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Digitalne izboljšane brezvrvične telekomunikacije (DECT) - Skupni vmesnik (CI) - 2. del: Fizična plast (PHL)

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

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Project 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 and ETR 043 (see bibliography).

National transposition dates	
Date of adoption of this EN:	27 July 2007
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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

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.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

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

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

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

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

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

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

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

[8] ITU-T Recommendation V.11: "Electrical characteristics for balanced double-current interchange circuits operating at data signalling rates up to 10 Mbit/s".

[9] Void.

[10] Void.

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

[12] CEPT ECC/DEC/(06)01: "ECC Decision of 24 March 2006 on the harmonised utilisation of spectrum for terrestrial IMT-2000/UMTS systems operating within the bands 1900-1980 MHz, 2010-2025 MHz and 2110-2170 MHz".

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
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 [6].

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 [6].

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 [11].

DECT is also an IMT-2000 [7] 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 [12].) E.g. within 1 900 MHz to 1 920 MHz, 1 920 MHz to 1 980 MHz and/or 2 010 MHz to 2 025 MHz.

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

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

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

where: $F0 = 1\,897{,}344$ MHz; and

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

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 [2], clauses 7.2.3.3 and 7.2.3.9).

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

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

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

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

4.1.2 Accuracy and stability of RF carriers

At an RFP the transmitted RF carrier frequency corresponding to RF channel c shall be in the range Fc ± 50 kHz at extreme conditions.

At a PP the centre frequency accuracy shall be within ±50 kHz at extreme conditions either relative to an absolute frequency reference or relative to the received carrier, except that during the first 1 s after the transition from the idle-locked state to the active-locked state the centre frequency accuracy shall be within ±100 kHz at extreme conditions relative to the received carrier.

NOTE: The above state transition is defined in EN 300 175-3 [2].

The maximum rate of change of the centre frequency at both the RFP and the PP while transmitting, shall not exceed 15 kHz per slot.

4.2 Time Division Multiple Access (TDMA) structure (access in time)

4.2.1 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 symbols, and the data is transmitted at a symbol rate of 1 152 ksymbol/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 a full slot (see figures 1 to 3).

NOTE 1: Some DECT documents sometimes refer to bits instead of symbols due to the fact that symbol and bit become synonyms for the mandatory 2-level modulation, for which most physical layer tests are defined, see EN 300 176-1 [6].

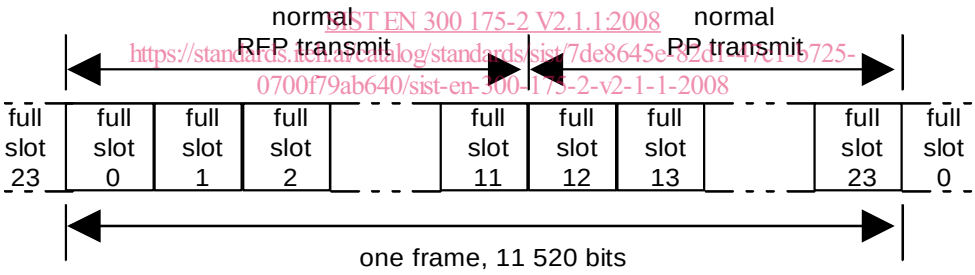

Figure 1: Full slot format

Full-slots are numbered from K = 0 to 23, and half-slots are numbered L = 0 or 1, where half-slot 0 occurs earlier than half-slot 1. Normally full-slots K = 0 to 11 are used in the RFP to PP direction, while full slots K = 12 to 23 are normally used in the PP to RFP direction. Double slots are numbered K = 0 to 10 and from 12 to 22. There is no double slot 11 due to the TDM structure imposed on the DECT frame.

Each full-slot has a duration of 480 symbol intervals. Symbol intervals within a full-slot are denoted f0 to f479 where interval f0 occurs earlier than interval f1. Each half-slot has a duration of 240 symbol intervals. Half-slots commence at f0 or f240 (see figure 2).

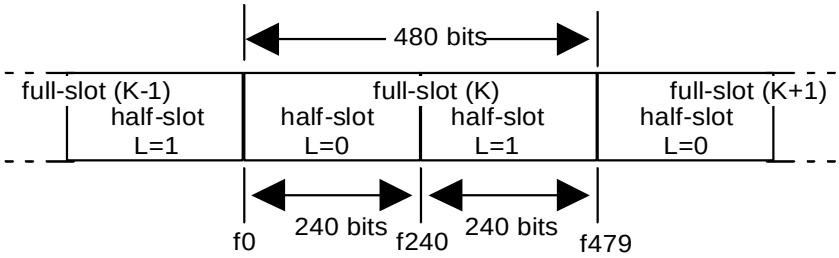

Figure 2: Half-slot format