



TECHNICAL REPORT

**Digital Enhanced Cordless Telecommunications (DECT);
DECT evolution technical study;
Requirements and technical analysis for the further evolution
of DECT and DECT ULE**

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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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Contents

Intellectual Property Rights	7
Foreword.....	7
Modal verbs terminology.....	7
Executive summary	7
1 Scope	8
2 References	8
2.1 Normative references	8
2.2 Informative references.....	8
3 Definitions, symbols and abbreviations	10
3.1 Definitions.....	10
3.2 Symbols and abbreviations.....	11
4 Overview	13
4.1 Scope of the present document.....	13
4.2 List of technical studies covered by the present document	14
5 Low Latency Machine-to-Machine communications.....	14
5.1 Low Latency ULE.....	14
5.2 Design objectives	15
5.3 Physical layer, spectrum and implementation considerations	15
5.4 Basic principles of the solution	15
5.4.1 Modulation.....	15
5.4.2 No scan sequence limitations in RFP.....	15
5.4.3 Absolute fast setup capability in PPs	16
5.4.4 Slot type	16
5.4.5 No limitations on slot direction in the frame	16
5.4.6 Basic decision: connection-oriented vs. connection-less bearers.....	16
5.4.7 Basic decision: mixed MAC C/L / C/O approach.....	17
5.4.7.1 Proposal of mixed C/L / C/O approach.....	17
5.4.7.2 Q1/Q2 bit reporting.....	17
5.4.8 U-plane model: MAC, DLC and NWK	17
5.4.9 C-plane NWK layer and security.....	17
5.4.10 Possible MAC messages.....	17
5.4.11 Channel selection.....	18
5.4.12 Example of sequence 1: short burst transmission PT => FT	18
5.4.13 Further considerations for short burst transmissions	20
5.4.13.1 Error cases.....	20
5.4.13.2 Effect of the dummy bearer.....	21
5.4.13.3 Solutions to the dummy bearer issue.....	22
5.4.14 Example of sequence 2: multi burst transmission PT => FT	23
6 Ultra Reliable Low Latency circuit mode C/O streaming applications.....	24
6.1 Overview	24
6.2 Investigation of the possibilities of current DECT technology	24
6.2.1 General.....	24
6.2.2 Latency in single-bearer DECT transmissions.....	25
6.2.3 Latency in multi-bearer (symmetric) DECT transmissions	25
6.2.4 Introducing flexibility in slot positions.....	25
6.2.5 Latency in multi-bearer (asymmetric) DECT transmissions.....	26
6.2.6 Sampling references for PCM-like and other codecs and impact on the delay.....	26
6.2.7 Examples	28
6.2.8 Data rates and data rate considerations	30
6.2.8.1 Using full slots	30
6.2.8.2 Reference values for audio applications.....	30
6.2.8.3 Using double slots.....	30

6.3	Further improvements to DECT technology	31
6.3.1	General.....	31
6.3.2	Use of A-field space in double-simplex slots	31
6.3.3	Use of A-field preamble and Z-field space in double-simplex slots.....	31
6.3.4	Use of bits from the inter-slot space	32
6.3.5	Introduction of 256 QAM.....	32
6.3.6	Sliding collision detection	33
6.3.7	Mixing full and double slots	33
6.3.8	Optimized slot structures	34
7	Ultra Reliable Low Latency multicast multi-bearer streaming applications.....	34
7.1	Overview	34
7.2	Basic principles	34
7.3	Possible configurations.....	35
7.3.1	General.....	35
7.3.2	Comments to the configuration's table.....	36
7.3.3	Remarks on the dummy	36
7.3.4	The traffic bearers.....	37
7.3.5	Notes on the synchronization approach	37
7.3.6	Notes on the inter-slot space	37
7.3.7	Notes on sliding collision detection.....	38
7.4	Available bitrates.....	38
7.4.1	Available bitrates possible with the proposed configurations (1 + 1 redundancy not considered yet)	38
7.5	Delay	38
7.5.1	Delay calculation	38
7.5.2	Codec cases and influence in delay.....	39
7.5.2.1	General	39
7.5.2.2	Detailed explanation of the codec impact on the delay.....	39
7.5.3	Introducing slot tolerance	41
7.6	Redundancy.....	42
7.6.1	General.....	42
7.6.2	Frequency redundancy	42
7.6.3	Space redundancy (antenna diversity) and adaptive equalization.....	42
7.6.4	Original proposal on "optimized" use of frequency diversity in high performance systems	43
7.6.5	Redundancy in the dummy or C/L bearer	43
7.6.5.1	Redundancy in the dummy or C/L bearer	43
7.6.5.2	Original idea.....	43
7.7	Case example.....	43
7.8	Quality control: a problem approximation	44
7.8.1	General.....	44
7.8.2	Analysis of the problem.....	44
7.8.2.1	Basic overview	44
7.8.2.2	The handover problem	44
7.8.2.3	The scan problem.....	45
7.8.3	Possible solution paths.....	45
7.8.3.1	General	45
7.8.3.2	Solutions based on slot tolerance	45
7.8.3.3	Solutions based on collecting feedback from the PP.....	45
7.8.3.3.1	General	45
7.8.3.3.2	Proposed uplink transmission mechanism.....	45
7.8.3.3.3	Impact on the downlink C-plane channel	46
7.8.3.3.4	Information to be transmitted uplink	46
7.9	Authentication, subscription and security	46
7.10	Way forward / for further study.....	47
8	High Level Modulation	48
8.1	General	48
8.2	Overview of current DECT standard.....	48
8.2.1	Features already defined in DECT standard	48
8.2.2	Features missing in DECT standard (general and packet mode transmission)	49
8.2.3	Features missing in DECT standard for constant-bit rate low latency applications.....	49
8.2.4	Analysis of some limitations in current standard.....	50

8.2.5	Some identified possible solutions (list not exhaustive).....	50
8.2.5.1	General.....	50
8.2.5.2	Proposal of improvements for no encoded protected modes.....	51
8.2.5.3	Proposal of improvements for encoded protected modes.....	52
8.2.5.3.1	Analysis.....	52
8.2.5.3.2	Pros and cons of ARQ schemas.....	55
8.2.5.4	Other improvements.....	56
8.2.5.4.1	Increasing of the modulation to 256 QAM.....	56
9	Long term evolution of DECT.....	56
9.1	DECT OFDM evolution.....	56
9.1.1	Overview and technology positioning.....	56
9.1.1.1	Basic principles.....	56
9.1.1.2	Target application and scenarios.....	57
9.1.1.3	Comparison with other technologies.....	57
9.1.1.3.1	Comparison with Wi-Fi.....	57
9.1.1.3.2	Differences with LTE and WiMAX.....	57
9.1.2	Basic specifications.....	58
9.1.3	Proposals for the physical layer.....	58
9.2	The 37,5 kHz subcarrier spacing proposal.....	59
9.2.1	Overview.....	59
9.2.2	Basic parameters for the frequency structure.....	59
9.2.3	Channelization and matching with current DECT 1,728 MHz channels.....	60
9.2.4	37,5 kHz proposal basic parameters.....	60
9.2.5	Slot Time Structure.....	61
9.2.5.1	Structure of single and multi-slot blocks.....	61
9.2.5.2	Inter-slot guard space.....	61
9.2.6	Control plane multiplexing (signalling).....	62
9.2.6.1	General.....	62
9.2.6.2	Possible C-plane multiplexing based on A-field / B-field mux schema.....	62
9.2.6.3	Capacity of the B-field.....	62
9.2.7	Frequency and mask considerations for back-compatibility with DECT "classic".....	63
9.2.8	Further improvements in the 37,5 kHz approach.....	64
9.2.8.0	General.....	64
9.2.8.1	Use of half-carrier channels.....	64
9.2.8.2	Use of half-slots.....	65
9.2.8.3	Figures if both improvements are implemented (half-carriers and half-slots).....	65
9.2.8.3.1	A-field signalling capacity (half carrier options).....	65
9.2.8.3.2	B-field data rates (half-carriers and half-slot).....	65
9.2.8.4	Use of SC-FDMA in the uplink.....	66
9.3	Other subcarrier spacings and comparative analysis.....	66
9.3.1	Overview of results on other subcarrier spacings.....	66
9.3.2	The 54 kHz proposal.....	67
9.3.2.1	54 kHz proposal basic parameters.....	67
9.3.3	Comparative analysis.....	67
9.3.3.1	Identification of key points for the analysis.....	67
9.3.3.2	Comparative analysis between 37,5 kHz and 54 kHz proposals.....	68
9.3.3.2.1	Overview.....	68
9.3.3.2.2	Analysis.....	68
9.3.3.2.3	Summary of the analysis.....	72
9.3.3.2.4	Conclusion.....	72
9.3.4	The 27 kHz proposal.....	72
9.3.5	Other identified options.....	74
9.3.6	For further study.....	75
10	Implementation of the IETF RFC 8105 (IPv6 over DECT ULE).....	75
10.1	Introduction.....	75
10.2	Overview of IETF RFC 8105.....	75
10.2.1	Introduction.....	75
10.2.2	IETF RFC 8105 protocol stack model.....	76
10.2.3	Data transmission setup.....	76
10.2.4	IETF RFC 8105 addressing model.....	77

10.2.5	Stateless Address Auto-configuration.....	77
10.2.6	Header Compression.....	78
10.2.7	Security Considerations	78
10.3	Impact and recommendations on DECT standardization	78
10.3.1	Regarding addressing.....	78
10.3.2	Regarding energy handling and initial configuration matters	78
11	Further topics for DECT evolution	79
11.1	Introduction	79
11.2	Redundant data transmission.....	79
11.3	FEC	80
11.4	Lower symbol rate.....	80
11.5	Coherent modulation and demodulation.....	81
11.6	Connectionless services.....	81
11.7	Lower energy consumption	81
11.8	Other topics and ideas	81
Annex A:	Background and additional information	83
A.1	Carrier frequencies for OFDMA 37,5 kHz option	83
History	84

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Full standard:
<https://standards.iteh.ai/catalog/standards/sist/95062483-56ee-407e-b79f-ae60e39d7cbe/etsi-tr-103-422-v1.1.1-2017-06>

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Foreword

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

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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Executive summary

The present document contains the outcome of a series of studies identified by ETSI TC DECT and required for the short and mid-term evolution of DECT and ULE technologies. The present document is primary addressed to TC DECT and DECT industry communities and, as well, to other participants from new industry sectors that may be considering using DECT technology for new applications.

1 Scope

The present document describes the outcome of a series of studies identified by ETSI TC DECT and required for the short and mid-term evolution of DECT and ULE technologies. The outcome of the present document will be used for planning the further evolution of technology and the immediate technology roadmap during the next years.

The outcome of the present document will allow addressing new applications and markets for ULE and DECT technologies in the mid-term, and will contribute to the ETSI effort on Internet of Things (IoT).

It is not the scope of the present document the description of DECT and ULE technologies. The core part of the DECT technology is described in the DECT common interface standard (ETSI EN 300 175) [i.1] to [i.8] plus a series of profiles, such as the GAP [i.9], DPRS [i.12], WRS [i.10] or New Generation DECT [i.14] to [i.18]. Further regulatory details of the Radio interface are given in ETSI EN 301 406 [i.24], ETSI EN 301 908-10 [i.37] and ETSI EN 300 176-1 [i.11]. A summary overview of DECT technology can be found in ETSI EN 300 175-1 [i.1].

The ULE technology is described in ETSI TS 102 939 series [i.19] and [i.20].

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 EN 300 444: "Digital Enhanced Cordless Telecommunications (DECT); Generic Access Profile (GAP)".
- [i.10] ETSI EN 300 700: "Digital Enhanced Cordless Telecommunications (DECT); Wireless Relay Station (WRS)".
- [i.11] ETSI EN 300 176-1: "Digital Enhanced Cordless Telecommunications (DECT); Test specification; part 1: radio".
- [i.12] ETSI EN 301 649: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS)".
- [i.13] IETF RFC 8105: "Transmission of IPv6 Packets over Digital Enhanced Cordless Telecommunications (DECT) Ultra Low Energy (ULE)".
- [i.14] ETSI TS 102 527-1: "Digital Enhanced Cordless Telecommunications (DECT); New Generation DECT; Part 1: Wideband Speech".
- [i.15] ETSI TS 102 527-2: "Digital Enhanced Cordless Telecommunications (DECT); New Generation DECT; Part 2: Support of transparent IP packet data".
- [i.16] ETSI TS 102 527-3: "Digital Enhanced Cordless Telecommunications (DECT); New Generation DECT; Part 3: Extended wideband speech services".
- [i.17] ETSI TS 102 527-4: "Digital Enhanced Cordless Telecommunications (DECT); New Generation DECT; Part 4: Light Data Services; Software Update Over The Air (SUOTA), content downloading and HTTP based applications".
- [i.18] 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.19] 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.20] 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.21] IEEE 802.11-2012™: "IEEE 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".
- [i.22] IEEE 802.16-2012™: "IEEE Standard for Information technology--Broadband Wireless Metropolitan Area Networks (MANs)--IEEE Standard for Air Interface for Broadband Wireless Access Systems".
- [i.23] ARIB STD T-95: "OFDMA/TDMA TDD Broadband Wireless Access System (XGP)".
- [i.24] ETSI EN 301 406: "Digital Enhanced Cordless Telecommunications (DECT); Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU".
- [i.25] ETSI TS 136 300: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2 (3GPP TS 36.300)".
- [i.26] IETF RFC 4291: "IP Version 6 Addressing Architecture".
- [i.27] IETF RFC 4861: "Neighbor Discovery for IP version 6 (IPv6)".
- [i.28] IETF RFC 4862: "IPv6 Stateless Address Autoconfiguration".
- [i.29] IETF RFC 4944: "Transmission of IPv6 Packets over IEEE 802.15.4 Networks".
- [i.30] IETF RFC 6282: "Compression Format for IPv6 Datagrams over IEEE 802.15.4-Based Networks".

- [i.31] IETF RFC 6775: "Neighbor Discovery Optimization for IPv6 over Low-Power Wireless Personal Area Networks (6LoWPANs)".
- [i.32] IETF RFC 7136: "Significance of IPv6 Interface Identifiers".
- [i.33] IETF RFC 3610: "Counter with CBC-MAC (CCM)".
- [i.34] IETF RFC 4903: "Multi-Link Subnet Issues".
- [i.35] IETF RFC 8065: "Privacy Considerations for IPv6 Adaptation- Layer Mechanisms".
- [i.36] IETF RFC 3315: "Dynamic Host Configuration Protocol for IPv6 (DHCPv6)".
- [i.37] 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.38] IEEE 802.15.4™: "IEEE Standard for Local and metropolitan area networks -- Part 15.4: Low-Rate Wireless Personal Area Networks (LR-WPANs)".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

algorithm: mathematical process or function that transforms an input into an output

antenna diversity: diversity implies that the Radio Fixed Part (RFP) for each bearer independently can select different antenna properties such as gain, polarization, coverage patterns and other features that may affect the practical coverage

NOTE: A typical example is space diversity, provided by two vertically polarized antennas separated by 10 cm to 20 cm.

expedited (messages, procedures, operations): MAC C/O operations (messages, procedures, operations) intended for ultra-fast setup and release of bearers, allowing in most cases reduction in the number of messages and early or late U-plane transmission compared to regular procedures

expedited connections: advanced connections able to use the expedited messages of the advanced connection control part 2 set and their associate procedures for bearer setup and release

eXtended Global Platform: wireless technology deployed mostly in Japan using the micro-cell and TDD/OFDMA/SC-FDM technology

guard space: nominal interval between the end of a radio transmission in a given slot and the start of a radio transmission in the next successive slot

half slot: one 48th of a TDMA frame which is used to support one physical channel

Home Automation Network: network that connects all sensors and actors in a house or apartment, providing interoperability for devices of different vendors and typically has a connection to the Internet

NOTE: The Home Automation Network is used for various applications, from Home Automation and Security to Climate Control and Energy Management.

3.2 Symbols and abbreviations

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

6CO	6LoWPAN Context Option
6LBR	6LoWPAN Border Router
6LN	6LoWPAN Node
6LoWPAN	IPv6 over Low power Wireless Personal Area Networks
ACK	(positive) ACKnowledgement
ADPCM	Adaptive Differential Pulse Code Modulation
AES	Advanced Encryption Standard
ARIB	Association of Radio Industries and Businesses (Japan)
ARO	Address Registration Option
ARQ	Automatic Repeat reQuest (also Automatic Repeat Query)
BER	Bit Error Ratio
BPSK	Binary Phase Shift Keying
B _S	Slow Broadcast channel
C	higher layer control Channel (see C _S and C _F)
C/L	ConnectionLess mode
C/O	Connection Oriented mode
CBC	Connectionless Bearer Control
CBC-MAC	Cipher Block Chaining Message Authentication Code
CCM	Counter with CBC-MAC
CGA	Cryptographically Generated Address
CI	Cell Identity
CI	Common Interface (standard)
CODEC	COder-DECoder
CP	Cyclic Prefix (OFDM)
C-plane	Control plane
CRC	Cyclic Redundancy Check
DBPSK	Differential Binary Phase Shift Keying
DC	Direct Current
DECT	Digital Enhanced Cordless Telecommunications
DES	Data Encryption Standard
DFT	Discrete Fourier Transform
DHCPv6	Dynamic Host Configuration Protocol for IPv6
DLC	Data Link Control Layer
DPRS	DECT Packet Radio Service

NOTE: See ETSI EN 301 649 [i.12].

DQPSK	Differential Quaternary Phase Shift Keying
DSAA2	DECT Standard Authentication Algorithm #2
DSC	DECT Standard Cipher (algorithm)
DSC2	DECT Standard Cipher #2 (algorithm)
DSP	Digital Signal Processing
DSSS	Direct Sequence Spread Spectrum
E type	B-field multiplexer mode when the slot carries signalling only (channels C _F , G _F and M)
E+U type	B-field multiplexer mode when the slot carries U-plane data (channel I _{PF}) AND signalling (channels G _F and M)
FDD	Frequency Division Duplex
FDMA	Frequency Division Multiple Access
FEC	Forward Error Correction
FFT	Fast Fourier Transform
FMID	Fixed part MAC IDentity
FP	DECT Fixed Part
FT	Fixed radio Termination
GAP	Generic Access Profile
G _{FA}	higher layer information control channel (slow) (a logical channel to the MAC layer)
GFSK	Gaussian Frequency Shift Keying
GI	Guard Interval (OFDM)

GMSK	Gaussian Minimum Shift Keying
GSM	Global System for Mobile communications
HBA	Hash-Based Address
HLM	High Level Modulation
HSDPA	High Speed Downlink Packet Access
HTTP	Hypertext Transfer Protocol
I	higher layer Information channel (see I_N and I_P) in general
IE	Information Element
IID	Interface Identifier (IPv6)
IID	Internet IDentity
I_N	higher layer Information channel unprotected (in general, any variant)
I_{NX}	A possible new name for the I_{PX} service
I_P	higher layer Information channel protected (in general, any variant)
IP	Internet Protocol
IPEI	International Portable Equipment Identity
I_{PQ}	higher layer Information channel (protected) with single subfield format
IPv6	Internet Protocol Version 6
I_{PX}	higher layer Information channel, encoded protected, minimum delay operation
IV	Initialization Vector
IWU	InterWorking Unit
LA	Location Area
LAN	Local Area Network
LL-ULE	Low Latency ULE
LO	Local Oscillator
LS	Least Squares (channel estimation)
M	MAC control channel in general (on A-tail or B fields)
MAC (CCM)	Message Authentication Code
MAC	Medium Access Control layer
MAP	bit MAPpings
MBC	Multi-Bearer Control
MCS	Multi-Channel Set
ME	Management Entity
MIMO	Multiple Input Multiple Output
MM	Mobility Management
MMSE	Minimum Mean-Square Error (channel estimation)
MTU	Maximum Transmission Unit
MUX	time MULtipleXor
N	identities channel
NBMA	Non-Broadcast Multi-Access
N_{FFT}	FFT size
NG-PHS	Next Generation PHS
NLOS	No Line Of Sight
NR	Normal-Reverse
N_S	Split identities channel on B-field for ULE
N_T	identities information channel or one message in such channel
NWK	NetWorK layer
OFDM	Orthogonal Frequency Division Multiplex
OFDMA	Orthogonal Frequency Division Multiple Access
P	Paging channel
PAPR	Peak-to-Average Power Ratio
PBX	Private Branch eXchange
PCM	Pulse Code Modulation
PDU	Protocol Data Unit
PHL	PHysical Layer
PHS	Personal Handyphone System
PHY	PHYsical
PMID	Portable part MAC IDentity (MAC layer)
PP	DECT Portable Part
PSK	Phase Shift Keying
PT	Portable radio Termination

PVC	Permanent Virtual Circuit
Q	system information channel
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
RFP	Radio Fixed Part
RFPI	Radio Fixed Part Identity
RX	Receiver
SC-FDM	Single Carrier Frequency Division Multiplexing
SC-FDMA	Single Carrier Frequency Division Multiple Access
STD	Standard
STF	Special Task Force
SUOTA	Software Update Over The Air
TBC	Traffic Bearer Control
TCP	Transmission Control Protocol
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
T_{FFT}	Transform period (FFT)
T_{SYM}	Symbol interval
U type	B-field multiplexer mode when the slot carries U-plane data only (channels I_N or I_P)
UDP	User Datagram Protocol
UEAR	Ultra-expedited_access_request (ULE)
UEARR	Ultra-expedited_access_request_ready_for_release (ULE)
UEBC	Ultra-expedited_continuation_of_transmission (ULE)
UER	Ultra-expedited_release (ULE)
UERR	Ultra-expedited ready for release (ULE)
ULE	Ultra Low Energy
UMTS	Universal Mobile Telecommunication System
U-plane	User plane
URLLC	Ultra Reliable Low Latency Communications
UTRAN	UMTS Terrestrial Radio Access Network
Wi-Fi	IEEE 802.11 [i.21] family of standards
WiMAX	IEEE 802.16 [i.22] family of standards
WLL	Wireless Local loop
WRS	Wireless Relay Station
XGP	eXtended Global Platform
XOR	eXclusive OR

4 Overview

4.1 Scope of the present document

The present document contains a list of technical studies required for the short term, mid-term and long term evolution of DECT technology. The selection of studies was chosen by TC DECT in years 2016 and beginning of 2017 as response to several technology and industry needs.

The outcome of the present document will be used for planning the further evolution of technology and the immediate technology roadmap during the next years.

The studies covered by the present document address four main technical and business areas:

- DECT ULE (Ultra Low Energy) variants with High Reliability and Low Latency intended primarily for industry automation scenarios.
- Ultra-Reliable Low Latency Communications (URLLC) high bit rate multibearer solutions intended primarily for the professional audio industry.
- Introduction to the long term evolution of DECT based on OFDM.