mechanism that is used to regulate the flow of data between two peer entities

fragment: one of the Service Data Units (SDUs) that is produced by the process of fragmentation

> NOTE 32: This is not the same as a segment.

fragmentation: process of dividing a Protocol Data Unit (PDU) into more than one SDU for delivery to a lower layer

> NOTE 33: This is not the same as segmentation.

> NOTE 34: The reverse process is recombination.

frame: See "TDMA frame" or "DLC frame".

full slot (slot): one 24th of a TDMA frame which is used to support one physical channel

generic: generalized set or general purpose set, often in the sense of basic or ordinary

Generic Access Profile (GAP): standard in addition to the DECT CI that ensures interoperability between FPs and PPs from different manufacturers

geographically unique: two FPs with the same PARI, or respectively two RFPs with the same RFPI, cannot be reached or listened to at the same geographical position

> NOTE 35: This term relates to FP identities, Primary Access Rights Identifiers (PARIs) and Radio Fixed Part Identifiers (RFPIs).

Global NetWork (GNW): telecommunication network capable of offering a long distance telecommunication service

> NOTE 36: The term does not include legal or regulatory aspects, nor does it indicate if the network is a public or a private network.

globally unique identity: identity is unique within DECT (without geographical or other restrictions)

guard space: nominal interval between the end of a radio transmission in a given slot, and the start of a radio transmission in the next successive slot

> NOTE 37: This interval is included at the end of every slot, in order to prevent adjacent transmissions from overlapping even when they originate with slightly different timing references (e.g. from different radio end points).

half slot: one 48th of a TDMA frame which is used to support one physical channel

handover: process of switching a call in progress from one physical channel to another physical channel

> NOTE 38: These processes can be internal (see internal handover) or external (see external handover). There are two physical forms of handover, intracell handover and intercell handover. Intracell handover is always internal, intercell handover can be internal or external.

handset echo: echo, perceptible by the far-end user, resulting from the coupling between the receiving and sending directions of the handset, mostly due to acoustic coupling between transducers

> NOTE 39: It is particularly objectionable in communications including a satellite and an echo canceller, as the DECT handset echo may be out of range of the echo canceller.

Hybrid Part (HyP): DECT terminal that provides FT as well as PT capabilities

> NOTE 40: It can play the role of the network master, i.e. the FT that controls the network or the role of a network member (PT). When it plays the role of a network member, it can receive/transmit on any slot from 0 to 23, synchronize to a master FT for the purpose of communicating with this FT and at the same time behaving as a part of this same FT (i.e. as another RFP) communicate with directly with other network members with or without the help of the master FT.

impersonation: where one identity claims the part of another identity

incoming call: call received at a PP

Integrated Services Digital Network (ISDN): digital telecommunications infrastructure to the Consultative Committee on International Telegraphy and Telephony (CCITT) standards

intercell handover: switching of a call in progress from one cell to another cell

internal call: call between 2 users that does not make use of the local network resources

internal handover: handover processes that are completely internal to one FT

> NOTE 41: Internal handover reconnects the call at the lower layers, while maintaining the call at the NWK layer. The lower layer reconnection can either be at the DLC layer (see connection handover) or at the MAC layer (see bearer handover).

International Portable User Identity (IPUI): identity that uniquely defines one user within the domain defined by his access rights related to this IPUI

> NOTE 42: The IPUI consists of a Portable User Type (PUT) and a Portable User Number (PUN). The IPUI may be locally unique or globally unique depending on type of PUT.

interoperability: capability of FPs and PPs, that enable a PP to obtain access to teleservices in more than one location area and/or from more than one operator (more than one service provider)

interoperator roaming: roaming between FP coverage areas of different operators (different service providers)

Interworking Unit (IWU): unit that is used to interconnect subnetworks

> NOTE 43: The IWU will contain the InterWorking Functions (IWF) necessary to support the required subnetwork interworking.

intracell handover: switching of a call in progress from one physical channel of one cell to another physical channel of the same cell

intraoperator roaming: roaming between different FP coverage areas of the same operator (same service provider)

Isochronous: essential characteristic of a time-scale or a signal such that the time intervals between consecutive significant instants either have the same duration or durations that are integral multiples of the shortest duration

> NOTE 44: ITU-T Recommendation R.140 (1988): "Definitions of essential technical terms in the field of telegraph transmission", definition 6014.

key management: way in which cryptographic keys are generated, distributed and used

Key Stream Generator (KSG): cryptographic algorithm which produces a stream of binary digits which can be used for encipherment and decipherment

link: See "DLC data link".

Local Area Network (LAN): electronic systems which are interconnected and in physical proximity to each other

Local Network (LNW): telecommunication network capable of offering local telecommunication services

> NOTE 45: The term does not include legal or regulatory aspects, nor does it indicate if the network is a public network or a private network.

locally unique identity: identity is unique within one FP or location area, depending on application

location area: domain in which a PP may receive (and/or make) calls as a result of a single location registration

location registration: process whereby the position of a DECT portable termination is determined to the level of one location area, and this position is updated in one or more databases

> NOTE 46: These databases are not included within the DECT FT.

logical channel: generic term for any distinct data path

> NOTE 47: Logical channels can be considered to operate between logical end points.

logical connection: association between two instances of the MAC MBC that can be used by higher layers to exchange U-plane or C-plane data

Lower Layer Management Entity (LLME): management entity that spans a number of lower layers, and is used to describe all control activities which do not follow the rules of layering

> NOTE 48: The DECT LLME spans the NWK layer, the DLC layer, the MAC layer and the PHL.

Lower Tester (LT): logical grouping that contains the test equipment, a functionally equivalent DECT PT, a functionally equivalent DECT FT and a test controller

MAC bearer (bearer): service element that is provided by each Cell Site Function (CSF)

> NOTE 49: Each MAC bearer corresponds to a single service instance to the physical layer. See also simplex bearer, duplex bearer and double simplex bearer.

MAC connection (connection): association between one source MAC Multi-Bearer Control (MBC) entity and one destination MAC MBC entity

> NOTE 50: This provides a set of related MAC services (a set of logical channels), and it can involve one or more underlying MAC bearers.

masquerading: where one identity plays the part of, or acts as, another identity

Medium Access Control (MAC): layer 2a of the DECT protocol stack

minimal MMS-message attributes: message meta-information used in the request-to-send, etc.

MMS-message attributes: message meta-information

Mobility class 1: local area applications, for which terminals are pre-registered off-air with one or more specific fixed parts, and establishment of service and user parameters is therefore implicit, according to a profile-defined list

Mobility class 2: private and public roaming applications for which terminals may move between FPs within a given domain and for which association of service parameters is explicit at the time of service request

multiframe: repeating sequence of 16 successive TDMA frames, that allows low rate or sporadic information to be multiplexed (e.g. basic system information or paging)

Multimedia Messaging Service: generic set of commands, information elements and functionality for file/messaging service

mutual authentication: where two entities corroborate the identity of each other

network (telecommunication network): all the means of providing telecommunication services between a number of locations where the services are accessed via equipment attached to the network

network echo: echo, perceptible by the DECT user, resulting from reflections in the network. It is mostly due to hybrid impairments at both ends of the communication

node: point at which switching occurs

operator (DECT operator): individual or entity who or which is responsible for operation of one or more DECT FPs

> NOTE 51: The term does not imply any legal or regulatory conditions, nor does it imply any aspects of ownership.

outgoing call: call originating from a PP

paging: process of broadcasting a message from a DECT FP to one or more DECT PPs

> NOTE 52: Different types of paging message are possible. For example, the {Request paging} message orders the recipient to respond with a call set-up attempt.

paging area: domain in which the PP will be paged as a part of incoming call establishment

> NOTE 53: In general, the paging area will be equal to the Temporary Portable User Identity (TPUI) domain, since the TPUI is used for paging.

PARK Length Indicator (PLI): associates a group of FP ARIs to the PARK, by indicating how many of the first ARC + ARD bits are relevant

> NOTE 54: The rest have "don't care" status.

> NOTE 55: The PLI is programmed into a PP as part of the subscription process.

Personal Identity Number (PIN): short sequence of numbers (usually 4 - 8 digits) which may be used in an authentication process to prove identity

> NOTE 56: The term User Personal Identity (UPI) may also be used.

phase: one discrete part of a procedure, where the start and end of the part can be clearly identified (e.g. by the arrival or dispatch of a primitive)

Physical (PHY): layer 1 of the DECT protocol stack

physical channel (channel): simplex channel that is created by transmitting in one particular slot on one particular RF channel in successive TDMA frames

> NOTE 57: One physical channel provides a simplex service. Two physical channels are required to provide a duplex service. See also simplex bearer.

plaintext: information or data which is intelligible to everyone

Portable Access Rights Key (PARK): this states the access rights for a PP

Portable Application (PA): logical grouping that contains all the elements that lie beyond the DECT network boundary on the portable side

> NOTE 58: The functions contained in the portable application may be physically distributed, but any such distribution is invisible to the DECT network.

Portable Handset (PHS): single physical grouping that contains all of the portable elements that are needed to provide a teleservice to the user

> NOTE 59: PHS is a subset of all possible portable parts. This subset includes all physical groupings that combine one PT plus at least one portable application in a single physical box.

Portable Part (DECT Portable Part) (PP): physical grouping that contains all elements between the user and the DECT air interface

> NOTE 60: PP is a generic term that may describe one or several physical pieces. A DECT PP is logically divided into one PT plus one or more portable applications.

Portable radio Termination (PT): logical group of functions that contains all of the DECT processes and procedures on the portable side of the DECT air interface

> NOTE 61: A PT only includes elements that are defined in EN 300 175. This includes radio transmission elements (layer 1) together with a selection of layer 2 and layer 3 elements.

Portable User Number (PUN): globally or locally unique number within one PUT

Portable User Type (PUT): this shows the numbering plan structure of a PUN

Primary Access Rights Identity (PARI): most frequently transmitted ARI

> NOTE 62: Every DECT RFP transmits a PARI.

primitive: distinct (but abstract) data element that is passed between adjacent protocol layers

> NOTE 63: A service primitive contains one SDU.

private: attribute indicating that the application of the so qualified term, e.g. a network, an equipment, a service, is offered to, or is in the interest of, a determined set of users

> NOTE 64: The term does not include any legal or regulatory aspects, nor does it indicate any aspects of ownership.

proprietary algorithm: algorithm which is the intellectual property of a legal entity

public: attribute indicating that the application of the so qualified term, e.g. a network, an equipment, a service, is offered to, or is in the interest of, the general public

> NOTE 65: The term does not include any legal or regulatory aspects, nor does it indicate any aspects of ownership.

Public Access Profile (PAP): profile which ensures interoperability between FPs and PPs for public access services

public access service: service that provides access to a public network for the general public

NOTE 66: The term does not imply any legal or regulatory aspect, nor does it imply any aspects of ownership.

public key algorithm: cryptographic algorithm in which a different key is used for encipherment and for decipherment

NOTE 67: Also known as an asymmetric algorithm.

radio channel: See RF channel or physical channel.

radio end point: physical grouping that contains one radio transceiver (transmitter/receiver), fixed or portable

NOTE 68: A radio end point may operate only as a receiver or only as a transmitter.

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

Radio Fixed Part Identity (RFPI): identity frequently transmitted by every RFP

NOTE 69: This is geographically unique. The RFPI shows:

- PARI;

- the RFPs local identity within that FP;

- domains for handover and location areas.

random number: number generated by a non-deterministic process

registration: See either location registration or subscription registration.

NOTE 70: Ambiguous term, that should always be qualified.

Repeater Part (REP): WRS that relays information within the half frame time interval

RF carrier (carrier): centre frequency occupied by one DECT transmission

RF channel: nominal range of frequencies (RF spectrum) allocated to the DECT transmissions of a single RF carrier

roaming: movement of a PP from one FP coverage area to another FP coverage area, where the capabilities of the FPs enable the PP to make or receive calls in both areas

NOTE 71: Roaming requires the relevant FPs and PPs to be interoperable.

roaming service: service which can be used in more than one FP coverage area

RS: value used to establish authentication session keys, as defined in clause 4.4.3

RSA (Rivest, Shamir & Adleman) algorithm: public key algorithm

Secondary Access Rights Identity (SARI): less frequently broadcast than the PARI

security attribute: protocol element indicating security services, mechanisms, processes or algorithms that are supported

segment: one of the pieces of data that is produced by the process of segmentation

NOTE 72: In general, one segment only represents a portion of a complete message.

segmentation: process of partitioning one SDU from a higher layer into more than one PDU

NOTE 73: The reverse process is assembly.

Session Key (KS): key which is used only for a single session

NOTE 74: A session may be a single connection or call, or it may be a number of calls made by a particular user through a particular system (for example the calls made by a roaming portable with a particular visited network)

service call: call initiated by a DECT PT for entering of FT related service and adjustment procedures in a transparent way

service provider (telecommunications service provider): individual, or entity, who, or which, interfaces to the customer in providing telecommunications service

NOTE 75: The term does not imply any legal or regulatory conditions, nor does it indicate whether public service or private service is provided.

NOTE 76: The term service provider is also used with a different meaning in the ISO/OSI layered model.

Service type A: low speed frame relay, with a net sustainable throughput of up to 24 kbit/s, optimized for burst data, low power consumption and low complexity applications such as hand-portable equipment

Service type B: high performance frame relay, with a net sustainable throughput of up to 552 kbit/s, optimized for high speed and low latency with burst data

NOTE 77: Equipment implementation the Type B profile shall inter-operate with Type A equipment.

Service type C: non-transparent connection of data streams requiring Link Access Protocol (LAP) services, optimized for high reliability and low additional complexity

NOTE 78: This builds upon the services offered by the type A or B profiles.

Service type D: non-transparent service that supports Isochronous Data Bearer Services and is suitable for transparent transfer of isochronous data streams

Service type E: short message transfer or paging service which may be unacknowledged or acknowledged, optimized for small SDUs, low PP complexity and ultra-low power consumption

Service type F: application profile specifically supporting teleservices such as fax, building upon the services offered by the type A/B and C profiles, optimized for terminal simplicity, spectrum efficiency and network flexibility

sequencing (sequence numbering): process of adding a sequence number to a set of data packets so that the packets can be reassembled in the correct order, regardless of the order they are received

NOTE 79: See also "segmentation".

simplex bearer: simplex bearer is the MAC layer service that is created using one physical channel

NOTE 80: See also "duplex bearer" and "double simplex bearer".

Single Radio Fixed Part (SRFP): radio FP that contains only one radio end point

NOTE 81: The SRFP is defined for DECT system analysis. Unless otherwise stated, a SRFP is assumed to support multiple calls, and is limited only by the capacity of its single radio end point.

stream cipher: algorithm in which the output is combined bit by bit with plaintext to produce the ciphertext

Subscriber Interface Module (SIM): smart card used for authentication in GSM

subscriber (customer): natural person, or juristic person who has subscribed to telecommunication services, and is, therefore, responsible for payment

subscription registration: infrequent process whereby a subscriber obtains access rights to one or more FPs

NOTE 82: Subscription registration is usually required before a user can make or receive calls.

Supplementary Service (SS): service that modifies or supplements a basic telecommunication service

NOTE 83: Three functional groups of SSs are defined for DECT:

1) DECT TRANSPARENT supplementary services:

- the service elements are unspecified within the present document;

2) DECT STANDARD supplementary services:

- the service elements are specified within the present document by reference to other standards;

3) DECT SPECIFIC supplementary services:

- the service elements are fully specified within the present document.

switching: process of interconnecting functional units, transmission channels or telecommunication circuits for as long as required to convey signals

symmetric algorithm: cryptographic algorithm in which the same key is used for both encipherment and decipherment

synchronization: methods used to ensure that time correspondence exists between processes to ensure that data is not repeated or lost

synchronous: essential characteristics of time-scales or signals such that their corresponding significant instants occur at precisely the same average rate

NOTE 84: ITU-T Recommendation R.140 (1988): "Definitions of essential technical terms in the field of telegraph transmission", definition 6016.

Synchronous transmission: transmission using isochronous signals in which the sending and receiving instruments are operating continuously in a constant time difference between corresponding significant instants

NOTE 85: ITU-T Recommendation R.140 (1988): "Definitions of essential technical terms in the field of telegraph transmission", definition 32.0110.

TDMA frame: time-division multiplex of 10 ms duration containing 24 successive full slots

NOTE 86: A TDMA frame starts with the first bit period of full slot 0 and ends with the last bit period of full slot 23.

telecommunication: any transmission and/or emission and/or reception of signals representing signs, writings, images, and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems

teleservice: type of telecommunication service that provides the complete capability, including terminal equipment functions, for communication between users, according to protocols that are established by agreement

Tertiary Access Rights Identity (TARI): available as a Yes/No answer upon a request including the wanted ARI, not broadcast at all

threat: indication of coming evil

TPUI domain: domain over which every TPUI is (locally) unique

NOTE 87: in general, the TPUI domain will be equal to the paging area and thereby equal to the location area.

U-plane: user plane of the DECT protocol stacks

NOTE 88: This plane contains most of the end-to-end (external) user information and user control.

NOTE 89: The U-plane protocols do not include any internal DECT protocol control, and it may be null at the NWK layer and at the DLC layers for some services.

up link: transmission in the direction PT to FT

User Authentication Key (UAK): cryptographic key held by a user to prove identity

NOTE 90: May also be combined with a PIN ("Something you have and something you know").

user (of a telecommunication network): person or machine delegated by a subscriber (by a customer) to use the services, and/or facilities, of a telecommunication network

variable geometry PP: PP that allows the position and/or orientation of its electro-acoustic transducers and their associated acoustic components to be changed during all on-line conditions of the PP

Wireless Relay Station (WRS): physical grouping that combines elements of both PTs and FTs to relay information on a physical channel from one DECT termination to a physical channel to another DECT termination

> NOTE 91: The DECT termination can be a PT or an FT or another WRS.

XRES1: expected response calculated by a Fixed radio Termination (FT)

> NOTE 92: as defined in clause 4.4.2

XRES2: expected response calculated by a Portable radio Termination (PT)

> NOTE 93: as defined in clause 4.4.2

X.25 [15]: packet switched network

> NOTE 94: based on ITU-T Recommendation X.25 [15]

3.2 Abbreviations

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

A	Algorithm
AC	Authentication Code
ACK	(positive) Acknowledgement
ACP	Adjacent Channel Power
ADPCM	Adaptive Differential Pulse Code Modulation
ADU	Adapted Data Unit
ALI	Assigned Link Identifier
A-MAP	A-field MAP
AMCI	Advanced MAC Connection Identifier
ANSI	American National Standards Institute
ARC	Access Rights Class
ARD	Access Rights Details
ARI	Access Rights Identity
ARQ	Automatic Repeat reQuest
ASM	Assigned Link Identifier with Synchronous Mode
BCD	Binary Coded Decimal
BCT	Business Cordless Telephone
B-MAP	B-field MAP
BMC	Broadcast Message Control
BMCI	Basic MAC Connection Identifier
BRAT	Basic Rate Adaption service
B_S	Slow Broadcast channel (a logical channel to the MAC layer)
C	higher layer control Channel (see C_S and C_F)
C/L	ConnectionLess mode
C/O	Connection Oriented mode
CBC	Connectionless Bearer Control
CBI	Collective Broadcast Identifier
CC	Call Control
CCF	Cluster Control Function
CCFP	Central Control Fixed Part
CEP	Connection End Point
C_F	higher layer signalling Channel (fast)
C_F, C_S	logical channels to the MAC layer
CHO	Connection HandOver
CHP	Connection Handover Pending

CI	Cell Identity
CI	Common Interface (standard)
CISS	Call Independent Supplementary Services
CK	Cipher Key
CL	higher layer Connectionless channel (protected; see CLS and CLF)
CL_F	higher layer Connectionless channel (fast), (logical channel to the MAC layer)
CLMS	ConnectionLess Message Service
CLRR	Circuit Loudness Rating, Receiving
CLRS	Circuit Loudness Rating, Sending
CL_S	higher layer Connectionless channel (slow), (logical channel to the MAC layer)
CMC	Connectionless Message Control
C-MMS	Call control part of MMS
CODEC	COder-DECoder
COMS	Connection Oriented Message Service
C-Plane	Control Plane
CRC	Cyclic Redundancy Check
CRFP	Cordless Radio Fixed Part
CRSS	Call Related Supplementary Services
C_S	higher layer signalling Channel (slow)
CSF	Cell Site Function
CSPDN	Circuit Switched Public Data Network
CX	Co-existence standard
DAM	DECT Authentication Module
dBc	dB relative to the peak power of an unmodulated carrier
DBC	Dummy Bearer Control
dBm	dB relative to 1 milliwatt
dBm0	the absolute power level in decibels referred to a point of zero relative level
dBr	the relative power level in decibels
DCDL-net	Distributed Communication DECT Local network
DCK	Derived Cipher Key
DECT	Digital Enhanced Cordless Telecommunications
DLC	Data Link Control
DLEI	Data Link Endpoint Identifier (DLC layer)
DLI	Data Link Identifier (DLC layer)
D-MAP	D-field MAP
DNW	DECT NetWork
DSAA	DECT Standard Authentication Algorithm
DSC	DECT Standard Cipher
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi-Frequency
E/U-MUX	switch between E-type and U-type Multiplexes
ECN	Exchanged Connection Number (DLC/MAC layer)
EIRP	Effective Isotropic Radiated Power
ERP	Ear Reference Point
ERP	Effective Radiated Power
ES	End System
FB_N	Frame Buffer (Unprotected)
FB_P	Frame Buffer (Protected)
FEC	Forward Error Correction service
FLEN	Frame Length
FMID	Fixed part MAC IDentity
FP	DECT Fixed Part
FREL	Frame Relay service
FSWI	Frame Switching service
FT	Fixed radio Termination
GAP	Generic Access Profile
GBN	Go Back N
GF	higher layer information control channel (a logical channel to the MAC layer)
GFSK	Gaussian Frequency Shift Keying
GMSK	Gaussian Minimum Shift Keying
GNW	Global NetWork

GSM	Global System for Mobile communications
HDB	Home Data Base
HOV	Handover flag
HyP	Hybrid Part
I	higher layer Information channel (see I_N and I_P)
IA5	International Alphabet No. 5 as defined by ITU-T
IFEI	International Fixed Equipment Identity
I_N	higher layer Information channel (unprotected), (logical channels to the MAC layer)
I_P	higher layer Information channel (protected), (logical channels to the MAC layer)
IP	Internet Protocol
IPEI	International Portable Equipment Identity
IPUI	International Portable User Identity
IPv4	Internet Protocol Version 4
IPv6	Internet Protocol Version 6
IRC	Idle Receiver Control
ISDN	Integrated Services Digital Network
ITU	International Telecommunications Union
IUT	Implementation Under Test
IV	Initial Vector
IWF	InterWorking Functions
IWU	InterWorking Unit
K	authentication Key
KS'	FT authentication Session Key
KS	PT authentication Session Key
KSG	Key Stream Generator
KSS	Key Stream Segment
LAL	Location Area Level
LAN	Local Area Network
LAPC	a DLC layer C-plane protocol entity
LAP-U	Link Access Procedure (U-plane) (a service offered by LU3)
Lb	a DLC layer C-plane protocol entity
LBN	Logical Bearer Number
Lc	a DLC layer C-plane protocol entity
LCE	Link Control Entity
LCN	Logical Connection Number (DLC/MAC layer)
LLe	Local echo Loss
LLME	Lower Layer Management Entity
LLN	Logical Link Number (DLC layer)
LNW	Local NetWork
LRMS	Low Rate Messaging Service
LRMS-PTM	Low Rate Messaging Service, Point to Multi-point
LRMS-PTP	Low Rate Messaging Service, Point to Point
LSB	Least Significant Bit
LSTR	Listener Sidetone Rating
LT	Lower Tester
M	MAC control channel
MAC	Medium Access Control layer
MAP	bit Mappings
MBC	Multi-Bearer Control
MCEI	MAC Connection Endpoint Identification
MCI	MAC Connection Identifier
MCS	Multi-Channel Set
MDU	Multiplexed Data Unit
MM	Mobility Management
M-MMS	Messaging Part of MMS
MMS	Multimedia Messaging Service
MMSP	Multimedia Messaging Service Protocol
MRP	Mouth Reference Point
MSB	Most Significant Bit
MSC	Mobile Switching Centre
MUX	time MUltipleXor

N	identities channel
NACK	Negative Acknowledgement
NLF	New Link Flag
NLP	Non-Linear Processor
NLR	No Link Required
NTP	Normal Transmitted Power
NWK	Network layer
OLR	Overall Loudness Rating
OSI	Open Systems Interconnection
P	Paging channel
PA	Portable Application
PABX	Private Automatic Branch Exchange
PAP	Public Access Profile
PARI	Primary Access Rights Identity
PARK	Portable Access Rights Key
PARK {y}	PARK with value y for it is Park length indicator
PAS	Public Access Service
PBX	Private Branch Exchange
PCI	Protocol Control Information
PCM	Pulse Code Modulated
PDU	Protocol Data Unit
PHL	Physical Layer
PHS	Portable HandSet
PLI	Park Length Indicator
PMID	Portable part MAC Identity (MAC layer)
POT(S)	Plain Old Telephone (Service)
PP	DECT Portable Part
ppm	parts per million
PSPDN	Packet Switched Public Data Network
PSTN	Public Switched Telephone Network
PT	Portable radio Termination
PTN	Private Telecommunication Network
PUN	Portable User Number
PUT	Portable User Type
PWT	Personal Wireless Telecommunications
Q	system information channel
QDU	Quantization Distortion Unit
RAND-F	a Random challenge issued by a FT
RAND-P	a Random challenge issued by a PT
ReFP	Reference Fixed Part
REP	REpeater Part
RePP	Reference Portable Part
RES1	a Response calculated by a PT
RES2	a Response calculated by an FT
RF	Radio Frequency
RFP	Radio Fixed Part
RFPI	Radio Fixed Part Identity
RLRH	Receiving Loudness Rating of the Handset
RPN	Radio fixed Part Number
RS	a value used to establish authentication session keys
RSSI	Radio Signal Strength Indicator
RU	Residential Unit
SAP	Service Access Point
SAPI	Service Access Point Identifier
SAR	Specific Absorption Rate
SARI	Secondary Access Rights Identity
SCK	Static Cipher Key
SDU	Service Data Unit
SEL	Selective
SIN	higher layer connectionless channel (Unprotected)
SIP	higher layer connectionless channel (Protected)
SLRH	Sending Loudness Rating of the Handset

SMS	Short Message Service
SRAT	Secondary Rate Adaption service
SS	Supplementary Services
STMR	Sidetone Masking Rating
TAF	Terminal Adoptation Function
TARI	Tertiary Access Rights Identity
TBC	Traffic Bearer Control
TCL	Telephone Coupling Loss
TCLw	weighted Terminal Coupling Loss
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
TELR	Talker's Echo Loudness Rating
TI	Transaction Identifier
T-MUX	Tail MUX
TPUI	Temporary Portable User Identity
TRUP	Transparent Unprotected service
UAK	User Authentication Key
UCN	U-plane Channel Number
ULI	Unassigned Link Identifier
ULN	U-plane Link Number
UPI	User Personal Identification
U-Plane	User Plane
VDB	Visitors Data Base
W-FT2FT	Wireless FT to FT communication
WRS	Wireless Relay Station
XRES1	an Expected Response calculated by a FT
XRES2	an Expected Response calculated by a PT

4   Structure

The present document consists of 8 parts (parts 1 to 8 inclusive) which are briefly described in clauses 4.1 to 4.8.

Parts 2 to 5 of EN 300 175 specify the air interface. They are structured into layers corresponding to the lower layers of the ISO OSI model. Part 6 specifies the identities and addressing structure and part 7 specifies the security features. Part 8 specifies speech aspects.

In addition there exists a DECT approval test specification EN 300 176 [6] which is not described in the present document.

4.1   Part 1: Overview

The overview contains an introduction to the complete European Standard. It includes a description of the system and the protocol architecture and a vocabulary of terms.

4.2   Part 2: Physical Layer (PHL)

The PHL specifies radio parameters such as the frequency, timing and power values, the bit and slot synchronization and the transmitter and receiver performance.

4.3   Part 3: Medium Access Control (MAC) layer

The MAC layer specifies three groups of MAC services. These are the broadcast message control service, the connectionless message control service and the multi-bearer control service. It also specifies the logical channels, which are used by the above-mentioned services, and how they are multiplexed fand mapped on to the physical channels.

4.4   Part 4: Data Link Control (DLC) layer

The DLC layer specifies two groups of DLC services. These are the services for the C-plane and the services for the U-plane.

For the C-plane a point-to-point service and a broadcast service are defined. The point-to-point service can operate in acknowledged or unacknowledged mode and provides addressing, frame delimiting, error control, flow control, segmentation of network layer information fields, fragmentation of DLC frames and connection handover.

For the U-plane the transparent unprotected service, the frame relay service, the frame switching service and the rate adoption service are defined.

4.5   Part 5: Network (NWK) layer

The NWK layer specifies the functions for the link control, the Call Control (CC), the Supplementary Services (SS), the Connection Oriented Message Service (COMS), the Connectionless Message Service (CLMS) and the Mobility Management (MM). For these groups it contains the procedures, messages and information elements.

4.6   Part 6: Identities and addressing

The identities and addressing specifies the main identities and addresses which are used in DECT. They are divided into the following four categories: FP identities, PP identities, connection related identities and equipment related identities.

Several of the FP identities and PP identities are allocated centrally in order to maintain global uniqueness for these identities.

4.7   Part 7: Security features

The security features specify the overall security architecture for DECT, the types of cryptographic algorithms required and the way in which they are to be used, and the requirements for integrating the security features provided by the architecture into the DECT air interface. It also describes how the features may be managed and how they relate to certain DECT fixed systems and local network configurations.

4.8   Part 8: Speech coding and transmission

The speech coding and transmission specifies the requirements for DECT equipment which includes all the necessary functions to provide real-time two-way speech conversation. It defines the speech encoding algorithm and the detailed speech performance characteristics such as sensitivity, frequency response, sidetone, terminal coupling loss, distortion, variation of gain with input level, out of band signals, noise, acoustic shock, delay and network echo control.

A 3,1 kHz telephony teleservice conveyed over a DECT link (including FP and PP) which is capable of being connected (directly or indirectly) to the public network access point shall comply with the requirements in EN 300 175-8 [5].

Furthermore, all DECT implementations capable of voice transmission that are not required to comply with EN 300 175-8 [5] shall not use more than 20 % of the available physical channels for connections that use more than one full slot duplex bearer.

Tethered fixed point local loop applications are not required to comply with the requirements of EN 300 175-8 [5].

5   The objectives of the CI standard

The DECT standard has grown out of the need to provide cordless communications, both for voice traffic and for data traffic.

The DECT standard is designed to support this versatility of applications at a cost that encourages wide adoption. It is envisaged that DECT will provide personal telecommunication services in residential, neighbourhood and business environments. It is particularly targeted at the following applications:

- residential - domestic cordless telephones;

- public access services;

- cordless business telephones (PBXs);

- cordless data - Local Area Networks (LANs) and point-to-point connections;

- wireless home networking;

- wireless access to the internet or intranet;

- extensions to cellular radio, and extensions of the local public network.

DECT has also been selected by the ITU as one of the radio interfaces for "International Mobile Telecommunications 2000" (IMT-2000) [14]. As DECT is using a combination of frequency and time multiple access the corresponding air-interface is called "IMT-2000 FDMA/TDMA" by the ITU.

Because of different regulatory requirements in the USA, the American National Standards Institute (ANSI) has published the DECT standard as PWT standard, implementing the required adaptations, especially in the physical layer.

One primary objective of this CI standard is to provide for interoperability between equipment of different origin, so offering users a family of telecommunication services for voice or data, either as basic services, or with optional (and compatible) extensions.

While providing for compatibility, the present document provides standard escape routes that allow manufacturers to retain options for innovation and product differentiation (see clause 8). In addition, reserved codes have been included in the present document to provide mechanisms for evolutionary development of the present document. At the same time, the existence of the present document allows implementers to design systems that can provide telecommunications to users in several different locations.

At a more detailed level, the protocols in the present document are designed to provide for the specific services and facilities defined in ETR 043 [9] and ITU-R Recommendation M.816 [13]. In the design process, the following additional objectives were considered:

- the structure should allow any other reasonable application;

- the structure should allow any reasonable implementation.

Lastly, the present standard also has the objective of regulating the use of, and interface of, two shared resources:

- the RF spectrum which is allocated to provide for the cordless operation of the communication system; and

- one or more networks for which the DECT network provides cordless connection.

It is the objective of the present standard to ensure that conforming equipment will be able to use the above resources efficiently and with the minimum degree of mutual interference, i.e. avoiding adverse affects to existing, or future, users of those resources, see also ITU-R Recommendation SM.1046-1 [12].

6 General description of the system

DECT is based on a micro-cellular radio communication system that provides low-power radio (cordless) access between PPs and (DECT) FPs at ranges up to a few hundred metres. The basic technical characteristics are as follows:

frequency band:	1 880 MHz to 1 939 MHz (see note);
number of carriers:	typical 10 (see note);
carrier spacing:	1,728 MHz (see note);
maximum peak transmit power:	250 mW;

carrier multiplex:	TDMA; 12 double slots / 24 full slots / 48 half slots per frame;
frame length:	10 ms;
basic duplexing:	TDD using 2 slots on same RF carrier;
gross bit rate:	1 152 kbit/s, 2 304 kbit/s or 3 456 kbit/s for 2-, 4-, or 8-level modulation respectively;
net channel rates:	6,4 kbit/s A-field (control/signalling) per slot.

B-field (traffic) rates per slot are described in table 1:

Table 1

B-field (traffic) rate per slot	half slot	full slot	double slot
2-level modulation	8 kbit/s	32 kbit/s	80 kbit/s
4-level modulation	16 kbit/s	64 kbit/s	160 kbit/s
8-level modulation	24 kbit/s	96 kbit/s	240 kbit/s

NOTE: New or modified carrier positions and/or frequency bands can be defined when needed, e.g. for emerging DECT applications in the UMTS/IMT-2000 bands. A connection is provided by transmitting bursts of data in the defined time slots. These may be used to provide simplex or duplex communications. Duplex operation uses a pair of evenly spaced slots; one for transmit and one for receive.

The simplest duplex service uses a single pair of time slots to provide e.g. a 32 kbit/s digital information channel capable of carrying coded speech or other low rate digital data. Higher data rates are achieved by using more time slots in the TDMA structure, and a lower data rate may be achieved by using half-slot data bursts. Different uplink and downlink bitrates are realized by using asymmetric connections, where a different number of time slots is used for the uplink and downlink. For efficient transmission of packet data the radio connection is suspended after the data has been sent and as soon as new data arrives, the radio connection is resumed again.

DECT is able to support a number of alternative system configurations ranging from single cell equipment (e.g. domestic FPs) to large multiple cell installations (e.g. large business cordless PBXs).

The protocols are designed to support uncoordinated system installation, even where the systems co-exist in the same physical location. Efficient sharing of the radio spectrum (of the physical channels) is achieved using a careful mechanism for selection of channels prior to their use. This is called dynamic channel selection (see ETR 310 [8]).

In addition, the DECT protocols provide two internal mechanisms to support rapid handover of calls in progress (both intracell and intercell handover are supported). These handover mechanisms allows a high quality of service to be maintained where the mobility of the PP requires transparent re-connection to another FP or where a new physical channel is required in response to a disturbances in the radio environment.

Direct communication from PT to PT and wireless communication between FTs are is also supported.

7 Description of the protocol architecture

7.1 General

The structure of the present document is based on the layered principles used in the ISO Open Systems Interconnection (OSI) model. The complete CI corresponds to the lower 3 layers of the ISO OSI model. In order to take care of the uncertainties introduced by using radio transmissions at the PHL and to include the concept of handover, the layer 2 has been split into two sub-layers. Therefore DECT defines 4 layers of protocol.

7.2 The DECT layered structure

A structure of four layers is used for the signalling protocols as shown in figure 1.
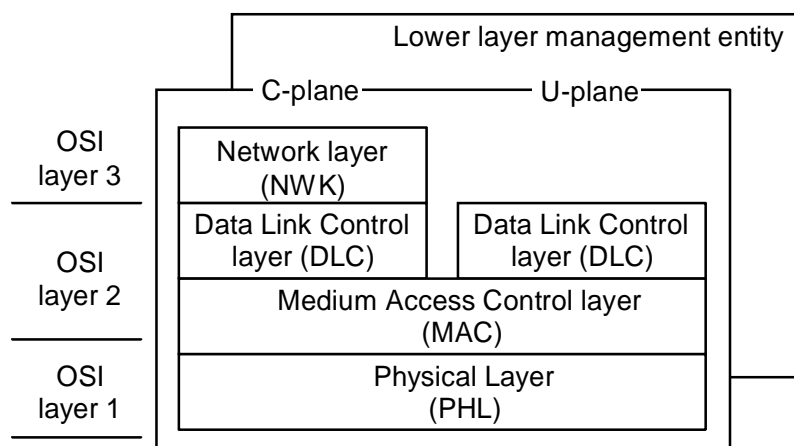
Figure 1: The layered structure

The top of the NWK layer corresponds to the top of the OSI layer 3. The intermediate boundaries have no OSI equivalent but for ease of understanding an approximate correspondence is given below:

OSI Layer 1:   all of the PHL plus part of MAC layer;

OSI Layer 2:   most of MAC layer plus all of DLC;

OSI Layer 3:   all of the NWK layer.

7.3   Physical Layer (PHL)

The PHL divides the radio spectrum into the physical channels. This division occurs in two fixed dimensions, frequency and time.

The frequency and time division uses Time Division Multiple Access (TDMA) operation on multiple RF carriers. Ten carriers are provided in the frequency band 1 880 MHz to 1 900 MHz. The present document also provides for possible extensions of the band to meet future demand. On each carrier the TDMA structure defines 24 full-slots in a 10 ms frame, where each timeslot may be used to transmit one self contained packet of data. Each transmitted packet contains a synchronization field, together with control information, service information and error control.

NOTE: In addition the radio spectrum is divided spatially into cells, where the same physical channels may be re-used in different (geographic) locations. The spatial re-use operates according to the principles of Dynamic Channel Selection (DCS) as described in ETR 310 [8] dealing with DECT features.

Each radio end point operates according to a timing reference and the PHL is then responsible for transmitting packets of data under direct control of the MAC layer. Adjacent FPs may be synchronized. This provides some advantages, particularly in high traffic situations (see ETR 310 [8]).

7.4   MAC layer

The MAC layer performs two main functions. Firstly, it selects physical channels, and then establishes and releases connections on those channels. Secondly, it multiplexes (and demultiplexes) control information, together with higher layer information and error control information, into slot-sized packets.

These functions are used to provide three independent services; a broadcast service, a connection oriented service and a connectionless service.

The broadcast service is a special DECT feature: it multiplexes a range of broadcast information into a reserved field (the A-field), and this field appears as part of all active transmissions. The broadcast service is always transmitted in every cell (even in the absence of user traffic) on at least one physical channel. These "beacon" transmissions allow PPs to quickly identify all FPs that are within range, to select one, and to lock to it without requiring any portable transmissions.

7.5   DLC layer

The DLC layer is concerned with the provision of very reliable data links to the NWK layer. Many of the imperfections of the radio transmissions are already removed by the efforts of the MAC layer, and the DLC layer is designed to work closely with the MAC layer to provide higher levels of data integrity than can be provided by the MAC layer alone.

The DECT layered model separates into two planes of operation at the DLC layer; the C-plane and the U-plane.

The C-plane is common to all applications, and provides very reliable links for the transmission of internal control signalling and limited quantities of user information traffic. Full error control is provided with a balanced Link Access Protocol (LAPC).

The U-plane provides a family of alternative services, where each service is optimized to the particular need of a specific type of services. The simplest service is the transparent unprotected service used for speech transmission. Other services support circuit mode and packet mode data transmission, with varying levels of protection.

7.6   Network (NWK) layer

The NWK layer is the main signalling layer of the protocol. It adopts a similar style to the ISDN layer 3 protocol (see EN 300 403-1 [11]) and offers a similar level of functions.

The NWK layer operates using an exchange of messages between peer entities. The basic set of messages supports the establishment, maintenance and release of calls. Additional messages support a range of extended capabilities.

The basic CC provides a circuit switched service selected from one of the range of DLC options. Other network layer services are SS, COMS, CLMS and MM. These services are arranged as independent entities, and a particular application can be realized using more than one.

The MM is a particularly important group of services. This group contains the procedures that support the special cordless mobility of PPs, for example authentication and location registration.

7.7   Lower Layer Management Entity (LLME)

The LLME contains defined procedures that concern more than one layer. The LLME procedures are included in EN 300 175 parts 3 to 5, [1] to [3]. Most of these procedures have only local significance, and they are defined in general terms to allow for alternative implementations. The location of some selected LLME procedures is as follows:

MAC layer:

- creation, maintenance and release of bearers, by activating and deactivating pairs of physical channels;

- physical channel management, including the choice of free physical channels and the assessment of the quality of received signals;

- switching between PT and FT mode when direct PT to PT or wireless FT to FT communication is provided.

DLC layer:

- connection management, which includes the establishment and release of connections in response to NWK layer demands;

- routing of C-plane and U-plane data to suitable connections.

NWK layer:

- service negotiation and mapping;

-   application parameters (e.g. addresses) and DECT identities resolution.

7.8   Interworking Units (IWU)

Transport of the information to the end user requires additional layers of protocol that are outside the scope of the present document. In general, an IWU will be required to provide the necessary interworking functions. This IWU plays an important role in defining the exact service that is provided. Specifications of IWUs defining the interworking between the DECT air interface and various networks and line interfaces can be found in additional DECT profile specifications. A brief overview can be found in TR 101 178 [7].

8   Proprietary escapes within the CI

A set of defined escape routes has been provided for implementers that wish to implement proprietary additions or alternatives to the CI protocol, as shown in figure 2.

8.1   Primary escape routes
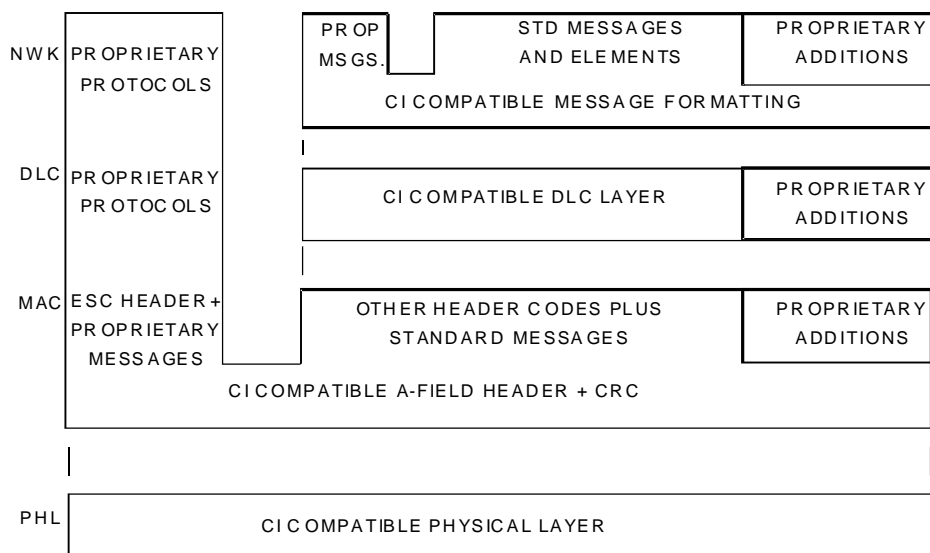
Figure 2: Structure of escape routes within the CI

Two primary escape routes are defined within the CI standard, one at the MAC layer and one at the NWK layer. In both cases these escape routes provide the possibility for manufacturers to branch into a family of proprietary protocols. These branches provide a compatible method for proprietary systems to operate without causing confusion or interference to systems that implement the other CI provisions.

The lowest branch occurs at the MAC layer. The branch is defined at this level in order to ensure a minimum level of conformance to the CI. The minimum level of conformance therefore includes all of the PHL and the lower parts of the MAC layer (in particular, the MAC A-field header, A-field CRC and the channel selection procedures).

This MAC branch operates by using one reserved code in the MAC header field (the field that appears at the start of every transmission, see EN 300 175-3 [1]). All equipment shall understand this reserved code. This reserved code shall be used in every transmission from proprietary equipment and shall never be used by equipment that conforms to the standard branch. This means that transmissions from proprietary systems can be immediately identified by all other equipment.

For approvals testing purposes a small number of standard messages shall be supported by proprietary equipment when operating in a special test mode. No messages are mandated for proprietary equipment in normal operating mode.

At the NWK layer the escape route operates by using a reserved protocol discriminator code. All equipment shall understand this code, it shall be used exclusively by proprietary protocols (other codes are reserved for the standard protocols) to clearly indicate that a proprietary protocol is in use. In this case proprietary protocols can co-exist with standard protocols as part of the same equipment.

8.2   Secondary escape routes

In addition to these primary escape routes, a series of secondary escape routes are defined at all layers using reserved codes or optional elements, as appropriate. These small branches allow proprietary information to be included in addition to the CI information. They are designed to allow manufactures to enhance the CI with proprietary features without compromising the basic level of interoperability.

9   Levels of conformance

The following levels of CI conformance are defined:

CI-PROFILE-PLUS: ETSI approved CI operating profile(s) with proprietary extensions;

CI-PROFILE: ETSI approved CI operating profile(s) (e.g. GAP);

CI-BASE: PHL and minimum MAC conformance.

The CI-Base defines the minimum level of conformance to the CI standard. This shall apply to all DECT equipment. It does not imply any speech transmission characteristics.

Annex A (informative):
Bibliography

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

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

RFC 791, STD0005: "Internet protocol (IPv4)".

RFC 2460: "Internet Protocol, Version 6 (IPv6) Specification".

ITU-T Recommendation R.140 (1988): "Definitions of essential technical terms in the field of telegraph transmission", definition 6014.

History

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