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European Standard (Telecommunications series)

Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 2: Physical Layer (PHL)

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ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Digital Enhanced Cordless Telecommunications (DECT).

The present document is part 2 of a multi-part deliverable. Full details of the entire series can be found in part 1 [1].

Further details of the DECT system may be found in TR 101 178 [i.1] and ETR 043 [i.2].

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Date of adoption of this EN:	17 October 2008
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1 Scope

The present document is one of the parts of the specification of the Digital Enhanced Cordless Telecommunications (DECT) Common Interface (CI).

This part of the DECT CI specifies the physical channel arrangements. DECT physical channels are radio communication paths between two radio end points. A radio end point is either part of the fixed infrastructure, a privately owned Fixed Part (FP), typically a base station, or a Portable Part (PP), typically a handset. The assignment of one or more particular physical channels to a call is the task of higher layers.

The Physical Layer (PHL) interfaces with the Medium Access Control (MAC) layer, and with the Lower Layer Management Entity (LLME). On the other side of the PHL is the radio transmission medium which has to be shared extensively with other DECT users and a wide variety of other radio services. The tasks of the PHL can be grouped into five categories:

- a) to modulate and demodulate radio carriers with a bit stream of a defined rate to create a radio frequency channel;
- b) to acquire and maintain bit and slot synchronization between transmitters and receivers;
- c) to transmit or receive a defined number of bits at a requested time and on a particular frequency;
- d) to add and remove the synchronization field and the Z-field used for rear end collision detection;
- e) to observe the radio environment to report signal strengths.

The present document includes New Generation DECT, a further development of the DECT standard introducing wideband speech, improved data services, new slot types and other technical enhancements.

2 References

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.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
 - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
 - for informative references.

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2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

- [1] ETSI EN 300 175-1: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 1: Overview".
- [2] Void.
- [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] Void.
- [8] Void.
- [9] ETSI EN 300 176-1: "Digital Enhanced Cordless Telecommunications (DECT); Test specification; Part 1: Radio".
- [10] ITU-R Recommendation M.1457-6: "Detailed specifications of the radio interfaces of International Mobile Telecommunications-2000 (IMT-2000)".
- [11] ITU-T Recommendation V.11: "Electrical characteristics for balanced double-current interchange circuits operating at data signalling rates up to 10 Mbit/s".
- [12] Federal Communications Commission FCC 02-151: "Second Report and Order, Amendment of Part 15 of the Commission's Rules Regarding Spread Spectrum Devices".
- [13] CEPT/ECC/DEC/(06)01: "ECC Decision of 24 March 2006 on the harmonized utilization of spectrum for terrestrial IMT-2000/UMTS systems operating within the bands 1900-1980 MHz, 2010-2025 MHz and 2110-2170 MHz".

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

- [i.1] ETSI TR 101 178: "Digital Enhanced Cordless Telecommunications (DECT); A High Level Guide to the DECT Standardization".
- [i.2] ETSI ETR 043: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Services and facilities requirements specification".
- [i.3] International Commission on Non-Ionizing Radiation Protection (ICNIRP): "Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz), Health Physics", vol. 74, pp 494-522, April 1998.
- [i.4] Council Recommendation 1999/519/EC of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (Official Journal of the European Communities, July 1999).

- [i.5] CENELEC EN 50360: "Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300 MHz - 3 GHz)", European Committee for Electrotechnical Standardization (CENELEC), July 2001. (Harmonized standard listed under the R&TTE directive).
- [i.6] CENELEC EN 50385: "Product standard to demonstrate the compliance of radio base stations and fixed terminal stations for wireless telecommunication systems with the basic restrictions or the reference levels related to human exposure to radio frequency electromagnetic fields (110 MHz - 40 GHz) - General public", European Committee for Electrotechnical Standardization (CENELEC), November 2001 (draft).
- [i.7] CENELEC EN 50383: "Basic standard for the calculation and measurement of electromagnetic field strength and SAR related to human exposure from radio base stations and fixed terminal stations for wireless telecommunication systems (110 MHz - 40 GHz)", European Committee for Electrotechnical Standardization (CENELEC), November 2001 (draft).
- [i.8] IEEE 802.11b: "Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".

3 Definitions and abbreviations

3.1 Definitions

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

antenna diversity: See EN 300 175-1 [1].

cell: See EN 300 175-1 [1].

Central Control Fixed Part (CCFP): See EN 300 175-1 [1].

channel: See EN 300 175-1 [1].

cluster: See EN 300 175-1 [1].

Connection Oriented mode (C/O): See EN 300 175-1 [1].

Cordless Radio Fixed Part (CRFP): See EN 300 175-1 [1].

coverage area: See EN 300 175-1 [1].

DECT Network (DNW): See EN 300 175-1 [1].

double duplex bearer: See EN 300 175-1 [1].

double simplex bearer: See EN 300 175-1 [1].

double slot: See EN 300 175-1 [1].

down-link: See EN 300 175-1 [1].

duplex bearer: See EN 300 175-1 [1].

Fixed Part (DECT Fixed Part) (FP): See EN 300 175-1 [1].

Fixed radio Termination (FT): See EN 300 175-1 [1].

frame: See EN 300 175-1 [1].

full slot (slot): See EN 300 175-1 [1].

guard space: See EN 300 175-1 [1].

half slot: See EN 300 175-1 [1].

handover: See EN 300 175-1 [1].

IMT-2000: International Mobile Telecommunications, Third Generation Mobile Systems

IMT-FT: International Mobile Telecommunications, FDMA/TDMA

NOTE: This is the DECT family member of IMT-2000.

intercell handover: See EN 300 175-1 [1].

intracell handover: See EN 300 175-1 [1].

Lower Layer Management Entity (LLME): See EN 300 175-1 [1].

multiframe: See EN 300 175-1 [1].

New Generation DECT: See EN 300 175-1 [1].

physical channel (channel): See EN 300 175-1 [1].

Portable Part (DECT Portable Part) (PP): See EN 300 175-1 [1].

Portable radio Termination (PT): See EN 300 175-1 [1].

public access service: See EN 300 175-1 [1].

radio channel: See EN 300 175-1 [1].

radio end point: See EN 300 175-1 [1].

Radio Fixed Part (RFP): See EN 300 175-1 [1].

Repeater Part (REP): See EN 300 175-1 [1].

RF carrier (carrier): See EN 300 175-1 [1].

RF channel: See EN 300 175-1 [1].

simplex bearer: See EN 300 175-1 [1].

Single Radio Fixed Part (SRFP): See EN 300 175-1 [1].

TDMA frame: See EN 300 175-1 [1].

Wireless Relay Station (WRS): See EN 300 175-1 [1].

3.2 Abbreviations

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

AM	Amplitude Modulation
BER	Bit Error Rate
CCFP	Central Control Fixed Part
CI	Common Interface (standard)
CRFP	Cordless Radio Fixed Part
CTA	Cordless Terminal Adapter
dBm	dB relative to 1 milliwatt
DBPSK	Differential Binary Phase Shift Keying
DC	Direct Current
DLC	Data Link Control layer
DQPSK	Differential Quaternary Phase Shift Keying
D-SAP	Data field-Service Access Point

DSV	Digital Sum Variation
EIRP	Equivalent Isotropically Radiated Power
ERP	Effective Radiated Power
EVM	Error-Vector Magnitude
FMID	Fixed part MAC IDentity
FP	Fixed Part
FT	Fixed radio Termination
Fy	Frequency
GFSK	Gaussian Frequency Shift Keying
GMSK	Gaussian Minimum Shift Keying
GPS	Global Positioning System
ICNIRP	International Commission on Non-Ionizing Radiation Protection
iDCS	instant Dynamic Channel Selection
IMT-FT	International Mobile Telecommunications - Frequency Time
ISM	Industrial, Scientific and Medical
LLME	Lower Layer Management Entity
MAC	Medium Access Control layer
MCM	Minimum Common Multiple
MFN	MultiFrame Number
NTP	Normal Transmitted Power
NWK	NetWoRk
PCMCIA	Personal Computer Memory Card International Association
PHL	PHysical Layer
PM-SAP	Physical layer Management entity - Service Access Point
PP	Portable Part
ppm	parts per million
PSCN	Primary receiver Scan Carrier Number
PT	Portable radio Termination
REP	REpeater Part
RF	Radio Frequency
RFP	Radio Fixed Part
RMS	Root Mean Square
RPN	Radio fixed Part Number
RSSp	Radio Signal Strength PP
SAP	Service Access Point
SAR	Specific Absorption Rate
SDU	Service Data Unit
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
UMTS	Universal Mobile Telecommunication System
UTC	Universal Time Coordinated
WLAN	Wireless Local Area Network
WRS	Wireless Relay Station

4 PHL services

A physical channel provides a simplex bit-pipe between two radio end points. To establish, for example, a duplex telephone connection, two physical channels have to be established between the endpoints.

Radio spectrum is needed to create a physical channel. The radio spectrum space has three dimensions:

- geometric (geographic) space;
- frequency;
- time.

Spectrum is assigned to physical channels by sharing it in these three dimensions.

DECT provides a mechanism called "handover" to release a physical channel and to establish another one in any or all of the three dimensions without releasing the end-to-end connection.

The requirements of the present document should be read in conjunction with EN 300 176-1 [9].

The requirements specified apply for nominal conditions unless extreme conditions are stated. Tests at extreme conditions may include combinations of limit values of extreme temperature and of power supply variation, defined for each case in EN 300 176-1 [9].

Nominal and extreme temperature ranges are defined below:

Nominal temperature:	PP, FP, RFP, CCFP	+15 °C to +35 °C;
Extreme temperature:	PP	0 °C to +40 °C;
	FP, RFP, CCFP, class E1	+10 °C to +40 °C;
	FP, RFP, CCFP, class E2	-10 °C to +55 °C.

The environmental class E1 refers to installation in indoor heated and/or cooled areas allowing for personal comfort, e.g. homes, offices, laboratories or workshops. The environmental class E2 refers to all other installations.

For nominal temperature, each measurement is made at the temperature of the test site, which shall be within +15 °C to +35 °C. For extreme temperatures, additional measurements are made, at each limit value of the extreme temperature.

4.1 RF channels (access in frequency)

4.1.1 Nominal position of RF carriers

DECT carriers are specified for the whole frequency range 1 880 MHz to 1 980 MHz and 2 010 MHz to 2 025 MHz. Carrier positions in the 902 MHz to 928 MHz ISM band and the 2 400 MHz to 2 483,5 MHz ISM band have been defined for the US market [12].

DECT is also an IMT-2000 [10] family member, called IMT-FT, the only member that provides for uncoordinated installations on an unlicensed spectrum. RF carriers for IMT-FT applications of DECT are placed within the parts of the European UMTS spectrum applicable for TDD operation. (See ECC/DEC/(06)01 [13].) E.g. within 1 900 MHz to 1 920 MHz, 1 920 MHz to 1 980 MHz and/or 2 010 MHz to 2 025 MHz.

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

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

$$F_c = F_0 - c \times 1,728 \text{ MHz};$$

where: $F_0 = 1\,897,344 \text{ MHz}$; and

$$c = 0, 1, \dots, 9.$$

Above this band, additional carriers are defined in annex F. Annex F shows the carrier frequencies for $c = 0$ to 9 and for $c \geq 10$ and RF bands 00001 to 01001 (see EN 300 175-3 [3], clauses 7.2.3.3 and 7.2.3.9).

The frequency band between $F_c - 1,728/2 \text{ MHz}$ and $F_c + 1,728/2 \text{ MHz}$ shall be designated RF channel c .

NOTE: A nominal DECT RF carrier is one whose centre frequency is generated by the formula:
 $F_g = F_0 - g \times 1,728 \text{ MHz}$, where g is any integer.

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

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