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Digital Enhanced Cordless Telecommunications (DECT); Implementing DECT in an arbitrary spectrum allocation

European Telecommunications Standards Institute

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Contents

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Foreword

This Technical Report (TR) has been produced by the Digital Enhanced Cordless Telecommunications (DECT) Project of the European Telecommunications Standards Institute (ETSI).

The present document provides a guide on how to implement and test DECT systems operating at frequencies outside the frequency-bands described in TBR 6 [11].

1 Scope

The present document is a guide how to implement and test Digital Enhanced Cordless Telecommunications (DECT) systems operating at frequencies outside the frequency-bands described in TBR 6 [11]. The need to have this arises if DECT equipment is to be adapted to national requirements of countries which do not allow to use the basic 1 880 to 1 900 MHz DECT frequency band.

The present document is thereby also a guide for approval of such DECT systems in the above mentioned countries.

2 References

References may be made to:

a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or

b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

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

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

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

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

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

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

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

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

[9] ETS 300 176-1: "Digital Enhanced Cordless Telecommunications (DECT); Approval test specification; Part 1: Radio".

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

[11] TBR 6: "Digital Enhanced Cordless Telecommunications (DECT); General terminal attachment requirements".

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

[13] ETR 056: "Digital European Cordless Telecommunications (DECT); System description document".

[14] ETS 300 700: "Digital European Cordless Telecommunications (DECT); Wireless Relay Station (WRS)".

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

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

[17] ETR 246: "Digital European Cordless Telecommunications (DECT); Application of DECT Wireless Relay Station (WRS)".

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

[19] 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".

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

[21] ETR 185: "Digital European Cordless Telecommunications (DECT); Data Services Profile (DSP); Profile overview".

[22] ETR 178: "Digital European Cordless Telecommunications (DECT); A high level guide to the DECT standardization".

[23] TBR 22: "Attachment requirements for terminal equipment for Digital Enhanced Cordless Telecommunications (DECT) Generic Access Profile (GAP) applications".

[24] 91/263/EEC: "Council Directive of 29 April 1991 on the approximation of the laws of the Member States concerning telecommunications terminal equipment, including the mutual recognition of their conformity" (Terminal Directive).

[25] 91/287/EEC: "Council Directive of 3 June 1991 on the frequency band to be designated for the co-ordinated introduction of digital European cordless telecommunications (DECT) into the Community".

[26] 91/288/EEC: "Council Directive of 3 June 1991 on the co-ordinated introduction of digital European cordless telecommunications (DECT) into the Community".

[27] 90/388/EEC: "Council Directive of 28 June 1990 on competition in the markets for telecommunications services".

3 Definitions and abbreviations

3.1 Definitions

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

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

Portable Part (DECT Portable Part) (PP): A physical grouping that contains all elements between the user and the DECT air interface. PP is a generic term that may describe one or several physical pieces.

3.2 Abbreviations

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

CTA	Cordless Terminal Adapter
CTR	Common Technical Regulation
DAS	DECT Access Site
DCS	Dynamic Channel Selection
DECT	Digital Enhanced Cordless Telecommunications
ERO	European Radio communications Office
EUT	Equipment Under Test
FDD	Frequency Division Duplex
FP	Fixed Part
FS	Fixed Service
FSS	Fixed Satellite Service
FWA	Fixed Wireless Access
GAP	Generic Access Profile
GPS	Global Positioning System
ISDN	Integrated Services Digital Network
LOS	Line Of Sight
NLOS	Near Line Of Sight
P-MP	Point-to-Multipoint
POTS	Plain Old Telephone Service
PP	Portable Part
PSTN	Public Switched Telephone Network
RAP	RLL Access Profile
RF	Radio Frequency
RFP	Radio Fixed Part
RLL	Radio in the Local Loop
TBR	Technical Basis for Regulation
TDD	Time Division Duplex
TE	Terminal Equipment
UMTS	Universal Mobile Telecommunications System
WLL	Wireless Local Loop
WRS	Wireless Relay Station

4 Introduction to DECT services and applications

DECT is a general radio access technology for short range wireless telecommunications. It is a high capacity, pico-cellular digital technology, for cell radii ranging from about 10 m to 5 km depending on application and environment. It provides telephony quality voice services, and a broad range of data services, including Integrated Services Digital Network (ISDN). It can be effectively implemented as a simple residential cordless telephone or as a system providing all telephone services in a city centre.

The DECT instant or continuos dynamic channel selection, provides effective coexistence of uncoordinated installations of private and public systems on the common designated DECT frequency band, and avoids any need for traditional frequency planning. See ETR 310 [19] for further explanation.

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

A list of all ETSI standards and ETSI technical reports for DECT are given in ETR 178 [22]. Annex A of ETR 178 [22] contains a list of the essential standards and reports.

The DECT standardization has developed a modern and complete standard within the area of cordless telecommunications.

The DECT standardization efforts have received substantial legal and financial support by the European Commission. The European wide allocation of the frequency band 1 880 - 1 900 MHz, has been reinforced by the Council Directive 91/287/EEC [25].

DECT carriers have been defined for the whole spectrum range 1 880 - 1 937 MHz in the basic DECT standards EN 300 175, parts 1 to 8 [1] - [8] and TBR 6 [11]. This allows for expansion of the basic DECT allocation or allows DECT services to be introduced in countries where the basic DECT frequencies 1 880 - 1 900 MHz are not available.

For rapid introduction on European wide bases, this directive and the Council Recommendation 91/288/EEC [26] refers to the EEC Terminal Directive 91/263 [24] for mutual recognition between countries of conformity. For this purpose Common Technical Regulations (CTRs) have been established for DECT relating to harmonized DECT standards, Technical Bases for Regulation (TBRs) and ENs. TBRs contain the technical requirements of a CTR. Approval to a CTR gives access to a single European market through a simplified legal procedure.

The Council Recommendation 91/288/EEC [26] recommends that the DECT standard should meet user requirements for residential, business, public pedestrian and radio in the local loop applications. The standard should also provide compatibility and multiple access rights to allow a single handset to access several types of systems and services, e.g. a residential system, a business system and one or more public systems. The public applications should be able to support full intersystem European roaming of DECT handsets. The DECT standard provides these features. Of special importance is the Generic Access Profile (GAP) and the related TBR 22 [23], which define common mobility and interoperability requirements for private and public DECT speech services. For a more comprehensive overview of the DECT standardization see ETR 178 [22].

The European Commission has elaborated an amendment of Directive 90/388/EEC [27] on competition in the market for telecommunications services. This Directive defines DECT as an important alternative to the wired Public Switched Telephone Network (PSTN)/ISDN network access. Furthermore any restriction on the combination of DECT with other mobile technologies are to be withdrawn.

The emerging deregulation of fixed services will also speed up fixed-mobile convergence in service offerings from operators. The different DECT interoperability profile standards are designed to facilitate provision of mixtures of fixed and mobile services through a single infrastructure.

The aim of the present document is to provide technical requirements that can be applied for DECT approval in countries having a spectrum allocation for DECT, different from the European allocation. The present document consists of references to the relevant ETSI DECT standards (TBR 6 [11]) and amendments required for application in a general spectrum allocation band.

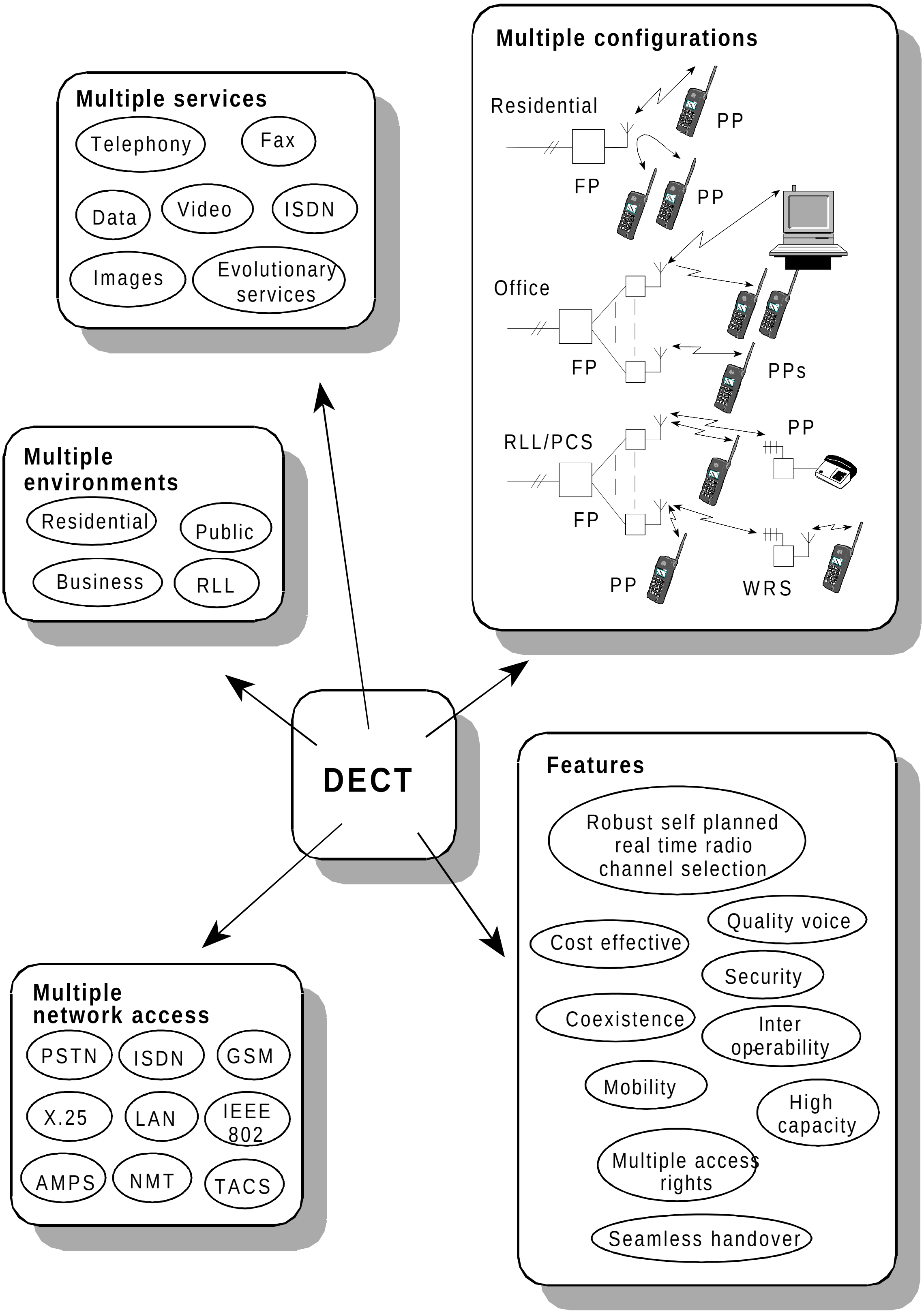


Figure 1: Overview of DECT applications and features

5 Requirements

This clause defines the minimum required functions and parameters for DECT equipment operating in the frequency band F_L to F_U. F_L defines the lower edge of the assigned frequency band and F_U defines the upper edge of the frequency band. The technical requirements are contained in TBR 6 [11] together with the amendments which are defined in this clause.

5.1 Carrier positions

Examples of carrier allocations and carrier positions are given in annex A.

The frequencies to be used can be software controlled by the DECT base stations. They are indicated in a broadcast message to the portables.

DECT equipment should be capable of working on all assigned channels. This normally provides the most efficient use of the spectrum, but it is possible to limit specific applications, or a specific system, to part of the spectrum if this is suitable due to local circumstances.

5.2 General requirements

A summary of the main technical requirements of TBR 6 [11] is given in table 1.

Table 1

Parameter	Characteristic/ Value	Reference
accuracy and stability of Radio Frequency (RF) carriers	RFP: ± 50 kHz PP: ± 100 kHz	7.2, 7.3, 7.4, 7.5
packet timing jitter	± 1 µs	8.3
reference timing accuracy of a Radio Fixed Part (RFP)	max 10 ppm	8.4
packet transmission accuracy of a PP	5 ms ± 2 µs	8.5
transmission burst	power-time template	9
transmitted power	max 250 mW	10
RF carrier modulation	digital modulation	11
unwanted emissions due to modulation	emission mask	12.2
unwanted emissions due to transmitter transient	emission mask	12.3
unwanted emissions due to intermodulation	1 µW	12.4
spurious emissions when allocated a transmit channel	250 nW below 1 GHz 1 µW above 1 GHz	12.5
radio receiver sensitivity	-83 dBm at BER = 10^{-3}	13.1
radio receiver reference BER	10^{-5} at -73 dBm	13.2
radio receiver interference performance	BER < 10^{-3}	13.3
radio receiver blocking	See table 2	13.4
radio receiver intermodulation performance	BER < 10^{-3}	13.6
spurious emissions when the PP has no allocated transmit channel	2 nW	13.7
efficient use of the radio spectrum	channel handling	17.1, 17.2, 17.3
antennas with directivity	12 dBi	H.2

The tests cases in table 1 shall be performed, where relevant, on the two supported carriers nearest to the band edges and on one carrier inside the band. The applicant shall declare the band edge limits F_L and F_U and the carriers supported.

For the blocking requirements, table 2 shall be applied instead of the requirements given in table 12 of TBR 6 [11].

Table 2

Frequency (f)	Continuous wave interferer level	
	For radiated measurements dB μV/m	For conducted measurements dBm
25 MHz $\leq f < F_L$ - 100 MHz	120	-23
F_L - 100 MHz $\leq f < F_L$ - 5 MHz	110	-33
$\lvert f - F_C \rvert$ > 6 MHz	100	-43
F_U + 5 MHz $< f \leq F_U$ + 100 MHz	110	-33
F_U + 100 MHz $< f \leq$ 12,75 GHz	120	-23

The Equipment Under Test (EUT) shall operate on the declared frequency allocation with the low band edge F_L MHz and the high band edge F_U MHz.

Annex A: Examples for frequency band allocations in the range 1 900 to 2 200 MHz

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

Fc = F9 + c * 1,728 MHz

where: F9 = 1 881,792 MHz

c = 10, 11, 12, ..., 32

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

A.1 Carrier allocation example for band 1 910 MHz to 1 930 MHz

c = 18, 19, ..., 27

These values of c give a guard distance of 2,896 MHz between the lower edge and the first carrier frequency, and a guard distance of 1,548 MHz between the upper edge and the last carrier frequency.

A.2 Carrier allocation example for band 1 900 MHz to 1 920 MHz

c = 12, 13, ..., 21

These values of c give a guard distance of 2,528 MHz between the lower edge and the first carrier frequency, and a guard distance of 1,920 MHz between the upper edge and the last carrier frequency.

Annex B: Examples of frequency band allocations in within 2 200 MHz to 105 GHz

B.1 Radio frequency bands for Fixed Wireless Access (FWA) applications in the range 2 200 MHz to 105 GHz

Following the ongoing work within European Radio communications Office (ERO) and the intentions of the draft European table of frequency allocations and utilization, the following general tentative frequency bands, or parts thereof, may be considered, but not limited to, for future FWA applications.

Table B.1

2 200 - 2 483,5 MHz	
2 483,5 - 2 500 MHz	
2 500 - 2 520 MHz	
2 520 - 2 690 MHz	
3 400 - 4 200 MHz	see clause B.2
5 150 - 5 250 MHz	
5 250 - 5 300 MHz	
10,15 - 10,68 GHz	
17,10 - 17,70 GHz	
24,25 - 26,5 GHz	
27,6 - 29,5 GHz	
31,8 - 33,4 GHz	
37,0 - 39,5 GHz	
40,0 - 43,5 GHz	
47,2 - 50,2 GHz	
50,4 - 51,4 GHz	
59,0 - 63 GHz	
74,0 - 75,5 GHz	
84,0 - 86,0 GHz	

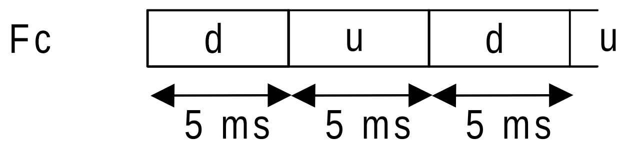
The regulatory regimes around the world for these bands are traditionally tailored for Frequency Division Duplex (FDD) applications, but Time Division Duplex (TDD) applications are also used. Although most regulators are expected to allow both TDD and FDD systems, it is important to define both TDD and FDD applications of DECT to allow for a most flexible approach to different regulatory regimes.

B.1.1 Definition of access channels, bearers

The different types of DECT bearers are defined in the time domain. Each bearer is also related to a specific carrier frequency number c and to a specific RF-band number (see EN 300 175-3 [3], subclause 7.2.3.3.1).

B.1.1.1 TDD

For TDD, the carrier number c relates to a specific carrier frequency Fc used for both the up-link and down-link parts of a bearer.



d indicates down link and **u** indicates up link. Each d and u field is further divided into 12 time slots.

Figure B.1: TDD frame structure

B.1.1.2 FDD

For FDD a different definition of the carrier number c is required.

Here the carrier number c relates to a specific pair of carrier frequencies Fcu and Fcd. All pairs have the same duplex frequency separation, fd, given by the regulator, typically 50 - 100 MHz or more. The up-links use carrier Fu and the down-links carrier Fd. The time relation between up-links and down-links of a bearer is the same as for the TDD case. Thus the same burst mode controllers are used for TDD and FDD. Thus for simplex and duplex beares the down-links are defined for the first 5 ms of a frame, and the up-links for the last 5 ms, and the time separation between the two parts of a duplex bearer is 5 ms.

B.1.1.3 Definition of Fc, Fd, Fcu and Fcd

The following carrier frequency definitions apply:

Fc = Fg + c * 1,728 MHz,

where c = 10, 11, 12, ..., 32

and Fg is a nominal DECT carrier frequency (see TBR 6 [11], subclause 7.1).

Each specific RF-band number shall have Fg defined, and also Fd if FDD operation shall be applied.

Fcd = Fc and Fcu = Fc - Fd. Fd can be a positive or a negative number.

B.1.2 Dynamic Channel Selection (DCS) algorithms

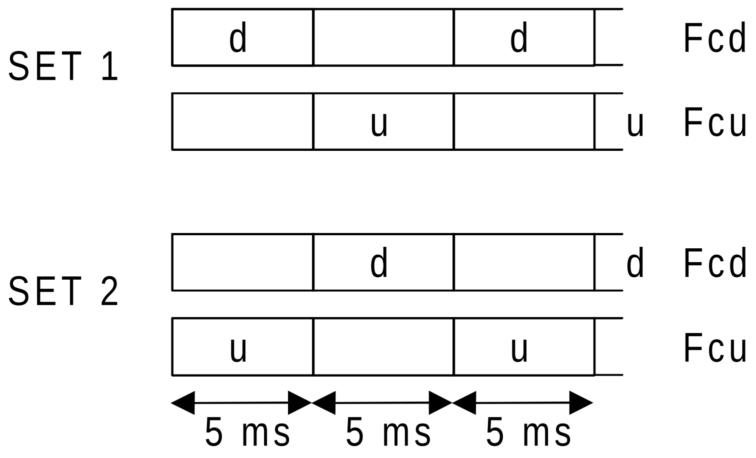
FDD operation does not require any changes to the DECT DCS algorithms. The DCS algorithms are identical for TDD and FDD. Only the bearer definitions have to be expanded according to subclause B.1.1.

B.1.3 Antenna diversity algorithms

In stationary and low mobility TDD applications, the fading on up- and down-links are correlated. Therefore it is possible to use quality information from one direction to influence the antenna selection for the other direction. Such a correlation does not exist for FDD, whereby it is essential to strictly relate the selection procedure to each link separately. This is not a regulatory issue, and it is not complicated.

B.1.4 Time domain offset for low cost spectrum efficient FDD applications

Due to combined time and frequency separation for FDD duplex bearers, only half the time domain will be utilized for each carrier Fcu and Fcd. Thus half of the capacity is unused. The remaining half shall be utilized by having two sets of base stations with 5 ms offset between the Global Positioning System (GPS) derived time references for the two sets. Thus every second base station shall belong to the same set. This fully avoids the need for expensive duplex filters for simplex and duplex bearer services (symmetric) in base sites with several RFPs. This gives a complication for handover between base sites, but this is not generally needed for fixed wireless access.



d indicates down-link and **u** indicates up-link. Blank field indicates unused area in the time domain.

Figure B.2: The base stations of Set 2 have the time reference, offset by 5 ms relative to Set 1

B.1.5 Operator codes, carrier number and RF-band definitions

A globally unique Operators Code has to be obtained from ETSI (see EN 300 175-6 [6]).

Spectrum allocations in this band are normally assigned each to a single operator. Therefore there is no need to standardize the carrier and band number assignments for these bands.

Each system however needs to define the carrier numbers internally.

RF-band number 31 (see EN 300 175-3 [3], subclause 7.2.3.3.1) shall be used for propitiatory system carrier frequency definitions.

ETSI may standardize carrier and band numbers upon local request for interoperability by a regulator.

B.2 FWA in frequency bands in the range 3 400 - 4 200 MHz

The frequency bands in the range 3 400 - 4 200 MHz are today in many countries allocated to the Fixed Service (FS) and thereby opened to Point-to-Multipoint (P-MP) FWA applications. The utilization in the bands are often subject to sharing on a co-primary basis with other services, such as the terrestrial FS and the Fixed Satellite Service (FSS) space to Earth. Accordingly the frequency arrangement will be account of in detail.

B.2.1 Duplex regimes

The available duplex regimes used in two way digital communications applications are considered:

- the widely used paired frequency band regime, where two transmission links, the up and down links, of one duplex channel operate on two different carriers;
- the often neglected duplex regime normally using an unpaired single frequency band regime, where one transmission link of one channel operates on the same carrier frequency spatially divided.

Where a frequency duplex assignment is required, the spacing between the lower edges of the paired sub-bands may be 50 MHz or 100 MHz, or any other applicable duplex spacing may be used.

Where a time duplex assignment is required an applicable unpaired sub-band may be used.

B.2.2 The regulatory environment

The current standards and regulations in the frequency bands in the range 3 400 - 4 200 MHz are vague in some areas and too detailed in others. Accordingly some important issues for FWA applications to impact are:

- the possibility to use frequency blocks of appropriate size, instead of pre defined sub-bands, adapted to a certain bandwidth in a given frequency channel arrangement;
- standards and regulations that offer the free choice of duplex regime, to users and operators;
- basically limit generic requirements to output power, out of assigned band emissions, and antenna gain. Modulation type, bit rates, transparency requirements and other and other interoperability related parameters do not belong to the generic regulatory requirements. Factors like packet data over the air and DCS are much more important to the customer satisfaction and efficient use of the spectrum, than strict limits on for instance type of modulation or receiver sensitivity, which appear in some proposals for regulatory regimes (see annex C). Too stringent or irrelevant regulatory requirements will limit the evolution of services service and economics within the deployed spectrum;
- output power may be up to typically 4 W;
- large freedom to apply antenna gain, typically up to 22 dBi and beyond;
- if applying TBR 6 [11] tests a 5 dB adjustment is required in the relation between field strength and power (see TBR 6 [11], subclause 6.1.1);
- the DECT TBR 6 [11] meets with large margin the out of assigned band emission limits normally applied for fixed services in the range 3 400 - 4 200 MHz.

B.2.3 Block allocations arrangement

B.2.3.1 Block allocation arrangement 50 MHz in CITEL countries

In the CITEL countries P-MP systems may be operated in the ranges 3 400 - 3 600 MHz. Where a frequency duplex allocation is required, the spacing between the lower edges of the paired sub-bands may be 50 MHz. The edges of each sub-band are specified as follows:

3 400 MHz - 3 600 MHz

Block A,C

Lower sub-band:	3 400 - 3 425	MHz
Upper sub-band:	3 450 - 3 475	MHz

Block B,D

Lower sub-band	3 425 - 3 450	MHz
Upper sub-band	3 475 - 3 500	MHz

Block E,G

Lower sub-band:	3 500 - 3 525	MHz
Upper sub-band:	3 550 - 3 575	MHz

Block F,H

Lower sub-band:	3 525 - 3 550	MHz
Upper sub-band:	3 575 - 3 600	MHz

B.2.3.2 Block allocation arrangement 100 MHz in CITEL countries

In the CITEL countries, P-MP systems may be operated in the ranges 3 400 - 3 500 MHz and 3 500 - 3 600 MHz. Where a frequency duplex allocation is required, the spacing between the lower edges of the paired sub-bands may be 100 MHz. The edges of each sub-band are specified as follows:

3 400 MHz - 3 600 MHz

Block A, E

Lower sub-band:	3 400 - 3 425	MHz
Upper sub-band:	3 500 - 3 525	MHz

Block B, F

Lower sub-band	3 425 - 3 450	MHz
Upper sub-band	3 525 - 3 550	MHz

Block C, G

Lower sub-band:	3 450 - 3 475	MHz
Upper sub-band:	3 550 - 3 575	MHz

Block D, H

Lower sub-band:	3 475 - 3 500	MHz
Upper sub-band:	3 575 - 3 600	MHz

B.2.3.3 Block allocation arrangements recommended in the CEPT countries

Where a block assignments are required, a block may be defined as follows:

Block allocation arrangement 50 MHz in CEPT countries

In the CEPT countries, P-MP systems may be operated in the ranges 3 410 - 3 500 MHz and 3 500 - 3 600 MHz. Where a frequency duplex allocation is required, the spacing between the lower edges of the paired sub-bands may be 50 MHz. The edges of each sub-band are defined as follows:

3 410 MHz - 3 500 MHz

Lower sub-band:	$0{,}25\,N + 3\,410$ to $0{,}25\,(N + k) + 3\,410$	MHz MHz
Upper sub-band:	$0{,}25\,(N + 200) + 3\,410$ to $0{,}25\,(N + k + 200) + 3\,410$	MHz MHz
$1 \leq k \leq 160$; $0 \leq N \leq 159$; $k + N \leq 160$		

3 500 MHz - 3 600 MHz

Lower sub-band	$0{,}25\,N + 3\,410$ to $0{,}25\,(N + k) + 3\,410$	MHz MHz
Upper sub-band	$0{,}25\,(N + 200) + 3\,410$ to $0{,}25\,(N + k + 200) + 3\,410$	MHz MHz
$1 \leq k \leq 200$; $360 \leq N \leq 559$; $k + N - 360 \leq 200$		

In the tables above, k defines the width of each sub-band and N defines the lower edge of each sub-band.

P-MP equipment may be used having a frequency duplex spacing other than exactly 50 MHz. However, such equipment may conform to the limits of the sub-band allocation as defined above.

Block allocation arrangement 100 MHz

Where a frequency duplex allocation is required, the spacing between the lower edges of each paired sub-band shall be 100 MHz. The edges of each sub-band are defined as follows:

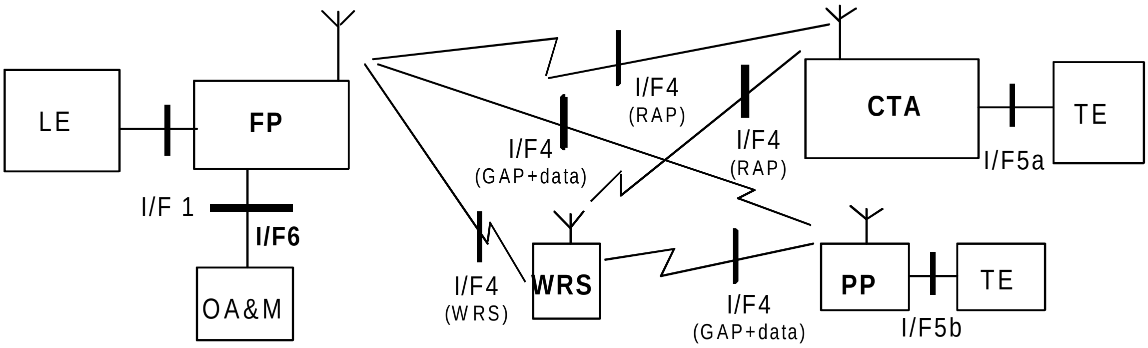
Lower sub-band	$0{,}25\,N + 3\,410$ to $0{,}25\,(N + k) + 3\,410$	MHz MHz
Upper sub-band	$0{,}25\,(N + 400) + 3\,410$ to $0{,}25\,(N + k + 400) + 3\,410$	MHz MHz
$1 \leq k \leq 360$; $0 \leq N \leq 359$; $k + N \leq 360$		

In the table above, k defines the width of each sub-band and N defines the lower edge of each sub-band.

P-MP equipment may be used having a duplex spacing other than exactly 100 MHz. However, such equipment must conform to the limits of the block allocation as defined above.

Annex C: Services and spectrum efficiency of DECT Fixed Wireless Access (FWA) applications

The reference model for DECT Radio in the Local Loop (RLL) (FWA) systems is presented in figure C.1.



TE:	Terminal Equipment.	I/F1:	Local exchange to FP Interface.
FP:	Fixed Part.	I/F4:	DECT air Interface.
WRS:	Wireless Relay Station.	I/F5a:	CTA to terminal Interface.
CTA:	Cordless Terminal Adapter.	I/F5b:	PP to terminal Interface.
PP:	Portable Part.	I/F6:	OA&M Interface.

Figure C.1: DECT RLL (FWA) reference model

Depending on whether the end-user uses a CTA or a PP, the IF/4 interface can be either RLL Access Profile (RAP) or GAP-compliant. The services facilities and configurations (see ETR 308 [18]) focuses on RAP and describes the services available at IF/1 that are expected to be provided at IF/5a. The OA&M facilities defined in RAP are only the ones that require information to be transported over the RAP air interface.

The DECT RAP standard, ETS 300 765, is divided into two parts:

a) Part 1 [15] "Basic telephony services", which includes Plain Old Telephone Service (POTS) services (unprotected 32 kbit/s ADPCM), a (protected) 64 kbit/s PCM bearer service and over-the-air OA&M services;

b) Part 2 [16] "Advanced telephony services" specifies 2B+D ISDN services (possible 30B + D in the future) and a data port for broadband (up to 552 kbit/s) packet data services.

The new DECT modulation options (on Public Enquiry spring 1998) will enable:

- 2 and 3 times higher user data rate on a standard time slot;
- 7 - 10 dB higher sensitivity (including coherent demodulation);
- uncritical Near Line Of Sight (NLOS) installation by coherent equalizer option;
- 15 km ranges;
- meets Universal Mobile Telecommunications System (UMTS) service requirements for short range mobile systems and for fixed access;
- Wireless Local Loop (WLL) services competitive with any third generation technology.

It should be noted that effective radio ranges achieved in the DECT RLL application using CTAs, will be considerably greater than when DECT is used in the mobile mode. The signal path is more consistent, it is often line-of- sight and base stations and CTAs may use high gain antennas, whose directionality also reduce multipath signals.

DECT provides high capacity FWA services with typically 40 - 100 E average traffic per DECT Access Site (DAS), in a 20 MHz allocation. The DAS highly sectorized and are deployed in cellular pattern. 10 - 22 dBi antennas are used.

For low traffic density scenarios, the capacity is not an issue, but the range is. High gain directive antennas and WRSs are often applied in order to increase the range of the links. The service and facilities description for DECT RLL requires a range up to 5 km for a DECT radio link. A Line Of Sight (LOS) range of up to 5 km is feasible with 12 dBi antennas at each end and reasonable antenna heights. Thus adding a WRS, will provide a 10 km range.

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

The DECT ISDN service monitors the ISDN layer 3 information, and allocates DECT bearer resources only when and as required by the specific instant ISDN services. The ISDN speech service has the same spectrum efficiency as the POTS speech service, and transmitting a specific amount of data (e.g. a document) via ISDN is much more spectrum efficient and loads in average the radio devices less than via POTS (modem). For packet data, transmission over the Data Port is much more spectrum efficient and loads in average the radio devices much less than any modem service or ISDN service.

By adding a 2 GHz to 3,5 GHz, 10,4 GHz or 18 GHz simple converter at the DECT radio antenna connector, part of the DECT links will provide P-MP services. This can be used to provide a link to a pool of WRS in a remote village. It will also be very efficient for concentrated high traffic transfer to residential block houses and (medium sized and larger) offices, where not range, but capacity is the main requirement.

It is also possible to deploy the whole DECT FWA within a band in 2 200 MHz - 105 GHz.

DECT FWA is *spectrum efficient* and very suitable for POTS services, general *ISDN services* and *Internet* and other packet data services in residential and *office* applications.

DECT offers a unique platform for future multimedia and fixed/mobile integration services.

History

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