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Digital Enhanced Cordless Telecommunications (DECT); DECT-2020 New Radio (NR) interface; Study on MAC and higher layers

Reference

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Digital Enhanced Cordless Telecommunications (DECT).

The present document presents a study of a new radio interface named DECT-2020. DECT-2020 is a state of the art radio interface based on OFDM with options for MIMO and is intended as long-term evolution of DECT technology.

The present document is focused on the MAC and higher layers.

The technical content in the present document has been compiled from numerous contributions by members of TC DECT and ad-hoc working groups. The structure of the document sometimes reflects this ad-hoc nature.

Modal verbs terminology

In the present document "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Introduction

The current DECT radio interface was designed in the early 1990's and is based on TDMA/TDD with Gaussian Frequency Shift Keying (GFSK) modulation. Although this interface is able to provide a cost-effective solution for cordless telephony applications with an appropriate reuse of the spectrum, it cannot provide the high data rates and bandwidth efficiency required by most modern evolution scenarios. In addition, promising applications such as Audio-Streaming and Wireless Industrial Automation in Internet of Things (IoT) domain introduces Ultra Reliability and Low Latency requirements that have to be taken into account in any technology evolution.

IMT-2000 is the term used by the International Telecommunications Union (ITU) for a set of globally harmonised standards for third generation (3G) mobile telecoms services and equipment. 3G services are designed to offer broadband cellular access at speeds of 2 Mbps, which will allow mobile multimedia services to become possible.

DECT is, and will continue to be, one of the IMT-2000 technologies. However, the ITU work continued, first with IMT-Advanced, and it is now going further with IMT-2020. The term IMT-2020 was coined in 2012 by the ITU and means International Mobile Telecommunication system with a target date set for 2020, with the intention of addressing fifth generation (5G) mobile telecoms services and equipment.

The ETSI DECT Technical Committee and the industry body DECT Forum are currently supporting activities to develop DECT to meet the IMT-2020 requirements. This will require major changes to the existing DECT standards, and specifically to the MAC and PHL layers.

The present document contains the outcome of a series of initial technical studies focused on the MAC and higher layers of DECT-2020: New Radio Interface (NR). DECT-2020 NR is a state of the art radio interface based on OFDM and supporting MIMO and is able to offer the required data rates, spectrum efficiency and other characteristics to become an IMT-2020 radio interface as defined by ITU-R.

The PHY layer study of DECT-2020 is described in ETSI TR 103 514 [i.26].

The present document does not attempt to close the topic and subsequent, more detailed studies, on the different layers are expected in further project stages.

The material described in the present document contains the outcome of STF 564, an ETSI task force created to perform the initial studies on the field, along with other contributions from the DECT industry.

1 Scope

The present document contains the outcome of a series of initial technical studies focused on the MAC and higher layers of DECT-2020: New Radio Interface (NR). DECT-2020 NR is a state of the art radio interface based on OFDM and supporting MIMO and is able to offer the required data rates, spectrum efficiency and other characteristics to become an IMT-2020 radio interface as defined by ITU-R.

The PHY layer study of DECT-2020 is described in ETSI TR 103 514 [i.26].

The present document does not attempt to close the topic and subsequently, more detailed studies, on the different layers are expected in further project stages.

The material described in the present document contains the outcome of STF 564, an ETSI task force created to perform the initial studies on the field, along with other contributions from the DECT industry.

For the purpose of the present document the terms "DECT-2020", "DECT-2020 New Radio" or "DECT-2020 NR" all have the same meaning, and all of them refer to DECT utilizing the new radio interface based on OFDM as described in ETSI TR 103 514 [i.26] (PHY layer) and in the present document (MAC and higher layers). This new radio interface is targeted to meet the IMT-2020 requirements.

The terms FP-2020 or PP-2020 refer to FP and PP (respectively) devices supporting DECT-2020.

The present document is motivated by recent efforts to identify new ways of utilizing efficiently DECT frequency bands and potentially additional bands. New modes of operation are defined to target a more diverse set of use cases, while addressing 5G requirements for low latency, high spectral efficiency and large numbers of client nodes.

2 References

2.1 Normative references

Normative references are not applicable in the present document.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

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

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

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

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

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

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

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

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

[i.9] ETSI TS 102 939-1: "Digital Enhanced Cordless Telecommunications (DECT); Ultra Low Energy (ULE); Machine to Machine Communications; Part 1: Home Automation Network (phase 1)".

[i.10] ETSI TS 102 939-2: "Digital Enhanced Cordless Telecommunications (DECT); Ultra Low Energy (ULE); Machine to Machine Communications; Part 2: Home Automation Network (phase 2)".

[i.11] ITU-R Recommendation M.2410-0: "Minimum requirements related to technical performance for IMT-2020 radio interface(s)".

[i.12] ETSI TR 103 515: "Digital Enhanced Cordless Telecommunications (DECT); Study on URLLC use cases of vertical industries for DECT evolution and DECT-2020".

[i.13] ITU-R Recommendation M.2412-0: "Guidelines for evaluation of radio interface technologies for IMT-2020".

[i.14] ITU Radiocommunication Study Groups; Working Party 5D; Attachment 7.4 to Document 5D/758; Liaison Statement to External Organizations; Further information related to draft new Report for IMT-2020 evaluation.

[i.15] Guidelines for evaluation of radio interface technologies for IMT-2020, ITU, Revision 2 to Document 5D/TEMP/347-E, 20 June 2017.

[i.16] IEEE Transactions on Communications: "Robust Frequency and Timing Synchronization for OFDM"; Timothy M. Schmidl and Donald C. Cox, Vol. 45, No. 12, December 1997, pp 1613-1621.

[i.17] ETSI TS 136 211 (V10.7.0): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation (3GPP TS 36.211 version 10.7.0 Release 10)".

[i.18] 3GPP TS 38.211 (V1.0.0) (2017-09): "NR; Physical channels and modulation".

[i.19] IEEE P802.11ah™/D10.0, Part 11: "Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications, Amendment 2: Sub 1 GHz License Exempt Operation", September 2016.

[i.20] IEEE 802.11ac™-2013, Part 11: "Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications, Amendment 4: Enhancements for Very High Throughput for Operation in Bands below 6 GHz".

[i.21] IEEE P802.11ax™/D1.4, Part 11: "Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications, Amendment 6: Enhancements for High Efficiency WLAN", August 2017.

[i.22] IEEE 802.11-03™/940r4: "TGn Channel Models", May 2004.

[i.23] ETSI TS 136 212 (V10.9.0): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding (3GPP TS 36.212 version 10.9.0 Release 10)".

[i.24] 3GPP TS 38.212 (V1.0.0) (2017-09): "NR; Multiplexing and channel coding".

[i.25] IEEE 802.15-04-0585-00-004b: "Multipath Simulation Models for Sub-GHz PHY Evaluation", October 2004.

[i.26] ETSI TR 103 514: "Digital Enhanced Cordless Telecommunications (DECT); DECT-2020 New Radio (NR) interface; Study on Physical (PHY) layer".

[i.27] ETSI TR 103 669: "Digital Enhanced Cordless Telecommunications (DECT); DECT-2020 New Radio (NR) interface; Study of self evaluation towards IMT-2020 submission".

[i.28] ETSI TR 103 637: "Digital Enhanced Cordless Telecommunications (DECT); DECT-2020 New Radio (NR) interface; Study on Security Architecture".

[i.29] METIS Channel Models, Deliverable D1.4, Document Number: ICT-317669-METIS/D1.4.

[i.30] ETSI EN 301 908-10: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS), Repeaters and User Equipment (UE) for IMT-2000 Third-Generation cellular networks; Part 10: Harmonised Standard for IMT-2000, FDMA/TDMA (DECT) covering the essential requirements of article 3.2 of the Directive 2014/53/EU".

[i.31] ETSI TS 102 527-1: "Digital Enhanced Cordless Telecommunications (DECT); New Generation DECT; part 1: Wideband Speech".

[i.32] ETSI TS 102 527-3: "Digital Enhanced Cordless Telecommunications (DECT); New Generation DECT; part 3: Extended Wideband Speech Services".

[i.33] ETSI TS 102 527-5: "Digital Enhanced Cordless Telecommunications (DECT); New Generation DECT; Part 5: Additional feature set nr. 1 for extended wideband speech services".

[i.34] IEEE 802.11: "Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI EN 300 175-1 [i.1] and the following apply:

beacon bearer packet types: packet formats intended for use in beacon bearers and C/L downlink bearers

NOTE: They include synchronization fields and do not need to support MIMO.

burst: concatenation of an I or O packet immediately followed by one or several C packets or, alternatively, an L or S packet

burst train: concatenation of several bursts transmitted over the same carrier or carriers separated by blank spaces of duration no longer than a given value (N_{MAXO}) and usually introduced for listening for responses from the opposite peer or to allow the transmission of other traffics

"HE" packet types: packet formats intended for continuous data transmission over several frames

NOTE: They may support circuit-mode traffic, URLLC traffic as well as packet mode traffic, and may implement MIMO.

"Legacy" DECT: current DECT technology as defined by ETSI EN 300 175 parts 1 [i.1] to 8 [i.8]

packet-mode: asynchronous unscheduled data transmission

RAC packet types: packet types formats intended for use in Random Access Channels (RAC)

NOTE: They may be used for initially accessing a channel, carry only C-plane traffic, and do not need to support MIMO.

RAC traffic: asynchronous unscheduled data traffic consisting on signalling only

slotxcarrier: basic resource block consisting on a single carrier (1,728 MHz) over a full slot