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Digitalne izboljġane brezvrviļ ne telekomunikacije (DECT) - Brezǵiļ na relejna postaja (WRS)

Digital Enhanced Cordless Telecommunications (DECT); Wireless Relay Station (WRS)

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Foreword

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

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1 Scope

The present document defines the Digital Enhanced Cordless Telecommunications (DECT) Wireless Relay Station (WRS). A WRS is an additional building block for the DECT fixed network.

The present document defines provisions needed for a controlled and reliable application of the DECT WRS infrastructure building block. These provisions are not related to any specific profile.

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] ETSI EN 300 175-1 (V1.4): "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 1: Overview".

[2] ETSI EN 300 175-2 (V1.4): "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 2: Physical Layer (PHY)".

[3] ETSI EN 300 175-3 (V1.4): "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 3: Medium Access Control (MAC) Layer".

[4] ETSI EN 300 175-4 (V1.4): "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 4: Data Link Control (DLC) Layer".

[5] ETSI EN 300 175-5 (V1.4): "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 5: Network (NWK) Layer".

[6] ETSI EN 300 175-6 (V1.4): "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 6: Identities and Addressing".

[7] ETSI EN 300 175-7 (V1.4): "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 7: Security Features".

[8] ETSI EN 300 175-8 (V1.4): "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 8: Speech Coding and Transmission".

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

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

[11] ETSI EN 300 444 (V1.3): "Digital Enhanced Cordless Telecommunications (DECT); Generic Access Profile (GAP)".

3 Definitions and abbreviations

3.1 Definitions

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

Cordless Radio Fixed Part (CRFP): WRS that provides independent bearer control to a Portable radio Termination (PT) and Fixed radio Termination (FT) for relayed connections

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 1: 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 2: A FT only includes elements that are defined in the DECT CI standard. This includes radio transmission elements together with a selection of layer 2 and layer 3 elements.

Handover: process of switching a call in progress from one physical channel to another physical channel. These processes can be internal (see internal handover) or external (see external handover)

NOTE 3: There are two physical forms of handover, intra-cell handover and inter-cell handover. Intra-cell handover is always internal. Inter-cell handover can be internal or external.

Inter Working Unit (IWU): unit that is used to interconnect sub networks

NOTE 4: The IWU contains the interworking functions necessary to support the required sub network interworking.

Medium Access Control (MAC) Connection (CONNECTION): association between one source MAC Multi-Bearer Control (MBC) entity and one destination MAC MBC entity. This provides a set of related MAC services (a set of logical channels), and it can involve one or more underlying MAC bearers

Portable Part (DECT Portable Part) (PP): 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

NOTE 5: A DECT PP is logically divided into one PT plus one or more Portable Applications (PAs).

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 6: A PT only includes elements that are defined in the DECT CI standard. This includes radio transmission elements (layer 1) together with a selection of layer 2 and layer 3 elements.

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

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

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 for another DECT termination

NOTE 7: The DECT termination can be a PT or an FT or another WRS.

3.2 Abbreviations

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

AC	Authentication Code
ARI	Access Rights Identity
BMC	Broadcast Message Control
C/O	Connection Oriented mode
CK	Cipher Key
CN	Carrier Number
CRFP	Cordless Radio Fixed Part
DCK	Derived Cipher Key
DECT	Digital Enhanced Cordless Telecommunications
DLC	Data Link Control
FMID	Fixed part MAC Identity
FP	Fixed Part
FT	Fixed radio Termination
GAP	Generic Access Profile
IPUI	International Portable User Identity
IWU	Inter Working Unit
KSG	Key Stream Generator
LLME	Lower Layer Management Entity
LSB	Least Significant Bit
MAC	Medium Access Control
MBC	Multi Bearer Control
MMI	Man Machine Interface
NWK	Network
OA&M	Operation, Administration and Maintenance
PA	Portable Application
PARI	Primary Access Rights Identity
PARK	Portable Access Rights Key
PHY	Physical Layer
PMID	Portable part MAC Identity
PP	Portable Part
PT	Portable radio Termination
REP	Repeater Part
RFP	Radio Fixed Part
RFPI	Radio Fixed Part Identity
RMBC	Relay Multi Bearer Control
RPN	Radio fixed Part Number
RX	Receive
SAP	Service Access Point
SN	Slot pair Number
TBC	Traffic Bearer Control
TPUI	Temporary Portable User Identity
TX	Transmit
UAK	User Authentication Key
WRS	Wireless Relay station

4 Wireless Relay Station (WRS)

4.1 Introduction

A WRS is a physical grouping that contains both Fixed radio Termination (FT) and Portable radio Termination (PT) elements, and that transfers information between a Radio Fixed Part (RFP) and a Portable Part (PP). The FT element acts towards a PP exactly as an ordinary RFP. The PT element acts like a PP towards the RFP, and is locked to the closest RFP. The WRS contains interworking between its FT and its PT, including transparent transfer of the higher layer DECT services. WRS links may be cascaded.

Compared to an RFP, a WRS may introduce capacity restrictions to the services offered. The restrictions may increase with the number of cascaded WRS links (hops). Single WRS link applications can be generally applied. However, special precautions are needed when applying cascaded WRS links. The capacity may be too low, or there may be a need to adjust the echo control requirements.

A WRS shall comply with the general FT identities requirements for RFPs. Installing or adding a WRS to a DECT infrastructure is not possible outside the control of the system operator/installer/owner, who provides the required system identities, access rights and authentication/encryption keys.

The present document defines two different WRS concepts, the CRFP and the REP, which are detailed in clauses 5 and 6 respectively.

4.2 Description

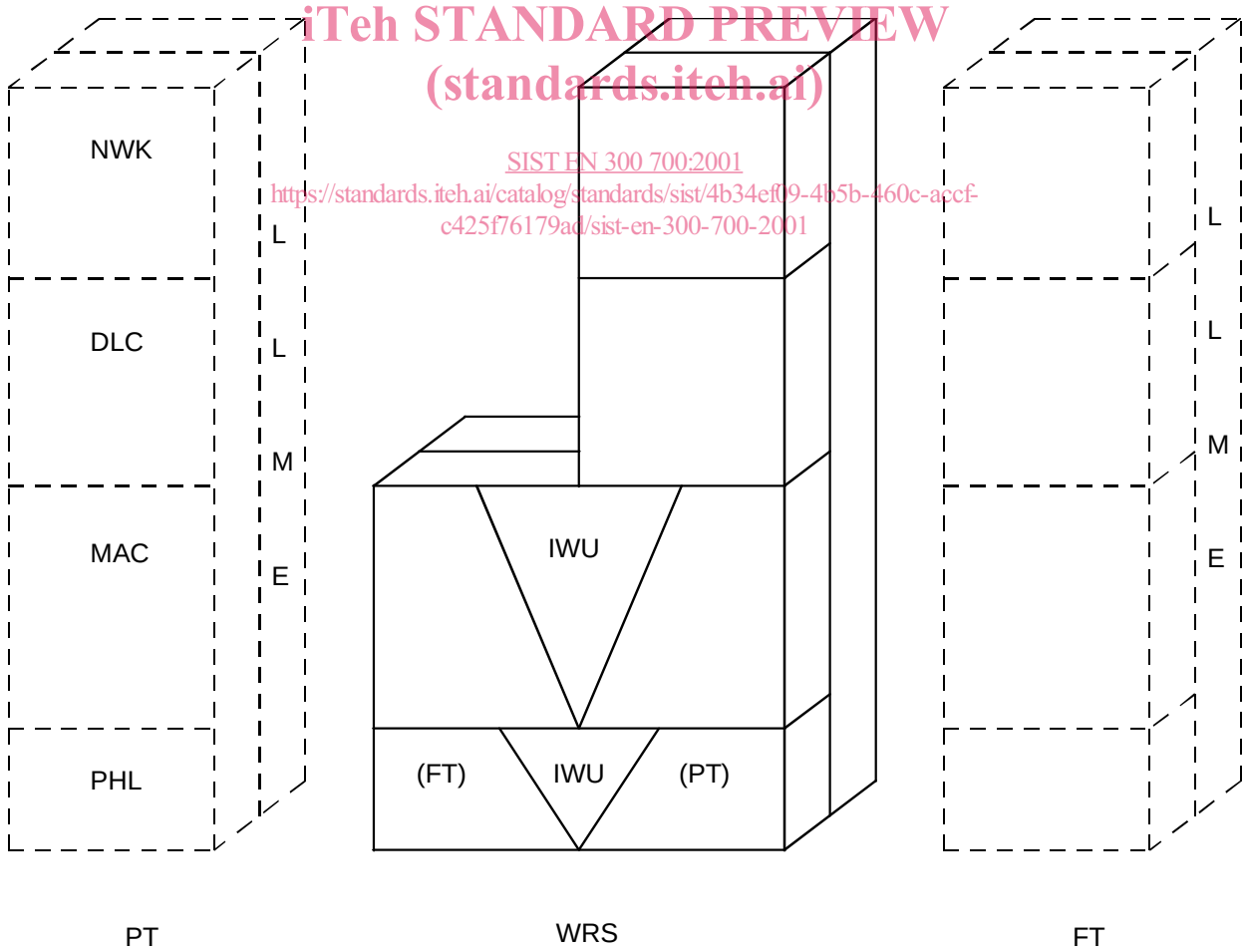

Figure 1: WRS reference model, Protocol stack model

The WRS, as shown in figure 1, provides interworking on the DECT air interface between a PT and an FT as described in EN 300 175, Parts 1 to 8, [1] to [8].

The PT may also be the PT side of a WRS in a multi-hop scenario.

The reference model of figure 1 establishes the following basic principles of the WRS:

- interworking with PTs as defined by EN 300 175, Parts 1 to 8, [1] to [8];
- interworking with FTs as defined by EN 300 175, Parts 1 to 8, [1] to [8], with additions defined in the present document;
- interworking between PT and FT side is provided at Medium Access Control (MAC) layer and Physical (PHY) layer;
- a logical grouping of PT and WRS operates as a PT;
- a logical grouping of FT and WRS operates as a FT.

Looking towards the PT the WRS is fully protocol transparent. The PT cannot distinguish the WRS from any other RFP within an FT. Therefore, the WRS puts no additional requirements on the PT.

4.2.1 PHY layer functions

The WRS shall fulfil the following PHY layer requirements:

- the WRS shall for the relevant packet type meet the PP requirements in EN 300 175-2 [2] when it is acting as a PP, and meet the RFP requirements in EN 300 175-2 [2] when it is acting as an RFP, except that the timing requirements in EN 300 175-2 [2], subclause 4.2.4 shall be met by all WRS transmissions and that the requirement in EN 300 175-2 [2], subclause 4.2.5 on difference between reference timers shall be disregarded;
- Z-field mapping as defined in EN 300 175-2 [2], subclause 4.8 shall be supported.

4.2.2 MAC layer functions

The WRS provides interworking at the MAC layer. The WRS incorporates PT and FT functions as defined in EN 300 175-3 [3].

The WRS shall fulfil the obligatory requirements of EN 300 175-3 [3], subclauses 11.4 and 11.6, with the modifications as defined in the present document.

4.2.3 DLC layer functions

The WRS may incorporate DLC layer PT functionality to support communication with the FT according to EN 300 175-4 [4].

4.2.4 NWK layer functions

The WRS may incorporate NWK layer PT functionality to support communication with the FT according to EN 300 175-5 [5].

4.2.4.1 Over-the-air maintenance

If Operation, Administration and Maintenance (OA&M) information transfer is supported, it may use the <<IWU-TO-IWU>> information element (see EN 300 175-5 [5], subclause 7.7.23) in NWK layer messages. This element can accommodate unstructured user specific data. For over the air maintenance, a link towards the WRS is created using the PP identity of the WRS.

4.2.5 Identities

The WRS shall have a specific Radio fixed Part Number (RPN) identity and Portable Access Rights Key (PARK). The RPN may be transferred by over-the-air maintenance procedures. For transferring the RPN to the WRS, the Fixed Identity information element with identity type "ARI + RPN for WRS" should be used.

The WRS may have additional specific PT identities when PT DLC and NWK layer functionality is included.

4.3 Services

The WRS may be used in all applications as defined in ETR 043 [9]. Typical WRS applications are presented in ETR 246 [10].

The WRS shall provide a relay service for MAC layer connection oriented, broadcast and connectionless services as defined in EN 300 175-3 [3], subclauses 5.6 and 5.7.

The WRS shall provide the services as given in table 1.

Table 1: WRS services

	Offered service	Support	Comment
S.1	Transparency between PT and FT	Yes	
S.2	MAC services	Yes	All, see EN 300 175-3 [3]
S.3	Over the air maintenance	Optional	
S.4	PT services (e.g. authentication)	Optional	As applicable for a certain application (e.g. based on a profile)

4.4 Procedures

4.4.1 PHY layer

The WRS shall conform to the PT and FT procedures as defined by EN 300 175-2 [2].

4.4.2 MAC layer

The WRS shall conform to the PT and FT procedures as defined by EN 300 175-3 [3].

4.4.2.1 Extended fixed part capabilities

The FP can control the hop configuration and indicate the admitted WRS scenarios by means of the extended fixed part capabilities message (see EN 300 175-3 [3]).

The extended fixed part capabilities message shall be sent by all WRSs at least once every 8 multiframes, and all WRSs shall understand this message. The WRS shall assume all WRS support bits being set to '0' when the FT does not transmit the message.

4.4.2.2 Hop control

The WRS that is locked to an FT shall decrease the value HOPS (when > 0) of the corresponding WRS type (CRFP or REP respectively; see clauses 5 and 6 in the received extended fixed part capabilities message (see EN 300 175-3 [3], subclause 7.2.3.5.2.1) for the transmission of its own extended fixed part capability information.

NOTE: The number of hops should be no more than one. Use of more than one hop may be subject to agreement with national radio authorities.

5 Cordless Radio Fixed Part (CRFP)

This clause defines requirements in addition to the general requirements for the WRS in clause 4.

5.1 Description

5.1.1 General

This description avoids defining specific implementations of the CRFP for a certain application. ETR 246 [10] clarifies the operation of the CRFP for typical applications. This description defines the architecture model of the CRFP and additional messages and procedures necessary to support the CRFPs in the DECT environment.

In this description the full slot frame multiplexing structure and IN_minimum_delay speech service are used for descriptive purposes only, and not to restrict the application of the CRFP to a specific slot structure or service.

5.1.2 Reference model

The reference model of figure 1 is applicable for the CRFP. The PT side of the CRFP is called CRFP_PT. The FT side of the CRFP is called CRFP_FT.

To support a CRFP, the following additional procedures are defined for the FT:

- MAC layer: access control of CRFP (for specific information transfer to CRFPs);
- NWK layer: Cipher Key (CK) transfer to CRFP.

The following functions are defined for the CRFP based on EN 300 175, Parts 1 to 8, [1] to [8]:

- FT and PT PHY and MAC layer to provide independent bearer control to PTs and FT;
- a selection of PT DLC and NWK layer to support communication between CRFP and FT.

The following additional functions and procedures are defined for the CRFP:

- IWU at MAC and PHY layer to provide interworking between CRFP_PT and CRFP_FT;
- access control procedures to support both relay and local handling of data on the same bearer;
- CK uploading and initialization for CRFP_FT MAC.

5.1.3 MAC layer functions

5.1.3.1 General

The basic function of the CRFP is defined by its frame multiplexing structure. Procedures are defined based on this structure to allow the CRFP to support required services.