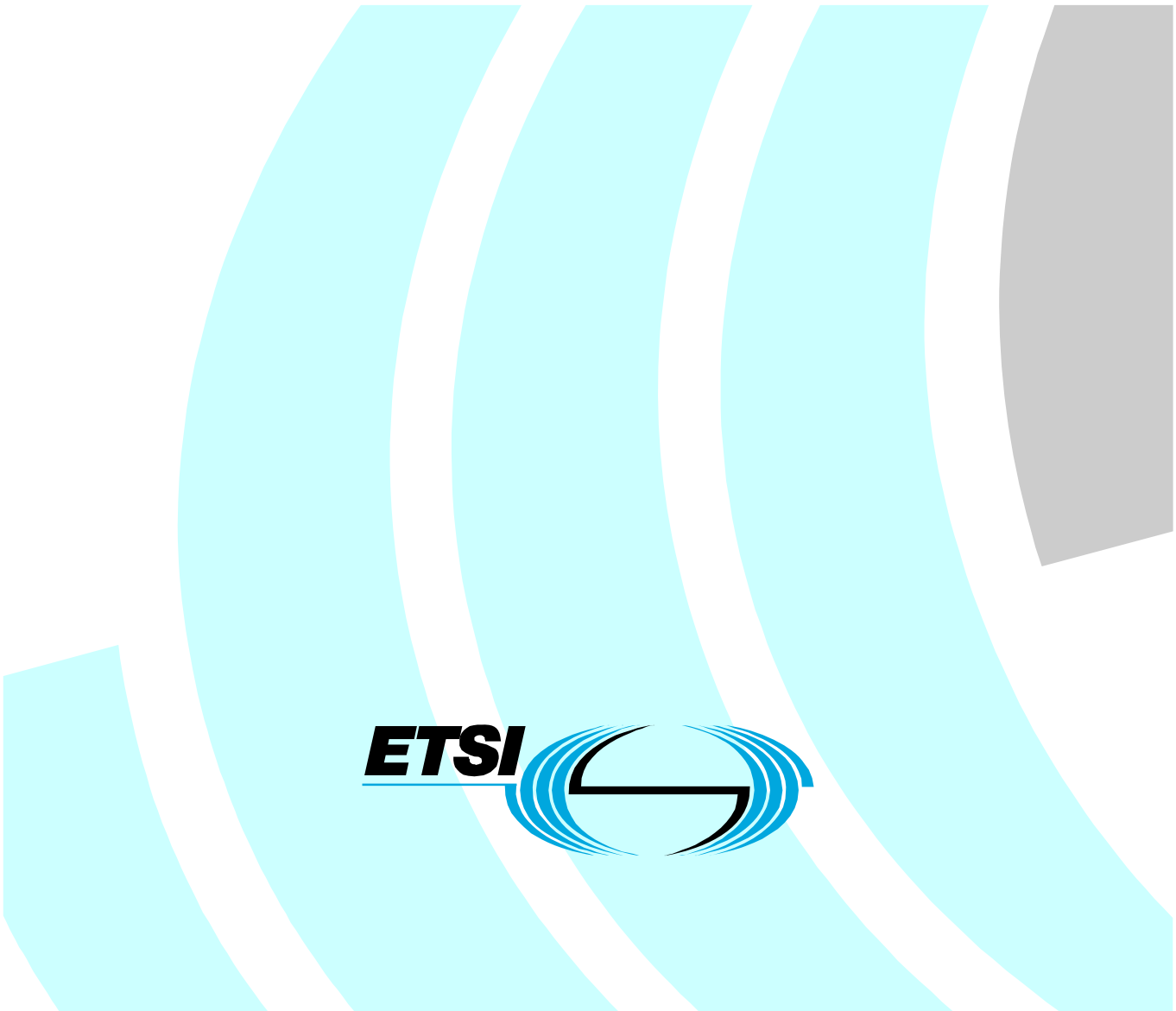
ETSI TS 102 527-1 V1.2.1 (2008-06)

Technical Specification

Digital Enhanced Cordless Telecommunications (DECT); New Generation DECT; Part 1: Wideband speech



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Contents

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Foreword

This Technical Specification (TS) has been produced by ETSI Project Digital Enhanced Cordless Telecommunications (DECT).

The present document is based on EN 300 175 parts 1 [1] to 8 [8] and EN 300 444 [12]. General attachment requirements and speech attachment requirements are based on EN 301 406 [11] (replacing TBR 006 [i.2]) and EN 300 176-2 [10] (previously covered by TBR 010 [i.3]). Further details of the DECT system may be found in TR 101 178 [i.1].

The present document has been developed in accordance to the rules of documenting a profile specification as described in ISO/IEC 9646-6 [13].

The information in the present document is believed to be correct at the time of publication. However, DECT standardization is a rapidly changing area, and it is possible that some of the information contained in the present document may become outdated or incomplete within relatively short time-scales.

The present document is part 1 of a multi-part deliverable covering the New Generation DECT as identified below:

Part 1: "Wideband speech";

Part 2: "Support of transparent IP packet data";

Part 3: "Extended wideband speech services";

Part 4: "Software Update Over The Air (SUOTA) and Content Download".

1 Scope

The present document specifies a set of functionalities of the New Generation DECT.

The New Generation DECT provides the following basic new functionalities:

- Wideband voice service.
- Packet-mode data service supporting Internet Protocol with efficient spectrum usage and high data rates.
- Extended Wideband speech services.

The present document describes the first part: Wideband speech service. For the description of the support of transparent IP packet data, see TS 102 527-2 [i.4]. For the description of Extended Wideband speech services, see TS 102 527-3 [i.5]

All New Generation DECT devices will offer at least one or both of these services. If the device offers the wideband voice service, it will support also the DECT standard 32 kbit/s voice service according to EN 300 444 [12] (GAP).

All DECT devices claiming to be compliant with this Application Profile will offer at least the basic services defined as mandatory. In addition to that, optional features can be implemented to offer additional DECT services.

The aim of the present document is to guarantee a sufficient level of interoperability and to provide an easy route for development of DECT wideband speech applications, with the features of the present document being a common fall-back option available in all compliant to this profile equipment.

2 References

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.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
  - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
  - for informative references.

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

For online referenced documents, information sufficient to identify and locate the source shall be provided. Preferably, the primary source of the referenced document should be cited, in order to ensure traceability. Furthermore, the reference should, as far as possible, remain valid for the expected life of the document. The reference shall include the method of access to the referenced document and the full network address, with the same punctuation and use of upper case and lower case letters.

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

2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

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

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

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

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

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

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

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

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

[9] Void.

[10] ETSI EN 300 176-2: "Digital Enhanced Cordless Telecommunications (DECT); Test specification; Part 2: Speech".

[11] ETSI EN 301 406: "Digital Enhanced Cordless Telecommunications (DECT); Harmonized EN for Digital Enhanced Cordless Telecommunications (DECT) covering essential requirements under article 3.2 of the R&TTE Directive; Generic radio".

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

[13] ISO/IEC 9646-6: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 6: Protocol profile test specification".

[14] ISO/IEC 9646-7: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 7: Implementation Conformance Statements".

[15] ITU-T Recommendation G.726 (12/1990): "40, 32, 24, 16 kbit/s Adaptive Differential Pulse Code Modulation (ADPCM) ".

[16] ITU-T Recommendation G.711 (11/1988): "Pulse code modulation (PCM) of voice frequencies".

[17] ITU-T Recommendation G.722 (11/1988): "7 kHz audio-coding within 64 kbit/s".

[18] ITU-T Recommendation G.729.1 (05/2006): "G.729 based Embedded Variable bit-rate coder: An 8-32 kbit/s scalable wideband coder bitstream interoperable with G.729".

[19] ISO/IEC JTC1/SC29/WG11 (MPEG): International Standard ISO/IEC 14496-3:2005/AMD 1:2007: "Coding of audio-visual objects - Part 3: Audio; AMENDMENT 1: Low Delay AAC profile".

[20] ISO/IEC JTC1/SC29/WG11 (MPEG): International Standard ISO/IEC 14496-3:2005: "Information Technology - Coding of audio-visual objects - Part 3: Audio".

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area**.** For non-specific references, the latest version of the referenced document (including any amendments) applies.

[i.1] ETSI TR 101 178: "Digital Enhanced Cordless Telecommunications (DECT); A high Level Guide to the DECT Standardization".

[i.2] ETSI TBR 006: "Digital Enhanced Cordless Telecommunications (DECT); General terminal attachment requirements".

[i.3] ETSI TBR 010: "Digital Enhanced Cordless Telecommunications (DECT); General terminal attachment requirements: Telephony applications".

[i.4] ETSI TS 102 527-2: "Digital Enhanced Cordless Telecommunications (DECT); New Generation DECT; Part 2: Support of transparent IP packet data".

[i.5] ETSI TS 102 527-3: "Digital Enhanced Cordless Telecommunications (DECT); New Generation DECT; Part 3: Extended wideband speech services".

[i.6] ITU-T Recommendation P.311 (06/2005): "Transmission characteristics for wideband (150-7000 Hz) digital handset telephones".

[i.7] IETF RFC 3640: "RTP Payload Format for Transport of MPEG-4 Elementary Streams".

[i.8] IETF RFC 3016: "RTP Payload Format for MPEG-4 Audio/Visual Streams".

[i.9] ITU-T Recommendation G.729: "Coding of speech at 8 kbit/s using conjugate structure algebraic-code-excited linear prediction (CS-ACELP)".

[i.10] IETF RFC 3261: "SIP: Session Initiation Protocol".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in EN 300 444 [12] and the following apply:

New Generation DECT: further development of the DECT standard introducing wideband speech, improved data services, new slot types and other technical enhancements

super-wideband speech: voice service with enhanced quality compared to ADPCM G.726 and allowing the transmission of a maximum vocal frequency of at least 14 kHz

wideband speech: voice service with enhanced quality compared to ADPCM G.726 and allowing the transmission of a vocal frequency range of at least 150 Hz to 7 kHz, and fulfilling the audio performance requirements described in the ITU-T Recommendation P.311 [i.6]

3.2 Symbols

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

M	Mandatory to support (provision mandatory, process mandatory)
O	Optional to support (provision optional, process mandatory)
I	out-of-scope (provision optional, process optional) not subject for testing
C	Conditional to support (process mandatory)
N/A	Not Applicable (in the given context the specification makes it impossible to use this capability)

Provision mandatory, process mandatory means that the indicated feature service or procedure shall be implemented as described in the present document, and may be subject to testing.

Provision optional, process mandatory means that the indicated feature, service or procedure may be implemented, and if implemented, the feature, service or procedure shall be implemented as described in the present document, and may be subject to testing.

NOTE: The used notation is based on the notation proposed in ISO/IEC 9646-7 [14].

3.3 Abbreviations

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

AAC	Advanced Audio Coding (MPEG)
AC	Authentication Code
ADPCM	Adaptive Differential Pulse Code Modulation
AI	Air Interface
CC	Call Control
CI	Common Interface
CLIP	Calling Line Identification Presentation
CNIP	Calling Name Identification Presentation
DECT	Digital Enhanced Cordless Telecommunications
DLC	Data Link Control
DTMF	Dual Tone Multi-Frequency
ER	Error Resilient (MPEG)
FP	Fixed Part
FT	Fixed radio Termination
GAP	Generic Access Profile
IA	Implementation Alternative
IE	Information Element
IP	Internet Protocol
IPUI	International Portable User Identity
ISDN	Integrated Services Digital Network
IWU	InterWorking Unit
LA	Location Area
LD	Low Delay (MPEG)
LLME	Lower Layer Management Entity
MAC	Medium Access Control
MM	Mobility Management
MPEG	Motion Picture Experts Group
NB	Narrow Band
NG	New Generation
NG-DECT	New Generation DECT
NWK	NetWorK
P	Public (environment)
PA	Portable Application
PABX	Private Automatic Branch eXchange
PARK	Portable Access Rights Key
PHL	PHysical Layer
PP	Portable Part
PRA	Primary Rate Access (ISDN)
PT	Portable radio Termination
R/B	Residential/Business (environment)
RFP	Radio Fixed Part
S/T	ISDN S/T Interface
SARI	Secondary Access Rights Identity
TCL	Telephone Coupling Loss
TPUI	Temporary Portable User Identity
TRUP	TRansparent UnProtected service
U	ISDN U-Interface
WB	Wideband

4 Description of services

4.1 Enhanced wideband speech

In traditional telephony applications the supported bandwidth is 3,1 kHz (300 Hz to 3,4 kHz). For better speech quality and a more natural sound, a bandwidth of at least 150 Hz to 7 kHz should be supported and may be extended even further.

New Generation DECT improves audio quality by implementing wideband enhanced quality audio codecs. All New Generation DECT wideband speech devices shall implement wideband (150 Hz to 7 kHz) audio (16 kHz frequency sampling). DECT devices supporting wideband audio shall support the speech coding format according to ITU-T Recommendation G.722 [17]. In addition to that, other wideband and super-wideband audio codecs, providing even better audio quality, may be implemented.

In order to transport the higher bitrate of the new enhanced codecs, the bitrate per channel at the air interface is doubled from 32 kbit/s in traditional DECT to 64 kbit/s.

All New Generation DECT wideband speech devices shall be backward compatible with traditional DECT 32 kbit/s voice (GAP) devices. New PPs shall operate with legacy base stations, and new bases shall support existing PPs. In such cases, the voice quality is the traditional DECT quality (32 kbit/s ADPCM).

4.1.1 Audio performance requirements

New Generation DECT handsets shall fulfil the audio performance requirements described in EN 300 175-8 [8]. Different audio specifications are available for different applications, services and performance levels. The basic audio specification for Wideband speech handsets (known as PP type 2a, see EN 300 175-8 [8]) fulfils the requirements of ITU-T Recommendation P.311 [i.6]. There is the option of implementing more demanding specifications (PP types 2b and 2c of EN 300 175-8 [8]) providing superior performance.

4.2 Wideband speech scenarios

The following scenarios are envisaged.

4.2.1 Internal calls inside a New Generation DECT system

In such a case, wideband (150 Hz to 7 kHz) communication is possible between both terminals without any special issue.

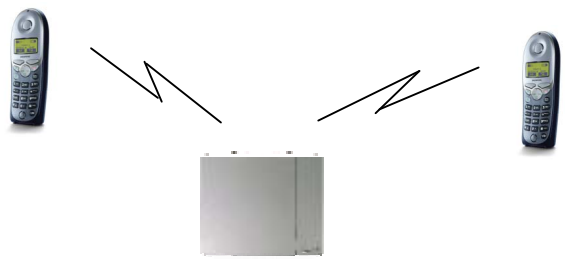


Figure 1: Internal wideband call

4.2.2 Calls between two New Generation DECT systems interconnected by ISDN

Two subscribers owning New Generation DECT base stations and handsets could establish a wideband voice communication between them if the DECT FPs are interconnected by an ISDN network with digital U or S/T interface, (or PRA) to the local exchange. The ISDN call should be digital unrestricted 64 kbit/s.

The scenario is also possible for business customers using PABX with DECT support and digital links to the public exchange.

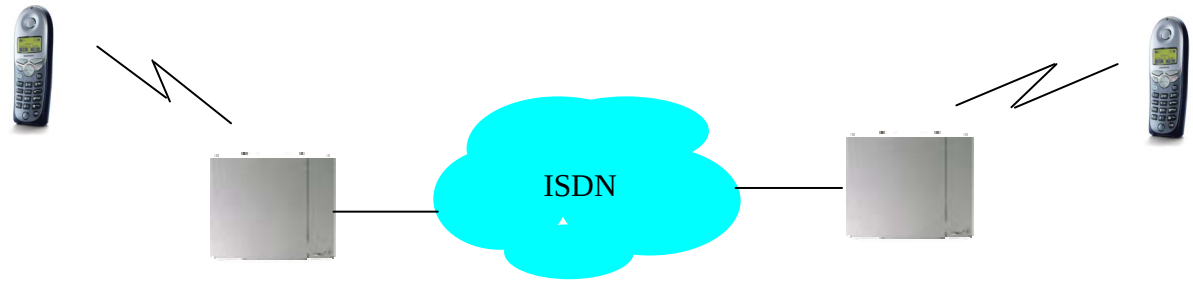


Figure 2: Wideband call via ISDN

4.2.3 Calls between two New Generation DECT systems interconnected by IP packet based network

Two subscribers owning New Generation DECT base stations and handsets, and interconnected via VoIP over an IP packet based network, could establish a wideband voice communication between them.

The IP packed based network can be either the Internet or a dedicated IP based network.

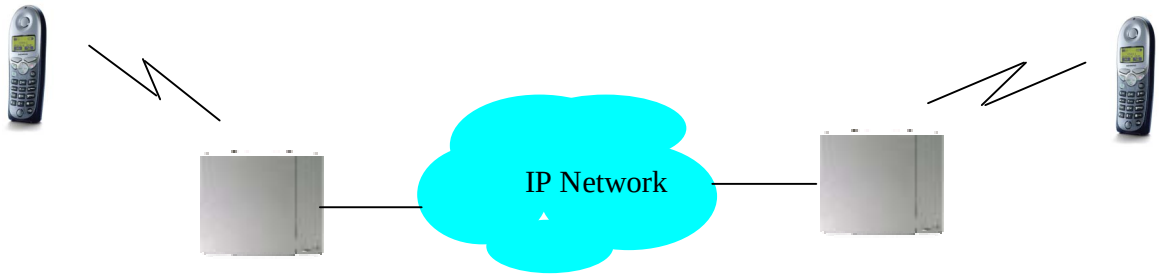


Figure 3: Wideband call via Internet

4.2.4 Calls between a New Generation DECT system and a digital phone supporting compatible codecs

This scenario is possible, at least in the following cases.

4.2.4.1 Via ISDN

ISDN digital phones with S/T interface and supporting the ITU-T Recommendation G.722 [17] codec could establish wideband calls with New Generation DECT equipment. Identical scenario is possible for PABX digital terminals calling or called by New Generation DECT systems.

4.2.4.2 Via IP network

Digital phones with a VoIP interface could also establish wideband communications with New Generation DECT equipment. This scenario includes both, dedicated VoIP phone devices and computers implementing the necessary software. Due to the evolution of computer industry, nearly all modern Personal Computers have the capability to become a wideband phone with DECT compatible codecs.

4.2.4.3 Internal PABX calls

PABX supporting New Generation DECT and digital extensions with compatible wideband codecs could also benefit from the wideband voice quality for their internal calls.

4.2.5 Legacy scenarios

Existing DECT GAP compliant equipment (both FT and PT) should be able to interoperate with New Generation DECT systems. In such cases, communication will be traditional 32 kbit/s ADPCM voice links.

Interoperability shall be possible in both directions:

- A new Generation DECT wideband speech PT should be interoperable with legacy DECT FTs.
- A legacy PT should be interoperable with new Generation DECT FTs.

5 Service and feature definitions

5.1 New Generation DECT Speech Services

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

Narrow band ADPCM G.726 voice service [NG1.1]: ITU-T Recommendation G.726 [15] narrow band codec **[NG1.SC.1]** over 32 kbit/s unprotected transmission channel.

Narrow band PCM G.711 voice service [NG1.2]: ITU-T Recommendation G.711 [16] narrow band codec **[NG1.SC.2]** over 64 kbit/s protected or unprotected transmission channels.

Wideband 7 kHz G.722 voice service [NG1.3]: ITU-T Recommendation G.722 [17] wideband codec **[NG1.SC.3]** over 64 kbit/s protected or unprotected transmission channels.

Wideband 7 kHz low rate G.729.1 voice service [NG1.4]: ITU-T Recommendation G.729.1 [18] wideband codec **[NG1.SC.4]** over 32 kbit/s unprotected transmission channels.

Super-wideband 14 kHz MPEG-4 ER AAC-LD voice service [NG1.5]: MPEG-4 ER AAC-LD super-wideband codec **[NG1.SC.5]** over 64 kbit/s protected or unprotected transmission channels.

Wideband 11 kHz low rate MPEG-4 ER AAC-LD voice service [NG1.6]: MPEG-4 ER AAC-LD super-wideband codec **[NG1.SC.6]** over 32 kbit/s unprotected transmission channels.

5.2 Network (NWK) features

For the purposes of the present document, all definitions of EN 300 444 [12], clause 4.1, plus the following shall apply:

Codec Negotiation [NG1.N.1): Capability to negotiate the speech codec to be used in a communication, based on the supported capabilities in both peers and the previsions included in the present document. This feature may require slot type change.

Codec Switching [NG1.N.2): Capability to switch between different speech codecs during a call. This feature may require slot type change.

5.3 Data Link Control (DLC) service definitions

For the purposes of the present document, all definitions of EN 300 444 [12], clause 5.1 plus the following shall apply:

LU1 Transparent UnProtected service (TRUP) Class 0/minimum_delay [NG1.D.1]: Transparent unprotected service introducing minimum delay , transmission Class 0/min_delay as defined by EN 300 175-4 [4], clause 11.2.

LU1 Transparent UnProtected service (TRUP) Class 0 [NG1.D.2]: Transparent unprotected service introducing minimum delay , transmission Class 0 as defined by EN 300 175-4 [4], clause 11.2.

LU7 64 kbit/s protected bearer service [NG1.D.3]: Protected service providing reliable 64 kbit/s transmission over packet type P80 incorporating FEC and ARQ protection mechanisms. Defined by EN 300 175-4 [4], clause 11.9.

LU12 UNProtected Framed service (UNF) Class 0 [NG1.D4]: Unprotected service introducing normal delay, transmission Class 0 as defined by EN 300 175-4 [4], clause 11.14.

FU1 DLC frame [NG1.D.5]: Bidirectional frame used in LU1 service. Defined in EN 300 175-4 [4], clause 12.2. Frame length depends on slot type and is defined in table 12.2.1.1 of EN 300 175-4 [4], clause 12.2.1.

FU7 DLC frame [NG1.D.6]: Bidirectional frame used in LU7 service. Defined in EN 300 175-4 [4], clause 11.9.

FU12 DLC frame with adaptation for codec G.729.1 [NG1.D.7]: Bidirectional frame used in LU12 service, as defined in EN 300 175-4 [4], clause 12.12, frame size specified for full slot, 2-level modulation and with the adaptation for codec G.729.1 defined in EN 300 175-4 [4], clause E.1.

5.4 Medium Access Control (MAC) service definitions

For the purposes of the present document, all definitions of EN 300 444 [12], clause 5.2 plus the following shall apply:

I_N_minimum delay symmetric MAC service type [NG1.M.1]: I_N_minimum delay symmetric connection as defined in EN 300 175-3 [3], clause 5.6.2.1.

I_N_normal delay symmetric MAC service type [NG1.M.2]: I_N_normal delay symmetric connection as defined in EN 300 175-3 [3], clause 5.6.2.1.

I_{PQ}_error_detection symmetric MAC service type [NG1.M.3]: I_{PQ}_error_detection symmetric connection as defined in EN 300 175-3 [3], clause 5.6.2.1 (type 3: I_P_error_detection with single-subfield protected B-field as defined in EN 300 175-3 [3], clause 6.2.1.3.4).

Advanced Connections [NG1.M.4]: MAC Connection Oriented service providing connection between FT and PT. Advanced connections are able to support multiple bearers, bearers different of the full slot, and any MAC service. The service includes the means for setting-up and releasing the required bearer(s).

5.5 Physical Layer (PHL) service definitions

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

2 level GFSK modulation [NG1.P.1]: 2 level Gaussian frequency Shift Key (GFSK) modulation as defined by EN 300 175-2 [2], clause 5.

Physical Packet P32 [NG1.P.2]: Physical packet P32 (full slot) as defined by EN 300 175-2 [2], clause 4.4.2.

Physical Packet P64 [NG1.P.3]: Variable capacity Physical packet P00j as defined by EN 300 175-2 [2], clause 4.4.3, with j = 640.

Physical Packet P67 [NG1.P.4]: Variable capacity Physical packet P00j as defined by EN 300 175-2 [2], clause 4.4.3, with j = 672.

Physical Packet P80 [NG1.P.5]: Physical packet P80 (double slot) as defined by EN 300 175-2 [2], clause 4.4.4.

5.6 Speech coding and audio feature definitions

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

G.726 32 kbit/s ADPCM [NG1.SC.1]: ITU-T Recommendation G.726 [15] narrow band codec as defined by EN 300 175-8 [8], clause 5.1. ITU-T Recommendation G.726 [15] codec is mandatory for New Generation DECT in order to ensure interoperability with existing DECT systems.

G.711 64 kbit/s log-PCM [NG1.SC.2]: ITU-T Recommendation G.711 narrow band codec [16] as defined by EN 300 175-8 [8], clause 5.2. ITU-T Recommendation G.711 [16] codec is optional for New Generation DECT in order to improve the quality of narrow band communications, and fax/modem transmissions. ITU-T Recommendation G.711 [16] provides a slightly higher intrinsic voice quality and no transcoding for PSTN calls. Both, A-Law and μ-Law are supported.

G.722 64 kbit/s wideband [NG1.SC.3]: ITU-T Recommendation G.722 wideband SB-ADPCM 7 kHz codec [17] as defined by EN 300 175-8 [8], clause 5.3. ITU-T Recommendation G.722 [17] is chosen as mandatory wideband codec for New Generation DECT in order to greatly increase the voice quality by extending the bandwidth from narrow band to wideband. ITU-T Recommendation G.722 [17] provides a high wideband quality at a bit rate of 64 kbit/s with low complexity and very low delay.

G.729.1 32 kbit/s wideband [NG1.SC.4]: ITU-T Recommendation G.729.1 [18] wideband codec as defined by EN 300 175-8 [8], clause 5.4. ITU-T Recommendation G.729.1 [18] codec is optional for New Generation DECT in order to provide even higher wideband quality and better robustness to packets/frames losses than ITU-T Recommendation G.722 [17] at half the bit rate of ITU-T Recommendation G.722 [17]. This allows a better transport efficiency on the network side and over the DECT air interface (one full slot). In addition, it is seamless interoperable with largely deployed ITU-T Recommendation G.729 [i.9] based VoIP networks and terminals. ITU-T Recommendation G.729.1 [18] encodes signals in frames of 20 ms. It is a scalable codec operating at bitrates of 8 kbit/s and from 12 kbit/s to 32 kbit/s per steps of 2 kbit/s, in narrow band or in wideband from 14 kbit/s.
ITU-T Recommendation G.729.1 [18] already incorporates a high efficiency packet loss concealment mechanism.

MPEG-4 ER AAC-LD 64 kbit/s super-wideband [NG1.SC.5]: MPEG-4 ER AAC-LD codec [19] - [20] as defined by EN 300 175-8 [8], clause 5.5.1. MPEG-4 ER AAC-LD is optional for New Generation DECT in order to provide higher quality than G.722 by further extending the bandwidth to super-wideband (50 Hz to 14 kHz) (and even further, up to full audio bandwidth (20 Hz to 20 kHz)). MPEG-4 ER AAC-LD is designed for high quality communication applications including all kind of audio signals e.g. speech and music and provides a high quality for music streaming or other multimedia applications mixing speech and music. It provides an audio bandwidth of 14 kHz or more at a bitrate of 64 kbit/s. MPEG 4 ER AAC-LD (Error Resilient, Low Delay AAC profile) is standardized as an audio profile [19] of MPEG-4 (ISO/IEC 14496-3 [20]). The frame size is 10 ms and the algorithmic delay 20 ms.

MPEG-4 ER AAC-LD 32 kbit/s wideband [NG1.SC.6]: As [NG1.SC5], but using the 32 kbit/s mode, as defined by EN 300 175-8 [8], clause 5.5.2. It provides a bandwidth of 11,5 kHz or more. The frame size is 20 ms and the algorithmic delay 40 ms.

PLC (Packet Loss Concealment) G.722 Appendix III & IV [NG1.SC.7]: To better cope with transmission errors, a Packet Loss Concealment algorithm (PLC) as defined by EN 300 175-8 [8], clause 5.3.2 may be optionally implemented for ITU-T Recommendation G.722 [17]. Appendices III and IV describe packet loss concealment solutions extending the ITU-T Recommendation G.722 [17] decoder. These PLC algorithms may be optionally implemented to improve voice quality in degraded transmission conditions where packets/frames may be lost (in IP network or on DECT air interface).

NOTE 1: Both appendices meet the same quality requirements but address two different quality/complexity trade offs:

1) Appendix III aims at maximizing the robustness at a price of additional complexity.

2) Appendix IV proposes an optimized complexity/quality trade off with almost no additional complexity compared with ITU-T Recommendation G.722 [17] normal decoding (0,07 WMOPS).

Since ITU-T Recommendation G.722 [17] does not incorporate any mechanism to cope with lost frames/packets, the use of a PLC algorithm is strongly recommended to avoid annoying effects in case of packet/frame losses.

NOTE 2: ITU-T Recommendation G.729.1 [18] already incorporates a packet loss concealment mechanism.

Detection of Modem/fax tone [NG1.SC.8]: Detection of the 1 100 Hz, 1 300 Hz and 2 100 Hz standard tones indicating a fax/modem transmission and answering, as defined by EN 300 175-8 [8], clause 5.2.2. The main utility of this function is the switching of codecs to transparent PCM (ITU-T Recommendation G.711 [16]) in order to facilitate modem/fax transmission. The tone detection can also be used to de-activate echo suppression if present.

Codec selection and switching [NG1.SC.9]: To handle several codecs (at least ITU-T Recommendation G.726 [15] and ITU-T Recommendation G.722 [17]), New Generation DECT will support a codec selection and switching mechanism. This may consequently allow the use of other codecs that could be specified in next releases as additional optional codecs according to future application or interoperability needs.

PP Audio type 1a ("classic GAP" handset) [NG1.SC.10]: Audio specification for a general purpose 3,1 kHz telephony handset as defined by EN 300 175-8 [8], clause 7.2.3.

PP audio type 1b ("improved GAP" handset) [NG1.SC.11]: Audio specification for a general purpose 3,1 kHz telephony handset with improved TCLw, as defined by EN 300 175-8 [8], clause 7.2.4. It is compatible with VoIP and long delay networks.

PP audio type 1c (HATS tested, 3,1 kHz handset) [NG1.SC.12]: Audio specification for a general purpose 3,1 kHz telephony handset based on the new HATS methodology, as defined by EN 300 175-8 [8], clause 7.2.5. It includes strong echo suppression (TCLw) requirements and is compatible with VoIP and long delay networks.

PP audio type 1d (HATS tested, 3,1 kHz "improved" handset) [NG1.SC.13]: Audio specification for a general purpose 3,1 kHz telephony handset based on the new HATS methodology with improved quality, as defined by EN 300 175-8 [8], clause 7.2.6. It includes strong echo suppression (TCLw) requirements and is compatible with VoIP and long delay networks. This type has a more demanding acoustic specification, providing superior subjective quality. In practice, this means better electro-acoustic components (speaker, microphone), electronics and signal processing.

PP Audio type 2a (ITU-T Recommendation P.311 [i.6**] 7 kHz handset) [NG1.SC.14]:** Audio specification for a wideband, 7 kHz service, handset based on the ITU-T Recommendation P.311 [i.6], as defined by EN 300 175-8 [8], clause 7.2.9.

PP Audio type 2b (HATS 7 kHz handset) [NG1.SC.15]: Handset for 7 kHz service (wideband), based on HATS methodology, as defined by EN 300 175-8 [8], clause 7.2.10. It includes strong echo suppression (TCLw) requirements and is compatible with VoIP and long delay networks.

PP Audio type 2c (HATS 7 kHz "improved" handset) [NG1.SC.16]: Handset for 7 kHz service (wideband), based on HATS methodology, with improved quality, as defined by EN 300 175-8 [8], clause 7.2.11. It includes strong echo suppression (TCLw) requirements and is compatible with VoIP and long delay networks. This type has a more demanding acoustic specification, providing superior subjective quality. In practice, this means better electro-acoustic components (speaker, microphone), electronics and signal processing.

PP audio type 3a (HATS tested, 3,1 kHz handsfree) [NG1.SC.17]: Audio specification for a Narrowband (3,1 kHz) handsfree device as defined by EN 300 175-8 [8], clause 7.2.7. This type applies to handsfree devices operating with an open loudspeaker and microphone. The type applies to either:

1) specific PPs designed to operate in handsfree mode;

2) standard handset implementing types 1a, 1b, 1c or 1d, but with the option to operate in handsfree mode; and

3) handsfree accessory devices connected to a handset by any wired or wireless technology.

It provides (300 Hz - 3,4 kHz) frequency range, and it is defined based on HATS methodology.

PP audio type 3b (HATS tested, 3,1 kHz "improved" handsfree) [NG1.SC.18]: Audio specification for a Narrowband (3,1 kHz) handsfree device, improved quality version, as defined by EN 300 175-8 [8], clause 7.2.8. This type applies to handsfree devices operating with an open loudspeaker and microphone. The type applies to either:

1) specific PPs designed to operate in handsfree mode;

2) standard handset implementing types 1a, 1b, 1c or 1d, but with the option to operate in handsfree mode; and

3) handsfree accessory devices connected to a handset by any wired or wireless technology.

It provides (300 Hz - 3,4 kHz) frequency range, and it is defined based on HATS methodology. This type has a more demanding acoustic specification, providing superior subjective quality. In practice, this means better electro-acoustic components (speaker, microphone), electronics and signal processing.

PP Audio type 4a (HATS 7 kHz handsfree) [NG1.SC.19]: Wideband (7 kHz) handsfree device, as defined by EN 300 175-8 [8], clause 7.2.12. This type applies to handsfree devices operating with an open loudspeaker and microphone. The profile applies to either:

1) specific PPs designed to operate in handsfree mode;

2) standard wideband handset implementing profiles 2a, 2b or 2c, but with the option to operate in handsfree mode; and

3) handsfree accessory devices connected to a handset by any wired or wireless technology.

It provides (150 Hz - 7 kHz) frequency range, and it is defined based on HATS methodology.

PP Audio type 4b (HATS 7 kHz "improved" handsfree) [NG1.SC.20]: Wideband (7 kHz) handsfree device, improved quality version, as defined by EN 300 175-8 [8], clause 7.2.13. This type applies to handsfree devices operating with an open loudspeaker and microphone. The profile applies to either:

1) specific PPs designed to operate in handsfree mode;

2) standard wideband handset implementing profiles 2a, 2b or 2c, but with the option to operate in handsfree mode; and

3) handsfree accessory devices connected to a handset by any wired or wireless technology.

It provides (150 Hz - 7 kHz) frequency range, and it is defined based on HATS methodology. This type has a more demanding acoustic specification, providing superior subjective quality. In practice, this means better electro-acoustic components (speaker, microphone), electronics and signal processing.

PP Audio type 5a (Super-wideband 14 kHz) [NG1.SC.21]: Handset for 14 kHz service (super-wideband), as defined by EN 300 175-8 [8], clause 7.2.14.

PP Audio type 5b (Super-wideband 14 kHz, handsfree) [NG1.SC.22]: Handsfree device for 14 kHz service (super-wideband), as defined by EN 300 175-8 [8], clause 7.2.15.

FP audio type 1b ("new ISDN" 3,1 kHz) [NG1.SC.23]: Audio specification for a DECT FP supporting narrowband service and providing a digital 64 kbit/s G.711 interface, typically (but not necessarily) an ISDN connection, new specification, as defined by EN 300 175-8 [8], clause 7.3.3.

NOTE: FP Audio type 1a ("classic ISDN", 3,1 kHz FP, see EN 300 175-8 [8]) is not to be used in New Generation DECT equipment. Instead of it, FP type 1b should be used in NG-DECT FPs with ISDN or digital circuit-switch interfaces.

PP echo canceller for FP, narrowband (3,1 kHz) service [NG1.SC.24]: Auxiliary feature for FPs consisting on echo canceller for handling the echo generated by PPs type 1a. As defined by EN 300 175-8 [8], clause 7.4.2. Only narrowband echo cancellation capability is required for this feature.

PP echo suppressor for FP, narrowband (3,1 kHz) service [NG1.SC.25]: Auxiliary feature for FPs consisting on echo suppressor for handling the echo generated by PPs type 1a. As defined by EN 300 175-8 [8], clause 7.4.3. Only narrowband capability is required for this feature.

FP audio type 2 (analog PSTN 3,1 kHz) [NG1.SC.26]: Audio specification for a DECT FP supporting narrowband service and providing an analog 2-wire PSTN interface. As defined by EN 300 175-8 [8], clause 7.3.4.

FP audio type 3 (VoIP 3,1 kHz) [NG1.SC.27]: Audio specification for a DECT FP supporting narrowband service and providing a VoIP interface, with codecs G.711 (typically) or G.726 on top of it. As defined by EN 300 175-8 [8], clause 7.3.5.

FP Audio type 4 (ISDN, wideband) [NG1.SC.28]: Audio specification for a DECT FP supporting wideband service and providing a digital 64 kbit/s interface, typically (but not necessarily) an ISDN connection, with a wideband codec such as G.722, MPEG, etc. As defined by EN 300 175-8 [8], clause 7.3.6.

FP Audio type 5 (VoIP wideband) [NG1.SC.29]: Audio specification for a DECT FP supporting wideband service and providing a VoIP interface, with a wideband codec on top such as G.722, MPEG, etc. As defined by EN 300 175-8 [8], clause 7.3.8.

PP echo canceller for FP, wideband (7 kHz) service [NG1.SC.30]: Auxiliary feature for FPs consisting on echo canceller for handling the echo generated by PPs type 2a. As defined by EN 300 175-8 [8], clause 7.4.2. Only wideband echo cancellation capability is required for this feature.

PP echo suppressor for FP, wideband (7 kHz) service [NG1.SC.31]: Auxiliary feature for FPs consisting on echo suppressor for handling the echo generated by PPs type 2a. As defined by EN 300 175-8 [8], clause 7.4.3. Only wideband echo cancelation capability is required for this feature.

FP audio type 6a (internal call) [NG1.SC.32]: This type of audio specification applies to the case of internal call inside a DECT FP or a DECT system without any external interface. This type applies to any service. As defined by EN 300 175-8 [8], clause 7.3.8.

FP audio type 6b (internal conference) [NG1.SC.33]: This type of audio specification applies to the case of 3-party or multi-party conference inside a DECT FP or a DECT system with or without an external interface. Applies to any service. As defined by EN 300 175-8 [8], clause 7.3.9.

Adaptive volume control for FP [NG1.SC.34]: Accessory feature for FPs consisting on an adaptive volume control depending on the level of environmental noise at the PP. The gain variation shall be symmetrical. As described in EN 300 175-8 [8], (detailed descriptions for each type of FP in clause 7.6, and examples of settings in annex D).

5.7 Application features

For the purposes of the present document, all definitions of EN 300 444 [12], clause 4.2 shall apply:

6 Inter-operability requirements

6.1 General

The tables listed in this clause define the status of all protocol elements (i.e. features, services, and procedures) which can be: mandatory, optional, conditional under the provision of another protocol element, outside the scope of the present document, or not applicable. The status is identified by the status column designations defined in clause 3.2, and is described separately for FT and PT. In the case of FT, the status can be different for products intended for the Residential/Business (R/B) market or for the Public market segment.

All optional elements shall be process mandatory according to the procedures described in the present document.

Protocol elements defined as mandatory, optional or conditional in this clause are further defined in the referenced DECT specification, or, if needed, in clause 7 of the present document.

New Generation DECT wideband speech is defined as a backcompatible enhancement of DECT Generic Access Profile (GAP) [12]. All procedures not specific of the New Generation DECT, are referenced to their original description in EN 300 444 [12] (GAP).

NOTE: Annexes A and D are informative and may be used as additional information, but do not mandate requirements. Annexes B, C, E, and F are normative.

The requirements of EN 301 406 [11] and EN 300 176-2 [10] shall be met by all equipment conforming to the present document.

6.2 New Generation DECT Speech Services support status

The following end-user services shall be supported by New Generation DECT wideband voice specification.

Table 1: Speech service status

Feature supported					
			Status		
Item no.	Name of Service	Reference	PT	FT	
				R/B	P
NG1.1	Narrow band ADPCM G.726 32 kbit/s voice service	5.1	M	M	M
NG1.2	Narrow band PCM G.711 64 kbit/s voice service	5.1	O	O	O
NG1.3	Wideband G.722 64 kbit/s voice service	5.1	M	M	M
NG1.4	Wideband G.729.1 32 kbit/s voice service	5.1	O	O	O
NG1.5	MPEG-4 ER AAC-LD super-wideband 64 kbit/s voice service	5.1	O	O	O
NG1.6	MPEG-4 ER AAC-LD wideband 32 kbit/s voice service	5.1	O	O	O

6.3 Services to DECT feature implementation mappings

New Generation DECT services shall be implemented using the following DECT services and features, according to the following implementation alternatives.

Table 2: Speech service to DECT features implementation mappings

Service/DECT Feature mapping						
				Status		
Service	**IA**	**DECT feature/service**	**Reference**	**PT**	**FT**	
					R/B	**P**
NG1.1 Narrow band ADPCM G.726 32 kbit/s voice service	**I**		**5.1**	**M**	**M**	**M**
		NG1.P.1 2 level GFSK modulation	5.5	M	M	M
		NG1.P.2 Physical Packet P32	5.5	M	M	M
		NG1.M.1 I_N_minimum delay symmetric MAC service type	5.4	M	M	M
		GAP.M.4 Basic Connections	5.2 [12]	M	M	M
		NG1.M.4 Advanced Connections	5.4	C201	C201	C201
		NG1.D.1 DLC Service LU1 TRUP Class 0/min_delay	5.3	M	M	M
		NG1.D.5 DLC frame FU1	5.3	M	M	M
		NG1.SC.1 ITU-T Recommendation G.726 [15] 32 kbit/s ADPCM codec	5.6	M	M	M
		NG1.SC.10 PP Audio type 1a (classic GAP handset)	5.6	C702	N/A	N/A
		NG1.SC.11 PP Audio type 1b (improved GAP handset)	5.6	C702	N/A	N/A
		NG1.SC.12 PP Audio type 1c (HATS 3,1 kHz handset)	5.6	C702	N/A	N/A
		NG1.SC.13 PP Audio type 1d (HATS 3,1 kHz improved handset)	5.6	C702	N/A	N/A
		NG1.SC.17 PP Audio type 3a (HATS 3,1 kHz handsfree)	5.6	O	N/A	N/A
		NG1.SC.18 PP Audio type 3b (HATS 3,1 kHz improved handsfree)	5.6	O	N/A	N/A
		NG1.SC.23 FP Audio type 1b (new ISDN 3,1 kHz)	5.6	N/A	C706	C706
		NG1.SC.24 PP echo canceller for FP, narrowband	5.6	N/A	C707	C707
		NG1.SC.25 PP echo suppressor for FP, narrowband	5.6	N/A	C707	C707
		NG1.SC.26 FP Audio type 2 (analog PSTN 3,1 kHz)	5.6	N/A	C706	C706
		NG1.SC.27 FP Audio type 3 (VoIP 3,1 kHz)	5.6	N/A	C706	C706
		NG1.SC.32 FP Audio type 6a (internal call)	5.6	N/A	C710	C710
		NG1.SC.33 FP Audio type 6b (internal conference)	5.6	N/A	O	O
		NG1.SC.34 Adaptive volume control for FP	5.6	N/A	O	O
NG1.2 Narrow band PCM G.711 64 kbit/s voice service	**I**		**5.1**	**O**	**O**	**O**
		NG1.P.1 2 level GFSK modulation	5.5	M	M	M
		NG1.P.3 Physical Packet P64	5.5	M	M	M
		NG1.M.1 I_N_minimum delay symmetric MAC service type	5.4	M	M	M
		NG1.M.4 Advanced Connections	5.4	M	M	M
		NG1.D.1 DLC Service LU1 TRUP Class 0/min_delay	5.3	M	M	M
		NG1.D.5 DLC frame FU1	5.3	M	M	M
		NG1.SC.2 ITU-T Recommendation G.711 [16] 64 kbit/s PCM codec	5.6	M	M	M
		NG1.SC.8 Detection of Fax/modem tone	5.6	O	O	O

Service/DECT Feature mapping						
				Status		
Service	**IA**	**DECT feature/service**	**Reference**	**PT**	**FT**	
					R/B	**P**
		NG1.SC.9 Codec selection and switching	5.6	M	M	M
		NG1.SC.10 PP Audio type 1a (classic GAP handset)	5.6	C702	N/A	N/A
		NG1.SC.11 PP Audio type 1b (improved GAP handset)	5.6	C702	N/A	N/A
		NG1.SC.12 PP Audio type 1c (HATS 3,1 kHz handset)	5.6	C702	N/A	N/A
		NG1.SC.13 PP Audio type 1d (HATS 3,1 kHz improved handset)	5.6	C702	N/A	N/A
		NG1.SC.17 PP Audio type 3a (HATS 3,1 kHz handsfree)	5.6	O	N/A	N/A
		NG1.SC.18 PP Audio type 3b (HATS 3,1 kHz improved handsfree)	5.6	O	N/A	N/A
		NG1.SC.23 FP Audio type 1b (new ISDN 3,1 kHz)	5.6	N/A	C706	C706
		NG1.SC.24 PP echo canceller for FP, narrowband	5.6	N/A	C707	C707
		NG1.SC.25 PP echo suppressor for FP, narrowband	5.6	N/A	C707	C707
		NG1.SC.26 FP Audio type 2 (analog PSTN 3,1 kHz)	5.6	N/A	C706	C706
		NG1.SC.27 FP Audio type 3 (VoIP 3,1 kHz)	5.6	N/A	C706	C706
		NG1.SC.32 FP Audio type 6a (internal call)	5.6	N/A	C710	C710
		NG1.SC.33 FP Audio type 6b (internal conference)	5.6	N/A	O	O
		NG1.SC.34 Adaptive volume control for FP	5.6	N/A	O	O
NG1.2 Narrow band PCM G.711 64 kbit/s voice service	**II**		**5.1**	**O**	**O**	**O**
		NG1.P.1 2 level GFSK modulation	5.5	M	M	M
		NG1.P.4 Physical Packet P67	5.5	M	M	M
		NG1.M.3 I_{PQ}_error_detection symmetric MAC service type	5.4	M	M	M
		NG1.M.4 Advanced Connections	5.4	M	M	M
		NG1.D.1 DLC Service LU1 TRUP Class 0/min_delay	5.3	M	M	M
		NG1.D.5 DLC frame FU1	5.3	M	M	M
		NG1.SC.2 ITU-T Recommendation G.711 [16] 64 kbit/s PCM codec	5.6	M	M	M
		NG1.SC.8 Detection of Fax/modem tone	5.6	O	O	O
		NG1.SC.9 Codec selection and switching	5.6	M	M	M
		NG1.SC.10 PP Audio type 1a (classic GAP handset)	5.6	C702	N/A	N/A
		NG1.SC.11 PP Audio type 1b (improved GAP handset)	5.6	C702	N/A	N/A
		NG1.SC.12 PP Audio type 1c (HATS 3,1 kHz handset)	5.6	C702	N/A	N/A
		NG1.SC.13 PP Audio type 1d (HATS 3,1 kHz improved handset)	5.6	C702	N/A	N/A
		NG1.SC.17 PP Audio type 3a (HATS 3,1 kHz handsfree)	5.6	O	N/A	N/A
		NG1.SC.18 PP Audio type 3b (HATS 3,1 kHz improved handsfree)	5.6	O	N/A	N/A
		NG1.SC.23 FP Audio type 1b (new ISDN 3,1 kHz)	5.6	N/A	C706	C706
		NG1.SC.24 PP echo canceller for FP, narrowband	5.6	N/A	C707	C707

Service/DECT Feature mapping						
				Status		
Service	**IA**	**DECT feature/service**	**Reference**	**PT**	**FT**	
					R/B	**P**
		NG1.SC.25 PP echo suppressor for FP, narrowband	5.6	N/A	C707	C707
		NG1.SC.26 FP Audio type 2 (analog PSTN 3,1 kHz)	5.6	N/A	C706	C706
		NG1.SC.27 FP Audio type 3 (VoIP 3,1 kHz)	5.6	N/A	C706	C706
		NG1.SC.32 FP Audio type 6a (internal call)	5.6	N/A	C710	C710
		NG1.SC.33 FP Audio type 6b (internal conference)	5.6	N/A	O	O
		NG1.SC.34 Adaptive volume control for FP	5.6	N/A	O	O
NG1.2 Narrow band PCM G.711 64 kbit/s voice service	**III**		**5.1**	**O**	**O**	**O**
		NG1.P.1 2 level GFSK modulation	5.5	M	M	M
		NG1.P.5 Physical Packet P80	5.5	M	M	M
		NG1.M.2 I_N_normal_delay symmetric MAC service type	5.4	M	M	M
		NG1.M.4 Advanced Connections	5.4	M	M	M
		NG1.D.3 DLC service LU7 64 kbit/s protected bearer service	5.3	M	M	M
		NG1.D.6 DLC frame FU7	5.3	M	M	M
		NG1.SC.2 ITU-T Recommendation G.711 [16] 64 kbit/s PCM codec	5.6	M	M	M
		NG1.SC.8 Detection of Fax/modem tone	5.6	O	O	O
		NG1.SC.9 Codec selection and switching	5.6	M	M	M
		NG1.SC.10 PP Audio type 1a (classic GAP handset)	5.6	C702	N/A	N/A
		NG1.SC.11 PP Audio type 1b (improved GAP handset)	5.6	C702	N/A	N/A
		NG1.SC.12 PP Audio type 1c (HATS 3,1 kHz handset)	5.6	C702	N/A	N/A
		NG1.SC.13 PP Audio type 1d (HATS 3,1 kHz improved handset)	5.6	C702	N/A	N/A
		NG1.SC.17 PP Audio type 3a (HATS 3,1 kHz handsfree)	5.6	O	N/A	N/A
		NG1.SC.18 PP Audio type 3b (HATS 3,1 kHz improved handsfree)	5.6	O	N/A	N/A
		NG1.SC.23 FP Audio type 1b (new ISDN 3,1 kHz)	5.6	N/A	C706	C706
		NG1.SC.24 PP echo canceller for FP, narrowband	5.6	N/A	C707	C707
		NG1.SC.25 PP echo suppressor for FP, narrowband	5.6	N/A	C707	C707
		NG1.SC.26 FP Audio type 2 (analog PSTN 3,1 kHz)	5.6	N/A	C706	C706
		NG1.SC.27 FP Audio type 3 (VoIP 3,1 kHz)	5.6	N/A	C706	C706
		NG1.SC.32 FP Audio type 6a (internal call)	5.6	N/A	C710	C710
		NG1.SC.33 FP Audio type 6b (internal conference)	5.6	N/A	O	O
		NG1.SC.34 Adaptive volume control for FP	5.6	N/A	O	O

Service/DECT Feature mapping						
				Status		
Service	**IA**	**DECT feature/service**	**Reference**	**PT**	**FT**	
					R/B	**P**
NG1.3 Wideband 7 kHz G.722 64 kbit/s voice service	**I**		**5.1**	**M**	**M**	**M**
		NG1.P.1 2 level GFSK modulation	5.5	M	M	M
		NG1.P.3 Physical Packet P64	5.5	M	M	M
		NG1.M.1 I_N_minimum delay symmetric MAC service type	5.4	M	M	M
		NG1.M.4 Advanced Connections	5.4	M	M	M
		NG1.D.1 DLC Service LU1 TRUP Class 0/min_delay	5.3	M	M	M
		NG1.D.5 DLC frame FU1	5.3	M	M	M
		NG1.SC.3 ITU-T Recommendation G.722 [17] 64 kbit/s 7 kHz wideband codec	5.6	M	M	M
		NG1.SC.7 Packet loss Concealment (PLC) for G.722	5.6	O	O	O
		NG1.SC.9 Codec selection and switching	5.6	M	M	M
		NG1.SC.14 PP Audio type 2a (ITU-T Recommendation P.311 [i.6] 7 kHz handset)	5.6	C703	N/A	N/A
		NG1.SC.15 PP Audio type 2b (HATS 7 kHz handset)	5.6	C703	N/A	N/A
		NG1.SC.16 PP Audio type 2c (HATS 7 kHz improved handset)	5.6	C703	N/A	N/A
		NG1.SC.19 PP Audio type 4a (HATS 7 kHz handsfree)	5.6	O	N/A	N/A
		NG1.SC.20 PP Audio type 4b (HATS 7 kHz improved handsfree)	5.6	O	N/A	N/A
		NG1.SC.28 FP Audio type 4 (ISDN wideband)	5.6	N/A	C708	C708
		NG1.SC.29 FP Audio type 5 (VoIP wideband	5.6	N/A	C708	C708
		NG1.SC.30 NG1.SC.24 PP echo canceller for FP, wideband	5.6	N/A	C709	C709
		NG1.SC.31 NG1.SC.24 PP echo suppressor for FP, wideband	5.6	N/A	C709	C709
		NG1.SC.32 FP Audio type 6a (internal call)	5.6	N/A	C710	C710
		NG1.SC.33 FP Audio type 6b (internal conference)	5.6	N/A	O	O
		NG1.SC.34 Adaptive volume control	5.6	N/A	O	O
NG1.3 Wideband 7 kHz G.722 64 kbit/s voice service	**II**		**5.1**	**O**	**O**	**O**
		NG1.P.1 2 level GFSK modulation	5.5	M	M	M
		NG1.P.3 Physical Packet P67	5.5	M	M	M
		NG1.M.3 I_{PQ}_error_detection symmetric MAC service type	5.4	M	M	M
		NG1.M.4 Advanced Connections	5.4	M	M	M
		NG1.D.1 DLC Service LU1 TRUP Class 0/min_delay	5.3	M	M	M
		NG1.D.5 DLC frame FU1	5.3	M	M	M
		NG1.SC.3 ITU-T Recommendation G.722 [17] 64 kbit/s 7 kHz wideband codec	5.6	M	M	M
		NG1.SC.7 Packet loss Concealment (PLC) for ITU-T Recommendation G.722 [17]	5.6	O	O	O
		NG1.SC.9 Codec selection and switching	5.6	M	M	M
		NG1.SC.14 PP Audio type 2a (ITU-T Recommendation P.311 [i.6] 7 kHz handset)	5.6	C703	N/A	N/A

Service/DECT Feature mapping						
				Status		
Service	**IA**	**DECT feature/service**	**Reference**	**PT**	**FT**	
					R/B	**P**
		NG1.SC.15 PP Audio type 2b (HATS 7 kHz handset)	5.6	C703	N/A	N/A
		NG1.SC.16 PP Audio type 2c (HATS 7 kHz improved handset)	5.6	C703	N/A	N/A
		NG1.SC.19 PP Audio type 4a (HATS 7 kHz handsfree)	5.6	O	N/A	N/A
		NG1.SC.20 PP Audio type 4b (HATS 7 kHz improved handsfree)	5.6	O	N/A	N/A
		NG1.SC.28 FP Audio type 4 (ISDN wideband)	5.6	N/A	C708	C708
		NG1.SC.29 FP Audio type 5 (VoIP wideband	5.6	N/A	C708	C708
		NG1.SC.30 NG1.SC.24 PP echo canceller for FP, wideband	5.6	N/A	C709	C709
		NG1.SC.31 NG1.SC.24 PP echo suppressor for FP, wideband	5.6	N/A	C709	C709
		NG1.SC.32 FP Audio type 6a (internal call)	5.6	N/A	C710	C710
		NG1.SC.33 FP Audio type 6b (internal conference)	5.6	N/A	O	O
		NG1.SC.34 Adaptive volume control	5.6	N/A	O	O
NG1.4 Wideband 7 kHz G.729.1 32 kbit/s voice service	**I**		**5.1**	**O**	**O**	**O**
		NG1.P.1 2 level GFSK modulation	5.5	M	M	M
		NG1.P.3 Physical Packet P32	5.5	M	M	M
		NG1.M.2 I_N_normal_delay symmetric MAC service type	5.4	M	M	M
		NG1.M.4 Advanced Connections	5.4	M	M	M
		NG1.D.4 DLC service LU12 (UNF) Class 0	5.3	M	M	M
		NG1.D.7 DLC frame FU12 with adaptation for codec G.729.1	5.3	M	M	M
		NG1.SC.4 ITU-T Recommendation G.729.1 [18] 32 kbit/s 7 kHz wideband codec	5.6	M	M	M
		NG1.SC.9 Codec selection and switching	5.6	M	M	M
		NG1.SC.14 PP Audio type 2a (ITU-T Recommendation P.311 [i.6] 7 kHz handset)	5.6	C703	N/A	N/A
		NG1.SC.15 PP Audio type 2b (HATS 7 kHz handset)	5.6	C703	N/A	N/A
		NG1.SC.16 PP Audio type 2c (HATS 7 kHz improved handset)	5.6	C703	N/A	N/A
		NG1.SC.19 PP Audio type 4a (HATS 7 kHz handsfree)	5.6	O	N/A	N/A
		NG1.SC.20 PP Audio type 4b (HATS 7 kHz improved handsfree)	5.6	O	N/A	N/A
		NG1.SC.28 FP Audio type 4 (ISDN wideband)	5.6	N/A	C708	C708
		NG1.SC.29 FP Audio type 5 (VoIP wideband	5.6	N/A	C708	C708
		NG1.SC.30 NG1.SC.24 PP echo canceller for FP, wideband	5.6	N/A	C709	C709
		NG1.SC.31 NG1.SC.24 PP echo suppressor for FP, wideband	5.6	N/A	C709	C709
		NG1.SC.32 FP Audio type 6a (internal call)	5.6	N/A	C710	C710
		NG1.SC.33 FP Audio type 6b (internal conference)	5.6	N/A	O	O
		NG1.SC.34 Adaptive volume control	5.6	N/A	O	O

Service/DECT Feature mapping						
				Status		
Service	**IA**	**DECT feature/service**	**Reference**	**PT**	**FT**	
					R/B	**P**
NG1.5 Super-wideband 14 kHz MPEG-4 ER AAC-LD 64 kbit/s voice service	**I**		**5.1**	**O**	**O**	**O**
		NG1.P.1 2 level GFSK modulation	5.5	M	M	M
		NG1.P.3 Physical Packet P64	5.5	M	M	M
		NG1.M.2 I_N_normal_delay symmetric MAC service type	5.4	M	M	M
		NG1.M.4 Advanced Connections	5.4	M	M	M
		NG1.D.2 DLC Service LU1 Class 0	5.4	M	M	M
		NG1.D.5 DLC frame FU1	5.3	M	M	M
		NG1.SC.5 MPEG4 AAC-LD 64 kbit/s 14 kHz super-wideband codec	5.6	M	M	M
		NG1.SC.9 Codec selection and switching	5.6	M	M	M
		NG1.SC.21 PP Audio type 5a (Super-wideband 14 KHz handset)	5.6	M	N/A	N/A
		NG1.SC.22 PP Audio type 5b (Super-wideband 14 KHz handsfree)	5.6	O	N/A	N/A
		NG1.SC.28 FP Audio type 4 (ISDN wideband)	5.6	N/A	C708	C708
		NG1.SC.29 FP Audio type 5 (VoIP wideband	5.6	N/A	C708	C708
		NG1.SC.32 FP Audio type 6a (internal call)	5.6	N/A	C710	C710
		NG1.SC.33 FP Audio type 6b (internal conference)	5.6	N/A	O	O
		NG1.SC.34 Adaptive volume control for FP	5.6	N/A	O	O
NG1.5 Super-wideband 14 kHz MPEG-4 ER AAC-LD 64 kbit/s voice service	**II**		**5.1**	**O**	**O**	**O**
		NG1.P.1 2 level GFSK modulation	5.5	M	M	M
		NG1.P.3 Physical Packet P67	5.5	M	M	M
		NG1.M.3 I_{PQ}_error_detection symmetric MAC service type	5.4	M	M	M
		NG1.M.4 Advanced Connections	5.4	M	M	M
		NG1.D.2 DLC service LU1 Class 0	5.3	M	M	M
		NG1.D.5 DLC frame FU1	5.3	M	M	M
		NG1.SC.5 MPEG4 AAC-LD 64 kbit/s 14 kHz super-wideband codec	5.6	M	M	M
		NG1.SC.9 Codec selection and switching	5.6	M	M	M
		NG1.SC.21 PP Audio type 5a (Super-wideband 14 KHz handset)	5.6	M	N/A	N/A
		NG1.SC.22 PP Audio type 5b (Super-wideband 14 KHz handsfree)	5.6	O	N/A	N/A
		NG1.SC.28 FP Audio type 4 (ISDN wideband)	5.6	N/A	C708	C708
		NG1.SC.29 FP Audio type 5 (VoIP wideband	5.6	N/A	C708	C708
		NG1.SC.32 FP Audio type 6a (internal call)	5.6	N/A	C710	C710
		NG1.SC.33 FP Audio type 6b (internal conference)	5.6	N/A	O	O
		NG1.SC.34 Adaptive volume control for FP	5.6	N/A	O	O

Service/DECT Feature mapping						
				Status		
Service	**IA**	**DECT feature/service**	**Reference**	**PT**	**FT**	
					R/B	**P**
NG1.6 Wideband 11 kHz MPEG-4 ER AAC-LD 32 kbit/s voice service	**I**		**5.1**	**O**	**O**	**O**
		NG1.P.1 2 level GFSK modulation	5.5	M	M	M
		NG1.P.3 Physical Packet P32	5.5	M	M	M
		NG1.M.2 I_N_normal_delay symmetric MAC service type	5.4	M	M	M
		NG1.M.4 Advanced Connections	5.4	M	M	M
		NG1.D.2 DLC service LU1 Class 0	5.4	M	M	M
		NG1.D.5 DLC frame FU1	5.3	M	M	M
		NG1.SC.6 MPEG4 AAC-LD 32 kbit/s 11 kHz wideband codec	5.6	M	M	M
		NG1.SC.9 Codec selection and switching	5.6	M	M	M
		NG1.SC.14 PP Audio type 2a (ITU-T Recommendation P.311 [i.6] 7 kHz handset)	5.6	C703	N/A	N/A
		NG1.SC.15 PP Audio type 2b (HATS 7 kHz handset)	5.6	C703	N/A	N/A
		NG1.SC.16 PP Audio type 2c (HATS 7 kHz improved handset)	5.6	C703	N/A	N/A
		NG1.SC.19 PP Audio type 4a (HATS 7 kHz handsfree)	5.6	O	N/A	N/A
		NG1.SC.20 PP Audio type 4b (HATS 7 kHz improved handsfree)	5.6	O	N/A	N/A
		NG1.SC.28 FP Audio type 4 (ISDN wideband)	5.6	N/A	C708	C708
		NG1.SC.29 FP Audio type 5 (VoIP wideband	5.6	N/A	C708	C708
		NG1.SC.30 NG1.SC.24 PP echo canceller for FP, wideband	5.6	N/A	C709	C709
		NG1.SC.31 NG1.SC.24 PP echo suppressor for FP, wideband	5.6	N/A	C709	C709
		NG1.SC.32 FP Audio type 6a (internal call)	5.6	N/A	C710	C710
		NG1.SC.33 FP Audio type 6b (internal conference)	5.6	N/A	O	O
		NG1.SC.34 Adaptive volume control	5.6	N/A	O	O

IA = Implementation Alternative

C201: Advanced connections for Service NG1.1 shall only be used in the case of multiple connections between the same PT-FT pair. The support of this case is optional.

C702: At least one should be provided. Type 1a may produce echo issues in combination with VoIP or long delay networks. Types 1b, 1c or 1d are recommended.

C703: At least one should be provided. Type 2a may produce echo issues in combination with VoIP or long delay networks. Types 2b and 2c are recommended.

C706: At least one should be provided.

C707: IF feature NG1.SC.23 (FP type 1b) OR NG1.SC.27 (FP type 3) THEN O ELSE I. Either NG1.SC.24 or NG1.SC.25 may be provided, but not both at the same time.

C708: At least one should be provided.

C709: IF feature NG1.SC.28 (FP type 4) OR NG1.SC.29 (FP type 5) THEN O ELSE I. Either NG1.SC.30 or NG1.SC.31 may be provided, but not both at the same time.

C710: IF feature GAP.N.31 THEN M ELSE I.

6.4 NWK features

New Generation DECT wideband speech devices shall support the following Network layer features:

Table 3: NWK features status

Feature supported					
			Status		
Item no.	Name of feature	Reference	PT	FT	
				R/B	P
NG1.N.1	Codec Negotiation	5.2	M	M	M
NG1.N.2	Codec Switching	5.2	M	M	M
GAP.N.1	Outgoing call	4.1 [12]	M	M	M
GAP.N.2	Off hook	4.1 [12]	M	M	M
GAP.N.3	On hook (full release)	4.1 [12]	M	M	M
GAP.N.4	Dialled digits (basic)	4.1 [12]	M	M	M
GAP.N.5	Register recall (note 4 and note 5)	4.1 [12]	M	O	O
GAP.N.6	Go to DTMF signalling (defined tone length) (note 1)	4.1 [12]	M	O	M
GAP.N.7	Pause (dialling pause) (note 3)	4.1 [12]	M	O	O
GAP.N.8	Incoming call	4.1 [12]	M	M	M
GAP.N.9	Authentication of PP	4.1 [12]	M	O	M
GAP.N10	Authentication of user (note 2)	4.1 [12]	M	O	O
GAP.N.11	Location registration	4.1 [12]	M	O	M
GAP.N.12	On air key allocation (note 2)	4.1 [12]	M	O	O
GAP.N.13	Identification of PP	4.1 [12]	M	O	O
GAP.N.14	Service class indication/assignment	4.1 [12]	M	O	M
GAP.N.15	Alerting	4.1 [12]	M	M	M
GAP.N.16	ZAP (note 2)	4.1 [12]	M	O	O
GAP.N.17	Encryption activation FT initiated	4.1 [12]	M	O	M
GAP.N.18	Subscription registration procedure on-air	4.1 [12]	M	M	M
GAP.N.19	Link control	4.1 [12]	M	M	M
GAP.N.20	Terminate access rights FT initiated (note 2)	4.1 [12]	M	O	O
GAP.N.21	Partial release	4.1 [12]	O	O	O
GAP.N.22	Go to DTMF (infinite tone length)	4.1 [12]	O	O	O
GAP.N.23	Go to Pulse	4.1 [12]	O	O	O
GAP.N.24	Signalling of display characters	4.1 [12]	O	O	O
GAP.N.25	Display control characters	4.1 [12]	O	O	O
GAP.N.26	Authentication of FT	4.1 [12]	O	O	O
GAP.N.27	Encryption activation PT initiated	4.1 [12]	O	O	O
GAP.N.28	Encryption deactivation FT initiated	4.1 [12]	O	O	O
GAP.N.29	Encryption deactivation PT initiated	4.1 [12]	O	O	O
GAP.N.30	Calling Line Identification Presentation (CLIP)	4.1 [12]	M	M	M
GAP.N.31	Internal call	4.1 [12]	O	O	O
GAP.N.32	Service call	4.1 [12]	O	O	O
GAP.N.33	Enhanced U- plane connection	4.1 [12]	O	O	O
GAP.N.34	Calling Name Identification Presentation (CNIP)	4.1 [12], F.1.2.1	O	O	O

NOTE 1: The PT is only required to be able to send the <<MULTI-KEYPAD>> information element containing the DECT standard 8-bit character (EN 300 175-5 [5], annex D) codings "Go to DTMF", defined tone length and the FT is required to be able to understand it in the public environment.
NOTE 2: This feature is required to be supported in the PT to guarantee the same level of security among all the handsets that operates in a system. The invocation of the feature is however optional to the operator.
NOTE 3: The PT is required to be able to send the <<MULTI-KEYPAD>> information element containing the DECT standard 8-bit character (EN 300 175-5 [5], annex D) codings "Dialling Pause". This guarantees automatic access to secondary or alternative networks.
NOTE 4: This feature uses keypad code 15 hex.
NOTE 5: The FT is not mandated to receive and understand the register recall DECT character. However, if a FT supports it there may be no corresponding action that the FT can take with the local network as a result of this function.

6.5 Data Link Control (DLC) services

New Generation DECT wideband speech devices shall support the following DLC services.

Table 4: DLC services status

Service supported					
			Status		
Item no.	Name of service	Reference	PT	FT	
				R/B	P
NG1.D.1	LU1 Transparent UnProtected service (TRUP) Class 0 /minimum_delay	5.3	M	M	M
NG1.D.2	LU1 Transparent UnProtected service (TRUP) Class 0	5.3	C401	C401	C401
NG1.D.3	LU7 64 kbit/s protected bearer service	5.3	C401	C401	C401
NG1.D.4	LU 12 Unprotected Framed service (UNF) Class 0	5.3	C401	C401	C401
NG1.D.5	FU1 DLC frame	5.3	M	M	M
NG1.D.6	FU7 DLC frame	5.3	C401	C401	C401
NG1.D.7	FU12 DLC frame with adaptation for codec G.729.1	5.3	C401	C401	C401
GAP.D.1	LAPC class A service and Lc	5.1 [12]	M	M	M
GAP.D.2	C_S channel fragmentation and recombination	5.1 [12]	M	M	M
GAP.D.3	Broadcast Lb service	5.1 [12]	M	M	M
GAP.D.4	Intra-cell voluntary connection handover	5.1 [12]	M	C402	C402
GAP.D.5	Intercell voluntary connection handover (note)	5.1 [12]	M	O	O
GAP.D.6	Encryption activation	5.1 [12]	M	C404	M
GAP.D.7	Encryption deactivation	5.1 [12]	C403	C403	C403
NOTE:	The PT is required to be able to support handover between RFPs. The invocation of the feature is however optional to the operator.				
C401:	Status defined by clause 6.3, table 2.				
C402:	IF service GAP.M.9 THEN O ELSE M.				
C403:	IF feature GAP.N.29 OR GAP.N.28 THEN M ELSE I.				
C404:	IF feature GAP.N.17 OR GAP.N.27 THEN M ELSE I.				

6.6 Medium Access Control (MAC) services

New Generation DECT wideband speech devices shall support the following MAC layer services.

Table 5: MAC services status

Service supported					
			Status		
Item no.	Name of service	Reference	PT	FT	
				R/B	P
NG1.M.1	I_N_minimum delay symmetric MAC service type	5.4	M	M	M
NG1.M.2	I_N_normal delay symmetric MAC service type	5.4	C501	C501	C501
NG1.M.3	I_{PQ}_error_detection symmetric MAC service type	5.4	C501	C501	C501
NG1.M.4	Advanced connections	5.4	M	M	M
GAP.M.1	General	5.2 [12]	M	M	M
GAP.M.2	Continuous broadcast	5.2 [12]	M	M	M
GAP.M.3	Paging broadcast	5.2 [12]	M	M	M
GAP.M.4	Basic connections	5.2 [12]	M	M	M
GAP.M.5	C_S higher layer signalling	5.2 [12]	M	M	M
GAP.M.6	Quality control	5.2 [12]	M	M	M
GAP.M.7	Encryption activation	5.2 [12]	M	C505	M
GAP.M.8	Extended frequency allocation (note)	5.2 [12]	M	O	O
GAP.M.9	Bearer Handover, intra-cell	5.2 [12]	M	C502	C502
GAP.M.10	Bearer Handover, inter-cell	5.2 [12]	M	O	O
GAP.M.11	Connection Handover, intra-cell	5.2 [12]	M	C503	C503
GAP.M.12	Connection Handover, inter-cell	5.2 [12]	M	O	O
GAP.M.13	SARI support	5.2 [12]	M	O	O
GAP.M.14	Encryption deactivation	5.2 [12]	C504	C504	C504
NOTE: Handsets not supporting these extra frequencies need only adapt scanning to allow continued use of the standard DECT frequencies.					
C501: Status defined by clause 6.3, table 2. C502: IF service GAP.M.11 THEN O ELSE M. C503: IF service GAP.M.9 THEN O ELSE M. C504: IF feature GAP.N.29 OR GAP.N.28 THEN M ELSE I. C505: IF feature GAP.N.17 OR GAP.N.27 THEN M ELSE I.					

6.7 Physical layer (PHL) services

New Generation DECT wideband speech devices shall support the following Physical layer (PHL) services.

Table 6: PHL services status

Service supported					
			Status		
Item no.	Name of service	Reference	PT	FT	
				R/B	P
NG1.P.1	2 level GFSK modulation	5.5	M	M	M
NG1.P.2	Physical Packet P32	5.5	M	M	M
NG1.P.3	Physical Packet P64	5.5	M	M	M
NG1.P.4	Physical Packet P67	5.5	O	O	O
NG1.P.5	Physical Packet P80	5.5	O	O	O

The requirements of EN 300 444 [12] clause 11 also apply.

6.8 Speech coding and audio features

New Generation DECT wideband speech devices shall support the following Speech codecs and related services.

Table 7: Speech Codecs

Feature supported					
			Status		
Item no.	Name of feature	Reference	PT	FT	
				R/B	P
NG1.SC.1	G.726 32 kbit/s ADPCM codec	5.6	M	M	M
NG1.SC.2	G.711 64 kbit/s PCM codec	5.6	C701	C701	C701
NG1.SC.3	G.722 64 kbit/s 7 kHz wideband codec	5.6	M	M	M
NG1.SC.4	G.729.1 32 kbit/s 7 kHz wideband codec	5.6	C701	C701	C701
NG1.SC.5	MPEG4 AAC-LD 64 kbit/s 14 kHz super-wideband codec	5.6	C701	C701	C701
NG1.SC.6	MPEG4 AAC-LD 32 kbit/s 11 kHz wideband codec	5.6	C701	C701	C701
NG1.SC.7	Packet loss Concealment (PLC) for G.722	5.6	C701	C701	C701
NG1.SC.8	Detection of Fax/modem tone	5.6	C701	C701	C701
NG1.SC.9	Codec selection and switching	5.6	M	M	M
NG1.SC.10	PP Audio type 1a (classic GAP handset)	5.6	C702	N/A	N/A
NG1.SC.11	PP Audio type 1b (improved GAP handset)	5.6	C702	N/A	N/A
NG1.SC.12	PP Audio type 1c (HATS 3,1 kHz handset)	5.6	C702	N/A	N/A
NG1.SC.13	PP Audio type 1d (HATS 3,1 kHz improved handset)	5.6	C702	N/A	N/A
NG1.SC.14	PP Audio type 2a (ITU-T Recommendation P.311 [i.6] 7 kHz handset)	5.6	C703	N/A	N/A
NG1.SC.15	PP Audio type 2b (HATS 7 kHz handset)	5.6	C703	N/A	N/A
NG1.SC.16	PP Audio type 2c (HATS 7 kHz improved handset)	5.6	C703	N/A	N/A
NG1.SC.17	PP Audio type 3a (HATS 3,1 kHz handsfree)	5.6	O	N/A	N/A
NG1.SC.18	PP Audio type 3b (HATS 3,1 kHz improved handsfree)	5.6	O	N/A	N/A
NG1.SC.19	PP Audio type 4a (HATS 7 kHz handsfree)	5.6	O	N/A	N/A
NG1.SC.20	PP Audio type 4b (HATS 7 kHz improved handsfree)	5.6	O	N/A	N/A
NG1.SC.21	PP Audio type 5a (super-wideband 14 kHz) handset	5.6	C704	N/A	N/A
NG1.SC.22	PP Audio type 5b (super-wideband 14 kHz) handsfree	5.6	C705	N/A	N/A
NG1.SC.23	FP Audio type 1b (new ISDN 3,1 kHz)	5.6	N/A	C706	C706
NG1.SC.24	PP echo canceller for FP, narrowband	5.6	N/A	C707	C707
NG1.SC.25	PP echo suppressor for FP, narrowband	5.6	N/A	C707	C707
NG1.SC.26	FP Audio type 2 (analog PSTN 3,1 kHz)	5.6	N/A	C706	C706
NG1.SC.27	FP Audio type 3 (VoIP 3,1 kHz)	5.6	N/A	C706	C706
NG1.SC.28	FP Audio type 4 (ISDN wideband)	5.6	N/A	C708	C708
NG1.SC.29	FP Audio type 5 (VoIP wideband)	5.6	N/A	C708	C708
NG1.SC.30	PP echo canceller for FP, wideband	5.6	N/A	C709	C709
NG1.SC.31	PP echo suppressor for FP, wideband	5.6	N/A	C709	C709
NG1.SC.32	FP Audio type 6a (internal call)	5.6	N/A	C710	C710
NG1.SC.33	FP Audio type 6b (internal conference)	5.6	N/A	O	O
NG1.SC.34	Adaptive volume control for FP	5.6	N/A	O	O

C701: Status defined by clause 6.3, table 2.
C702: At least one should be provided. Type 1a may produce echo issues in combination with VoIP or long delay networks. Types 1b, 1c or 1d are recommended.
C703: At least one should be provided. Type 2a may produce echo issues in combination with VoIP or long delay networks. Types 2b and 2c are recommended.
C704: IF Service NG1.5 (Super-wideband) THEN M ELSE I.
C705: IF Service NG1.5 (Super-wideband) THEN O ELSE I.
C706: At least one should be provided.
C707: IF feature NG1.SC.23 (FP type 1b) OR NG1.SC.27 (FP type 3) THEN O ELSE I. Either NG1.SC.24 or NG1.SC.25 may be provided, but not both at the same time.
C708: At least one should be provided.
C709: IF feature NG1.SC.28 (FP type 4) OR NG1.SC.29 (FP type 5) THEN O ELSE I. Either NG1.SC.30 or NG1.SC.31 may be provided, but not both at the same time.
C710: IF feature GAP.N.31 THEN M ELSE I.

NOTE 1: Testing specification for audio features, including handsfree, is provided in EN 300 176-2 [10].

NOTE 2: PP types 1c, 1d, 2b and 2c are based on HATS methodology. This methodology provides objective test results more consistent with subjective tests compared to artificial ear methodology.

6.9 Application features

New Generation DECT wideband speech devices shall support the following Application features.

Table 8: Application features status

Feature supported					
			Status		
Item no.	Name of feature	Reference	PT	FT	
				R/B	P
GAP.A.1	AC_bitstring_mapping	4.2 [12]	M	C801	M
GAP.A.2	Multiple subscription registration	4.2 [12]	M	N/A	N/A
GAP.A.3	Manual entry of the PARK	4.2 [12]	O	N/A	N/A
GAP.A.4	Terminal identity number assignment in mono cell system	4.2 [12]	O	O	N/A
C801:	IF feature GAP.N.9 OR GAP.N.10 OR GAP.N.12 OR GAP.N.26 THEN M ELSE N/A.				

6.10 Network (NWK) feature to procedure mapping

The NWK features to procedure mapping of EN 300 444 [12] (GAP), clause 6.7 apply with the following changes and additional features.

Table 9: NWK feature to procedure mapping

Feature/Procedure mapping					
			Status		
Feature	Procedure	Reference	PT	FT	
				R/B	P
NG1.N.1 Codec Negotiation		5.2	M	M	M
	Exchange of codec list during registration and location registration	7.3.1	M	M	M
	Basic service wideband speech and default attributes	7.3.2	M	M	M
	Codec Negotiation during call establishment	7.3.3	M	M	M
NG1.N.2 Codec Switching		5.2	M	M	M
	Codec Change	7.3.4	M	M	M
	Slot type modification	7.3.5	M	M	M
	MAC layer advanced connection slot type modification	7.6.5	M	M	M
	MAC layer connection type modification: basic to/from advanced	7.6.6	M	M	M
GAP.N.11 Location registration		4.1 [12]	M	O	M
	Location registration	8.28 [12]	M	M	M
	Location update	8.29 [12]	M	O	O
	Terminal Capability indication	7.3.7	M	M	M
GAP.N.14 Service class indication/assignment		4.1 [12]	M	O	M
	Obtaining access rights	8.30 [12]	M	M	M
	Terminal Capability indication	7.3.7	M	M	M
	Authentication of PT	8.24 [12]	M	M	M
GAP.N.16 ZAP		4.1 [12]	M	O	O
	Obtaining access rights	8.30 [12]	M	M	M
	Terminal Capability indication	7.3.7	M	M	M
	Incrementing the ZAP value	8.26 [12]	M	M	M
	Terminal Capability indication	7.3.7	M	M	M
GAP.N.18 Subscription registration user procedure on-air		4.1 [12]	M	M	M
	Obtaining access rights	8.30 [12]	M	M	M
	Terminal Capability indication	7.3.7	M	M	M

Feature/Procedure mapping					
			Status		
Feature	Procedure	Reference	PT	FT	
				R/B	P
GAP.N.19 Link control		4.1 [12]	M	M	M
	Indirect FT initiated link establishment	7.3.8	M	M	M
	Direct PT initiated link establishment	8.36 [12]	M	M	M
	Link release "normal"	8.37 [12]	M	M	M
	Link release "abnormal"	8.38 [12]	M	M	M
	Link release "maintain"	8.39 [12]	M	M	M
GAP.N.24 Signalling of display characters		4.1 [12]	O	O	O
	Display	8.16 [12]	M	M	M
	Terminal capability indication	7.3.7	M	M	M
GAP.N.25 Display control characters		4.1 [12]	O	O	O
	Display	8.16 [12]	M	M	M
	Terminal capability indication	7.3.7	M	M	M
GAP.N.31 Internal Call		4.1 [12]	O	O	O
	Internal call setup	7.3.6	M	M	M
	Internal call keypad	8.19 [12]	M	O	O
	Internal call CLIP	8.43 [12]	O	O	O
	Internal call CNIP	8.44 [12]	O	O	O

6.11 Data Link Control (DLC) Service to procedure mapping

The DLC service to procedure mapping of EN 300 444 [12] (GAP), clause 6.8.1 apply with the following changes and additional services.

Table 10: DLC service to procedure mapping

Service/Procedure mapping					
			Status		
Service	Procedure	Reference	PT	FT	
				R/B	P
NG1.D.1 LU1 Transparent UnProtected service (TRUP) Class 0/minimum_delay		5.3	M	M	M
	LU1 Transparent UnProtected service (TRUP) operation	11.2 [4]	M	M	M
	Class 0: No Lu_x retransmission or sequencing	14.2.3.1 [4]	M	M	M
	Class 0 procedures	14.3.2 [4]	M	M	M
	Minimum delay (speech) operation	14.2.3 [4]	M	M	M
	LLME U-plane establishment	9.9.1 [12]	M	M	M
NG1.D.2 LU1 Transparent UnProtected service (TRUP) Class 0		5.3	C401	C401	C401
	LU1 Transparent UnProtected service (TRUP) operation	11.2 [4]	M	M	M
	Class 0: No Lu_x retransmission or sequencing	14.2.3.1 [4]	M	M	M
	Class 0 procedures	14.3.2 [4]	M	M	M
	LLME U-plane establishment	9.9.1 [12]	M	M	M
NG1.D.3 LU7 64 kbit/s protected bearer service		5.3	C401	C401	C401
	LU7 DLC layer service	11.9.4 [4]	M	M	M
NG1.D.4 LU12 LU 12 Unprotected Framed service (UNF) Class 0		5.3	C401	C401	C401
	LU12 UNprotected Framed service (UNF) operation	11.14 [4]	M	M	M
	Class 0: No Lu_x retransmission or sequencing	14.2.3.1 [4]	M	M	M
	Class 0 procedures	14.3.2 [4]	M	M	M
	LLME U-plane establishment	9.9.1 [12]	M	M	M
NG1.D.5 FU1 DLC frame		5.3	M	M	M
	FU1 frame operation	7.5.1	M	M	M
	FU1 frame structure	12.2 [4]	M	M	M
NG1.D.6 FU7 DLC frame		5.3	C401	C401	C401
	FU7 frame structure	11.9.4.2 [4]	M	M	M

Service/Procedure mapping					
			Status		
Service	Procedure	Reference	PT	FT	
				R/B	P
NG1.D.7 FU12 DLC frame with adaptation for codec G.729.1		5.3	C401	C401	C401
	FU12 frame structure	12.12 [4]	M	M	M
	Annex for codec G.729.1 [18]	E.1 [4]	M	M	M
	FU12 frame operation	7.5.2	M	M	M

6.12 Medium Access Control (MAC) service to procedure mapping

The MAC service to procedure mapping of EN 300 444 [12] (GAP), clause 6.8.2 apply with the following changes and additional services.

Table 11: MAC service to procedure mapping

Service/Procedure mapping					
		Status			
Service	Procedure	Reference	PT	FT	
				R/B	P
NG1M.1 I_N_minimum delay symmetric MAC service type		5.4	M	M	M
	MAC layer procedures: general	7.9.1	M	M	M
	MAC Connection oriented service	5.6 [3]	M	M	M
	MAC Basic connection	5.6.1.1 [3]	M	M	M
	MAC Advanced connection	5.6.1.2 [3]	M	M	M
	I_N_minimum delay symmetric MAC service, type 1	5.6.2.1 [3]	M	M	M
NG1.M.2 I_N_normal delay symmetric MAC service type		5.4	O	O	O
	MAC layer procedures: general	7.9.1	M	M	M
	MAC Connection oriented service	5.6 [3]	M	M	M
	MAC Basic connection	5.6.1.1 [3]	M	M	M
	MAC Advanced connection	5.6.1.2 [3]	M	M	M
	I_N_normal delay symmetric MAC service type 2	5.6.2.1 [3]	M	M	M
NG1.M.3 I_{PQ}_error_detection symmetric MAC service type		5.4	O	O	O
	MAC layer procedures: general	7.9.1	M	M	M
	MAC Connection oriented service	5.6 [3]	M	M	M
	MAC Basic connection	5.6.1.1 [3]	M	M	M
	MAC Advanced connection	5.6.1.2 [3]	M	M	M
	I_P_error_detection symmetric MAC service type 3	5.6.2.1 [3]	M	M	M
	Single-subfield protected format	6.2.1.3.4 [3]	M	M	M

Service/Procedure mapping					
		Status			
Service	Procedure	Reference	PT	FT	
				R/B	P
NG1.M.4 Advanced connections		5.4	M	M	M
	Setup of advanced connection, bearer setup (A-field)	7.6.5	M	M	M
	Connection type modification: basic to/from advanced	7.6.6	M	M	M
	Slot type modification	7.6.7	M	M	M
	Service type modification	7.6.8	C1101	C1101	C1101
	ECN number modification	7.6.9	C1102	C1102	C1102
	Connection/bearer release	7.6.10	M	M	M
GAP.M.2 Continuous broadcast		5.2 [12]	M	M	M
	Downlink broadcast	7.6.3	M	M	M
	Higher Layer information FP broadcast	7.3.9	M	M	M
GAP.M.3 Paging broadcast		5.2 [12]	M	M	M
	Paging broadcast	7.6.4	M	M	M
GAP.M.9 Bearer handover, intra-cell		5.2 [12]	M	C502	C502
	Bearer handover request	7.6.11	M	M	M
GAP.M.10 Bearer handover, inter-cell		5.2 [12]	M	O	O
	Bearer handover request	7.6.11	M	M	M
GAP.M.11 Connection handover, intra-cell		5.2 [12]	M	C503	C503
	Connection handover request	7.6.12	M	M	M
GAP.M.12 Connection handover, inter-cell		5.2 [12]	M	O	O
	Connection handover request	7.6.12	M	M	M
GAP.M.13 SARI support		5.2 [12]	M	O	O
	Downlink broadcast	7.6.3	M	M	M
	Higher Layer information FP broadcast	7.3.9	M	M	M
C502: IF service GAP.M.11 THEN O ELSE M. C503: IF service GAP.M.9 THEN O ELSE M. C1101: IF service NG1.4 OR NG1.5 OR NG1.6 OR NG1.2 IA II OR NG1.2 IA III THEN M ELSE O. C1102: IF multiple connection between the same PT-FT pair THEN M ELSE O					

6.13 Application feature to procedure mapping

The Application feature to procedure mapping of EN 300 444 [12] (GAP), clause 6.8.3 shall apply.

6.14 General requirements

6.14.1 Network (NWK) layer message contents

All reserved single bits shall be set to 0.

6.14.2 Transaction identifier

The transaction identifier value for a CC call shall always get assigned the lowest available free number.

6.14.3 Length of a Network (NWK) layer message

PP and the FP shall be capable of receiving and processing NWK layer messages of at least 63 octets long. All mandatory information elements as defined in the present document shall be included in the first 63 octets.

This requires only one DLC segment to be supported as mandatory. The DLC shall convey the first segment of a layer 3 message to the NWK layer. Additional segments of a layer 3 message may be discarded by the receiving side, (see clause 9.2.3 of EN 300 444 [12]).

6.14.4 Handling of error and exception conditions

If a MM message, requesting initiation of a MM procedure, is received in a CC state where the receiving entity is not required to support it and does not support it, this message shall be ignored.

Whenever an unexpected CC message, except {CC-RELEASE} or {CC-RELEASE-COM}, or an unrecognized message is received in any CC state, the message shall be ignored.

When a message other than {CC-SETUP}, {CC-RELEASE} or {CC-RELEASE-COM} is received which has one or more mandatory information elements missing or with invalid content, the normal release procedure as described in clause 8.7 shall be invoked.

EN 300 175-5 [5], clause 17.6.4 shall also apply to mandatory information elements in MM messages with a length exceeding the allowed maximum value.

The usage of a reserved value in an information element field shall not by itself constitute an error. The receiver of such a value shall process the value if it understands it or shall ignore it otherwise.

In all other cases the rules and order of precedence specified in EN 300 175-5 [5], clause 17, shall be obeyed.

6.14.5 Generic Access Profile (GAP) default setup attributes

The <<IWU-ATTRIBUTES>> and <<CALL-ATTRIBUTES>> information elements are not required to be understood by a "GAP" equipment. The values, as stated in EN 300 175-5 [5], annex E shall be considered as default. The value "1" of the field <Network layer attributes> in <<CALL-ATTRIBUTES>> shall be interpreted as indicating "Generic Access Profile (GAP)".

6.14.6 Coexistence of Mobility Management (MM) and Call Control (CC) procedures

Table 12 below describes whether a MM procedure is supported in any CC state or whether a restriction applies. The restriction has been made in order to limit the complexity of the receiving side so that it is not mandated to understand MM messages in all CC states for the purpose of achieving inter-operability.

Table 12: Support of MM procedures in CC states

Procedure	Mandatory support in CC state
Identification of PT	All states
Authentication of FT	All states
Authentication of PT	All states
Authentication of user	All states
Location registration	All states
Location update	All states
Obtaining access rights	T(F)-00
FT terminating access rights	F(T)-00, T-01, T-10
Key allocation	F(T)-00
Cipher-switching initiated by FT	All states
Cipher switching initiated by PT	All states

The CC and MM entities may work independently one from the other. If a FT decides to perform a MM procedure prior to proceeding with a PT initiated CC procedure, the FT has the rights to restart the CC timers in the PT to prevent the CC state machine from waiting on a response delayed because of the MM procedure execution. For this purpose the FT may send a {CC-NOTIFY} message. The support of this message is mandatory for the PT and optional for the FT. The {CC-NOTIFY} shall include the <<TIMER-RESTART>> information element.

6.14.7 Coding rules for information elements

For mandatory information elements, at least the first octet within any octet group shall be present. It is not permitted to use the information element field <Length of Contents> to omit an octet group. However, if explicitly stated a mandatory information element may contain zero length contents.

7 Procedure description

The following clauses define the process mandatory procedures which are in the scope of the New Generation DECT wideband speech. Each procedure (if appropriate) is divided into three parts:

a) normal (i.e. successful) case(s). This part defines the functions and respective protocol element values in normal operation;

b) associated procedure(s). This is an integral part of the actual procedure (if defined in the present document), i.e. if a procedure is being declared to be supported, the respective entity shall also support the associated procedures, e.g. timer management, in the clause following the description of the normal case;

c) exceptional case(s). This is an integral part of the actual procedure (if defined in the present document), i.e. if a procedure is being declared to be supported, the respective entity shall also support the exception handling defined in the clause following the description of the normal case.

All protocol elements listed in the following clauses are process mandatory, i.e. the FT and PT depending on their role in the procedure shall send or shall receive and process the relevant protocol elements as listed in the respective tables if not explicitly stated as being optional.

The primitives used in procedure descriptions are defined only for the purpose of describing layer-to-layer interactions. The primitives are defined as an abstract list of parameters, and their concrete realization may vary between implementations. No formal testing of primitives is intended. The primitive definitions have no normative significance.

7.1 Backward compatibility with Generic Access Profile (GAP)

7.1.1 Requirement for New Generation DECT Fixed Parts (FPs) requirement

New Generation DECT Fixed Parts shall support all GAP [12] standard mandatory procedures (basic connections, full slot and ITU-T Recommendation G.726 [15]). In other words, they shall inter-operate with GAP compliant Portable Parts (PPs).

7.1.2 Requirement for New Generation DECT Portable Parts (PPs) registered on GAP compliant FPs

The PPs shall use GAP [12] standard procedures (full slot and ITU-T Recommendation G.726 [15]) in front of GAP compliant FPs. In other words, they shall inter-operate with GAP compliant FPs.

7.2 Generic Access Profile (GAP) procedures

Unless otherwise noted, all procedures defined in EN 300 444 [12] (GAP) are automatically applicable to New Generation DECT wideband speech. Therefore New Generation DECT wideband speech can be considered an extension of GAP.

The following clauses describe the additional procedures specific for New Generation DECT wideband speech.

7.3 Network (NWK) layer procedures

This clause specifies the additional NWK layer procedures, messages and information elements required in New Generation DECT wideband speech not described in EN 300 444 [12] (GAP), or incorporating modifications to the GAP specification.

This profile does not prevent any PT or FT from transmitting or receiving and processing any other NWK layer message or information element not specified in the profile. A PT or FT receiving an unsupported NWK layer message or information element, which it does not recognize, shall ignore it, as specified in EN 300 175-5 [5], clause 17.

7.3.1 Exchange of codec list during registration and location registration

Equipment supporting New Generation DECT wideband speech shall add the IE << CODEC-LIST>> indicating the supported codecs in the following messages:

{ACCESS-RIGHTS-REQUEST}, {ACCESS-RIGHTS-ACCEPT}

{LOCATE-REQUEST}, {LOCATE-ACCEPT}

The IE << CODEC-LIST>> shall contain at least ITU-T Recommendation G.722 [17] and ITU-T Recommendation G.726 [15] codecs.

The transmitting side shall always indicate "Codec Negotiation possible" (value "001") in the IE <<CODEC LIST>>.

7.3.2 Basic service wideband speech and default attributes

The attribute "wideband speech default" in Information Element <<Basic Service>> indicates that the default setup attributes for wideband speech shall be valid as indicated in clause E.2 of EN 300 175-5 [5], and that the mechanism for codec negotiation as described in clause 7.3.3 of the present document are valid.

7.3.3 Codec Negotiation during call establishment

Equipment supporting New Generation DECT wideband voice shall support the codec negotiation as described in the following.

A CC-SETUP that offers more codecs than ITU-T Recommendation G.726 [15] shall contain the basic service "wideband speech default setup attributes", instead of the basic service "basic speech default setup attributes".

The IE <<CODEC-LIST>> may be added in CC-SETUP if a new list of codec is needed on a call by call basis. This may be useful when requesting a new codec (codec different from the location/registration phase) or changing the priorities within the list of codecs. The IE << CODEC-LIST>> shall contain at least ITU-T Recommendation G.722 [17] and ITU-T Recommendation G.726 [15] codecs.

Sending the IE <<CODEC-LIST>> in CC-SETUP is not necessary in case the most recent list sent during registration/location registration is still the valid one.

The receiving side chooses the codec in a response message, which does not have to be the first response message. The codec has at latest to be chosen in a CC-INFO that connects the U-Plane using the IE <<PROGRESS-INDICATOR>> or with CC-CONNECT. The response message which chooses the codec uses the same IE <<CODEC-LIST>>, but only one codec shall be in the list.

The IEs <<IWU-attributes>>, <<CALL-attributes>> and <<CONNECTION-attributes>> shall not be used in the CC-SETUP or in the response message.

After a codec was chosen, the call initiating side initiates a slot type modification at MAC layer if necessary.

In the case where the slot type modification is necessary and fails, the initiating side shall switch to a mandatory codec supporting the current slot format and indicate so by sending {IWU-INFO} including the IE <<CODEC-LIST>> with the required codec. On receiving this message, the receiving side shall also switch back to the required codec and indicate so by sending {IWU-INFO} including the IE <<CODEC-LIST>> with the required codec.

In the case where no slot type modification is necessary or the slot type modification is successful, {IWU-INFO} messages are not exchanged.

The transmitting side shall always indicate "Codec Negotiation possible" (value "001") in the IE <<CODEC LIST>>.

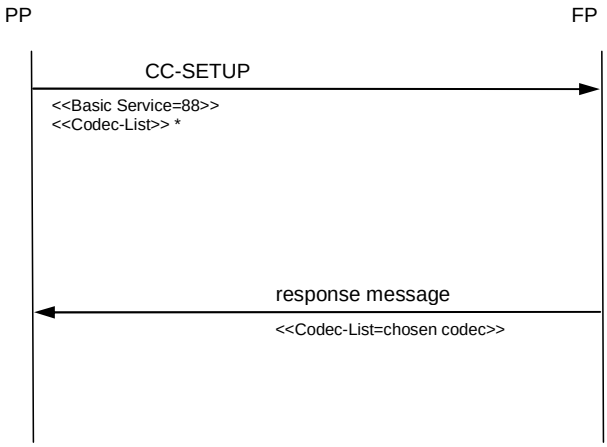


Figure 4: Codec Negotiation during call setup

7.3.4 Codec Change

Equipment supporting New Generation DECT wideband voice shall support the codec change as described in the following during call establishment after the codec negotiation is finished and in CC-state ACTIVE.

To switch the codec the initiating side sends a CC-SERVICE-CHANGE including the IE<<CODEC-LIST>> and the IE<<SERVICE-CHANGE-INFO>>.

The IE <<CODEC-LIST>> shall contain only one codec.

The IE <<SERVICE-CHANGE-INFO>> shall indicate that an audio codec change is attempted and that the sending side is master of the change.

The receiving side shall either accept or reject the change.

Both CC-SERVICE-ACCEPT and CC-SERVICE-REJECT shall not contain the IE <<CODEC-LIST>>.

In case the change is accepted, the initiator of the service change also initiates a slot type modification at MAC layer if necessary.

Having switched to the new codec and performed slot type modification if necessary, both sides shall indicate so by sending {IWU-INFO} including the IE <<CODEC-LIST>> with the new codec.

In case the slot type modification fails the initiating side shall switch back to the old codec and indicate so by sending {IWU-INFO} including the IE <<CODEC-LIST>> with the old codec. On receiving this message, the receiving side shall also switch back to the old codec and indicate so by sending {IWU-INFO} including the IE <<CODEC-LIST>> with the old codec.

Each side shall mute its receiving path at sending/receiving CC-SERVICE-ACCEPT.

Receiving {IWU-INFO} shall be a trigger for each side that it may unmute its receiving path.

{IWU-INFO} shall also be sent in case the service change is performed before CONNECT, although the U-Plane will not be connected before CONNECT.

The service change for audio codec change is always followed with sending {IWU-INFO} from both sides. A new service change shall not be initiated until both sides have sent {IWU-INFO}.

The transmitting side shall always indicate "Codec Negotiation possible" (value "001") in the IE <<CODEC LIST>>.

7.3.4.1 Service change info

In order to change the codec, the value "Audio Change codec" (see clause 7.7.38 of EN 300 175-5 [5]) shall be inserted in the IE <<Service Change Info>>.

7.3.5 Slot type modification

If the codec change requires a modification in the slot type, the MAC slot change procedure shall be executed as described in EN 300 175-3 [3], clause 10.3.2.

The initiating side of the Network Layer procedure shall also initiate the slot type modification at MAC layer in order to change the audio codec.

7.3.5.1 Failure of slot type modification

On failure of the slot type modification the initiating side shall not release the call but switch back to the previously active codec and indicate so to the receiving side by sending {IWU-INFO} including the IE <<CODEC-LIST>> with the old codec. On receiving this message, the receiving side shall also switch back to the old codec and indicate so by sending {IWU-INFO} including the IE <<CODEC-LIST>> with the old codec.

This can happen both after Service Negotiation and after Service Change. After Service Change the previously active codec shall be restored. After Service Negotiation a mandatory codec shall be used fitting to the previous slot format.

7.3.6 Internal call setup

NOTE 1: This procedure description replaces clause 8.18 of EN 300 444 [12] (GAP).

The following text together with the associated clauses define the mandatory requirements with regard to the present document.

For the initiation of this procedure the "outgoing call request" procedure defined in GAP (clause 8.2 of EN 300 444 [12]) shall be used, with the following replacement to the {CC-SETUP} message.

Table 13: Values used within the outgoing {CC-SETUP} message for internal call

Information element	Field within the information element	Standard values within the field/information element	Normative action/comment
<<Basic service>>	<Call class>	9	Internal call

For the termination of this procedure the "incoming call request" procedure defined in GAP (clause 8.12 of [12]) shall be used.

However, if the Portable Part is an NG DECT PP, the NG DECT FP shall use the following replacement to the {CC-SETUP} message.

Table 14: Values used within the incoming {CC-SETUP} message to a New Generation DECT PP for internal call

Information element	Field within the information element	Standard values within the field/information element	Normative action/comment
<<Basic service>>	<Call class>	9	Internal call

NOTE 2: A New Generation DECT PP is identified by the support in the "Terminal capability indication" procedure (clause 7.3.5).

For backward compatibility reasons, New Generation DECT FPs shall use the "external call" call class if the PP is a GAP PP.

NOTE 3: A New Generation DECT PP is identified by the support in the "Terminal capability indication" procedure (clause 7.3.5).

7.3.7 Terminal capability indication

NOTE: This procedure description replaces clause 8.17 of EN 300 444 [12] (GAP).

The PP shall be able to send the <<Terminal capability>> information element and the FP shall be able to receive it at least in {ACCESS-RIGHTS-REQUEST} and when location registration is supported in the {LOCATE-REQUEST}. The following text together with the associated clauses define the mandatory requirements with regard to the present document.

Table 15: Values used within the <<TERMINAL CAPABILITY>> information element

Information element	Field within the information element	Standard values within the field/information element	Normative action/comment
<<Terminal capability>>			
	<Tone capability>	All	
	<Display capability>	All	If PT supports feature (GAP.N.24) it shall indicate in this field value which is equal to or higher than 2
	Echo parameters	[1, 2, 3]	See note
	Slot type capability	All	See note
	Ambient noise Rejection (N-REJ)	[1, 2]	See note
	Adaptive volume control (A-VOL)	[1, 2 , 3]	See note
	<Profile indicator_1>	"xxxxx1x"B	GAP and/or PAP supported
	<Profile indicator_7>	"xxxxx1x"B	New Generation DECT Wideband speech supported
	<Control codes>	All	If PT supports feature (GAP.N.25) it shall indicate in this field value which is equal to or higher than 2
NOTE: This capability is assumed as the default value (see table 16) if the <<TERMINAL-CAPABILITY>> information element is omitted.			

The capabilities in table 16 shall be assumed as default if the following fields in the <<TERMINAL CAPABILITY>> information element are not present.

Table 16: Values assumed as terminal capabilities

Information element	Field within the information element	Standard values within the field/information element	Normative action/comment
<<Terminal capability>>			
	<Echo parameters>	1	Minimum Telephone Coupling Loss (TCL) (> 34 dB)
	<N-REJ>	1	No noise rejection
	<A-VOL>	1	No PP adaptive volume control
	<Slot type capability>	"xxx1x1x"B	Full slot and Long slot (j=640) supported

No echoing of characters is allowed in the FT and therefore the PT would be responsible for displaying dialled digits. All display information from the FT would be assumed to be additional information that the PT shall display in addition. The PT shall logically separate display information originating at the FT and PT. This could be achieved, for example, by one physical display and two logical displays or two physical displays and two logical displays. The key point is that display characters from the PT and FT shall not be simultaneously interleaved/mixed on the same physical display.

7.3.8 Indirect FT initiated link establishment

The procedure shall be performed as defined in EN 300 175-5 [5], clauses 14.2.1 and 14.2.3. The following text together with the associated clauses define the mandatory requirements with regard to the present document.

FT and PT shall support SHORT format and FULL format with TPUI for the {LCE-REQUEST-PAGE} message. When the FT request for a link establishment is successfully received by the intended PT, the PT shall initiate direct PT link establishment (see clause 8.36 of EN 300 444 [12] (GAP)).

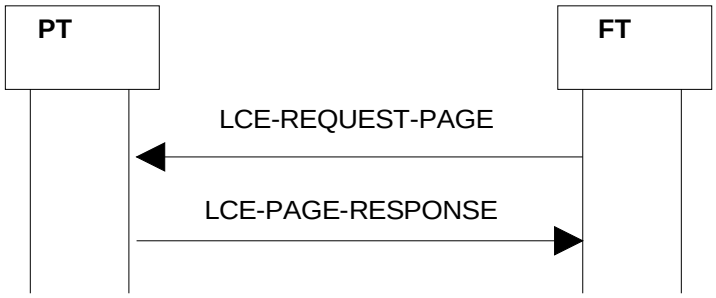


Figure 5: Indirect FT initiated link establishment

7.3.8.1 Paging messages

7.3.8.1.1 LCE-REQUEST-PAGE message

SHORT paging format as define in EN 300 175-5 [5], clause 8.2.1 and FULL paging format with TPUI address structure, as defined in EN 300 175-5 [5], clause 8.2.2 shall be supported.

SHORT paging format shall be used for link establishment when the intended service is "Narrow band ADPCM G.726 32 kbit/s voice service" (service NG1.1). For all other services, FULL paging format with TPUI shall be used.

Table 17: Values used within the {LCE-REQUEST-PAGE} message in case of SHORT paging format

Information element	Field within the information element	Standard values within the field/information element	Normative action/comment
<<LCE Header>>			
	<W>	All	
	<LCE-header>	"000"B	The "0" value shall be used when only C-plane is required (e.g. MM procedures). The PT shall support a follow on call on the same link even if value "0" was used during initial paging
		"100"B	The "100" value shall be used for service NG1.1 (Narrow band ADPCM G.726 32 kbit/s voice service)
<<Short TPUI address>>			
	<Short TPUI Address>	All	The lowest 16 bits from the actual TPUI value

Table 18: Values used within the {LCE-REQUEST-PAGE} message in case of FULL paging format with TPUI

Information element	Field within the information element	Standard values within the field/information element	Normative action/comment
<<LCE Header>>			
	<W>	All	
	<LCE-header>	"000"B	The "0" value shall be used when only C-plane is required (e.g. MM procedures). The PT shall support a follow on call on the same link even if value "0" was used during initial paging
		"100"B	The "100" value shall be used for all services (irrespective of the MAC service to be used, that will be defined in the Attributes negotiation)
<<Field 1>>			
	<Slot type >	"0001"B	Long slot 640: shall be used for services NG1.2, IA=1; NG1.3, IA=1; NG1.5, IA=1
		"0010"B	Long slot 672: shall be used for services NG1.2, IA=2; NG1.3, IA=2; NG1.5, IA=2
		"0100"B	Full slot: shall be used for services NG1.4 and NG1.6
		"0101"B	Double slot: shall be used for service NG1.2, IA=3
<<TPUI Address>>			
	<complete TPUI Address>	All	Complete (20 bits) TPUI address of the PT
<<Field 2>>			
	<Setup info >		
		"0000"B	Default value: it will produce the PT response: Mt signalling Advanced Connection , Attributes_T negotiation mandatory (see EN 300 175-5 [5], clause 8.2.4.3)
<<Field 3>>			
	<Additional discriminator>	"0000"B	Default value
NOTE: Values in the fields/information elements corresponding to services/implementation alternatives not supported or to optional features not implemented do not need to be supported.			

7.3.8.1.2 LCE-PAGE-RESPONSE message

This message shall be as defined in EN 300 175-5 [5], clause 6.3.7.1.

Table 19: Values used within {LCE-PAGE-RESPONSE} message

Information element	Field within the information element	Standard values within the field/information element	Normative action/comment
<<Protocol discriminator>>	<LCE messages>	"0000"B	
<<Transaction identifier>>	<LCE>	"0000"B	Only "0000" value allowed for LCE (1 transaction)
<<Message Type>>	<LCE-PAGE-RESPONSE>	"01110001"B	
<<Portable identity>>			Depends upon subscription records
	<Type>	"0000000"B	IPUI
	<PUT>	All	
	<PUN>	All	
<<Fixed identity>>			Parameters depend upon subscription records
	<Type>	32	PARK
	<Length of identity value>	All	PLI+1
	<ARC+ARD>	All	

7.3.8.2 Associated procedure

7.3.8.2.1 Timer F-<LCE.03> management

There shall be separate instances of a <LCE.03> timer corresponding to each IPUI identity that has been paged with {LCE-REQUEST-PAGE} message.

<LCE.03>: {LCE-REQUEST-PAGE} message re submission timer;

Value: Refer to EN 300 175-5 [5], annex A;

Start: A {LCE-REQUEST-PAGE} message is sent;

Stop: A {LCE-PAGE-RESPONSE} message with a matching IPUI or a release from the higher entity is received.

7.3.8.3 Exceptional cases

7.3.8.3.1 The IPUI received in the {LCE-PAGE-RESPONSE} does not match

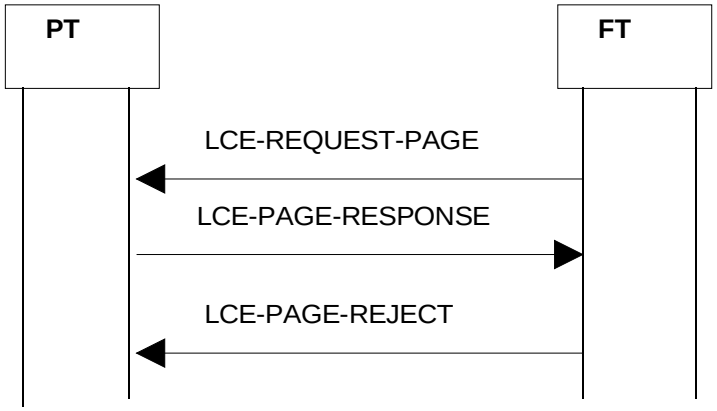


Figure 6: The IPUI received in the {LCE-PAGE-RESPONSE} does not match

Table 20: Values used within the short format {LCE-PAGE-REJECT} message

Information element	Field within the information element	Standard values within the field/information element	Normative action/comment
<<Protocol discriminator>>	<LCE messages>	"0000"B	
<<Transaction identifier>>	<LCE>	"0000"B	Only "0000" value allowed for LCE (1 transaction)
<<Message Type>>	<LCE-PAGE-REJECT>	"01110010"B	
<<Portable identity>>			It shall be the full IPUI of the PT that is rejected
	<Type>	"0000000"B	IPUI
	<PUT>	All	
	<PUN>	All	

The unwanted link shall immediately be released using the Link release "normal" procedure (see clause 8.37 of EN 300 444 [12]).

The {LCE-PAGE-REJECT} message shall be sent by a DL_DATA-req primitive via the S-Service Access Point (SAP) (SAP Identifier (SAPI) = "0") using the same Data Link Endpoint Identifier (DLEI) as indicated by the DL_ESTABLISH-ind carrying the {LCE-PAGE-RESPONSE}. This FT reply shall also use the same transaction value as used by the PT in the {LCE-PAGE-RESPONSE} message.

7.3.8.3.2 Timer <LCE.03> expiry

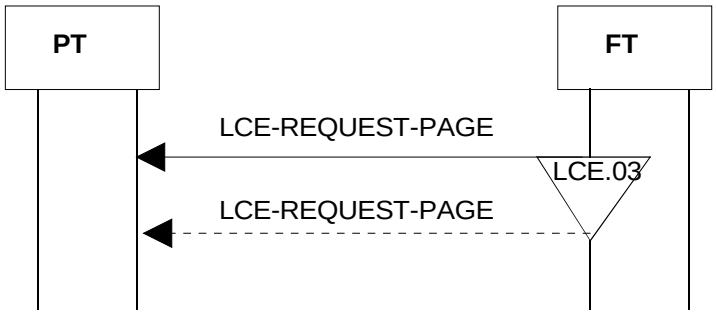


Figure 7: Timer <LCE.03> expiry

If timer <LCE.03> expires before the wanted link is established, the LCE may resubmit the {LCE-REQUEST-PAGE} message; in this case the link shall remain in the "ESTABLISH-PENDING" state. Resubmitted messages shall only be issued at a lower priority than other outstanding B-format messages. A message may be resubmitted a maximum of N300 times, before it is discarded.

NOTE: N300 is an application specific value. Recommended value for voice applications is three (3).

7.3.8.3.3 Release from the higher entity

If the higher entity indicates that the link resources are no longer required the LCE shall immediately delete the outstanding IPUI and stop the corresponding timer <LCE.03>.

7.3.9 Higher layer information FP broadcast

The FP and PT shall support the broadcast of Higher Layer capabilities as part of Q_T MAC broadcast messages (see clauses 7.6.3, 7.6.4 and 7.6.5).

The broadcast attributes are a small set of NWK layer and DLC layer capabilities (jointly known as "higher layer capabilities") that shall be broadcast regularly as part of the MAC layer broadcast service. See EN 300 175-5 [5], annex F.

RFPs belonging to the same LA shall broadcast the same values of higher layer attributes (see EN 300 175-5 [5], annex F) at any given time.

The PP shall be capable to read and interpret at least the following broadcast attributes codings during locking procedure. In the locked state the PP may assume them as static.

FP and PT shall support the following values of "Higher Layer capabilities" information attributes.

7.3.9.1 Higher layer information in standard FP broadcast (Qh= 3)

Table 21: Higher layer information attributes in standard FP broadcast (Qh = 3)

BIT Number	Attribute	Value	Note
a32	ADPCM/G.726 Voice service	1	
a33	GAP and/or PAP basic speech	1	
a36	Standard authentication required	0,1	
a37	Standard ciphering supported	0,1	
a38	Location registration supported	0,1	See location update procedure, clause 8.29 of EN 300 444 [12] (GAP) as an exception
a40	Non-static FP	0,1	A FP which is mounted on a moving vehicle
a44	Access Rights requests supported	0,1	The FP can toggle this bit to enable or disable on air subscription (see annex A)
a46	Connection handover supported	0,1	

7.3.9.2 Higher layer information in Extended FP broadcast part 2 (Qh= 11)

Table 22: Higher layer information attributes in Extended FP broadcast part 2 (Qh = 11)

BIT Number	Attribute	Value	Note
a24	NG-DECT Wideband voice service	1	Value 1 mandatory

7.4 Implementation examples of specific procedures

For detailed examples please refer to annex D. These diagrams are strongly recommended to be used as implementation guidelines as they are best practice cases and respect all mandatory requirements of the current standard.

7.5 Data Link Control (DLC) layer procedures

This clause specifies the additional DLC layer procedures, messages and information elements required in New Generation DECT wideband speech not described in EN 300 444 [12] (GAP), or incorporating modifications to the GAP specification.

7.5.1 FU1 frame operation

The procedure shall be performed as defined in EN 300 175-4 [4], clauses 12.1 and 12.2. The following text together with the associated clauses define the mandatory requirements with regard to the present document.

Figure 8: Sending a FU1 frame

NOTE: The case when FT initiates differs only in the notations.

The length of a FU1 frame will be k = 40 (full slot) for 32 kbit/s services and k = 80 octets (long slot) for 64 kbit/s services.

One complete frame shall be submitted to/from MAC layer included in a MAC_CO_DATA-req(ind) primitive.

7.5.2 FU12 frame operation for G.729.1 codec

The procedure shall be performed as defined in EN 300 175-4 [4], clauses 12.12. The following text together with the associated clauses define the mandatory requirements with regard to the present document.

G.729.1 coded shall operate at a maximum bit rate of 30 kbit/s, generating a codec frame of a maximum size of 600 bits each 20 ms.

The codec frame shall be formatted to produce a LU12 SDU as given in clauses E.1.1 and E.1.2 of EN 300 175-4 [4].

The LU12 SDU shall be segmented in two PDUs (fixed number in all cases). Filling bits shall be added if needed (see EN 300 175-4 [4], clause E.1). Segmentation shall be performed as described in EN 300 175-4 [4], clause 11.14.2.1. Only segment numbers "0" and "1" shall be alternatively used ("SN" field in FU12 code word, see EN 300 175-4 [4], clause 11.14.2.1).

Codec shall be synchronized in a way that the codec frame is ready immediately before the beginning of a DECT TDMA frame in order to allow transmission of the first segment in this frame.

7.6 Medium Access Control (MAC) layer procedures

This clause specifies the additional MAC layer procedures, messages and information elements required in New Generation DECT wideband speech not described in EN 300 444[12] (GAP), or incorporating modifications to the GAP specification.

7.6.1 MAC services

The FT and PT shall support I_N_minimum_delay symmetric service as defined in EN 300 175-3 [3], clauses 5.6.2.1 and 10.8.3.1.

The FT and PT may support I_N_normal_delay symmetric service as defined in EN 300 175-3 [3], clauses 5.6.2.1 and 10.8.3.2.

The FT and PT may support I_{PQ}_error_detection symmetric service as defined in EN 300 175-3 [3], clauses 5.6.2.1 and 10.8.3.2.

7.6.2 Frame formats and multiplexers

The FT and PT shall support the following frame formats:

- D-field mapping for the full slot structure (physical packet P32), as defined in EN 300 175-3 [3], clause 6.2.1.1.2.
- D-field mapping for the variable slot structure (physical packet P00j), as defined in EN 300 175-3 [3], clause 6.2.1.1.3, with a j value of j = 640.

The FT and PT may support frame format as follows:

- D-field mapping for the variable slot structure (physical packet P00j), as defined in EN 300 175-3 [3], clause 6.2.1.1.3, with a j value of j = 672.
- D-field mapping for the double slot structure (physical packet P80), as defined in EN 300 175-3 [3], clause 6.2.1.1.1.

The FT and PT shall support A-field mapping A-MAP.

The FT and PT shall understand all A field tail identifications (a0, a1 and a2) in the header field as defined in EN 300 175-3 [3], clauses 6.2.1.2 and 7.1.2.

The FT and PT shall support the following B-field field identifications (a4, a5 and a6) as defined in EN 300 175-3 [3], clause 7.1.4:

- U-type: In, "000"B.
- No B-field, "111" B (shall only be used for dummy bearers).
- Long slot required, "101"B.

The FT and PT shall support T-MUX as defined in EN 300 175-3 [3], clause 6.2.2.1.

The FT and PT shall support B-field multiplex E/U MUX type U32a and U64a.

The FT and PT shall support scrambling as defined in EN 300 175-3 [3], clause 6.2.4.

The FT and PT shall provide R-CRC generation and checking as defined in EN 300 175-3 [3], clause 6.2.5.2. The FT and PT shall provide X-CRC generation and checking as defined in EN 300 175-3 [3], clauses 6.2.5.3 and 6.2.5.4.

The PT shall support the normal duty cycle idle_locked mode as defined in EN 300 175-3 [3], clauses 11.3 and 4.3.1.

The FT and PT shall support primary scan procedure as defined in EN 300 175-3 [3], clause 11.8.

All requirements specified in EN 300 444 [12] (GAP), clause 10, shall apply.

7.6.3 Downlink broadcast

The procedure shall be performed as defined in EN 300 175-3 [3], clause 9.1.1.

7.6.3.1 N_T message

The FT shall be capable of sending and the PT shall be capable of receiving and processing the N_T message as defined in EN 300 175-3 [3], clause 7.2.2.

Table 23: Values used within N_T message

MAC message/broadcast element	Field within the message/broadcast element	Standard values within the MAC message	Normative action/comment
<<RFPI>>			
	<E-bit>	0	No SARI.
		1	SARI available. Relates to service SARI support [GAP.M.13].
	<PARI>	All	
	<RPN>	All	

7.6.3.2 Q_T - static system information

The FT shall be capable of sending and the PT shall be capable of receiving and processing the Q_T message as defined in EN 300 175-3 [3], clause 7.2.3.2 with the following values.

Table 24: Values used within static system info

MAC message	Field within the message	Standard values within the MAC message	Normative action/comment
<<Static system info>>			
	<Qh>	0	
	<NR>	0	PT shall support all values in order to gain lock. Asymmetric connections are not required to be supported by the PT
	<SN>	0 to 11	PT shall support all values
	<SP>	0	PT shall support all values in order to gain lock. Half slot connections are not required to be supported by the PT
	<ESC>	0	PT may ignore and assume the value to be 0
	<Txs>	0	PT may ignore and assume the value to be 0
	<Ext-car>	0,1	PT shall support all values in order to keep in synchronization with the primary scan
	<RF-car>	1 to 1 023	The PT shall not use carriers which are not supported
	<SPR>	0	PT may ignore
	<CN>	0 to 9	PT shall support all values
	<SPR>	0	PT may ignore
	<PSCN>	0 to N	PT shall support values 0 to 9

7.6.3.3 Q_T – Fixed Part capabilities

The FT shall be capable of sending and the PT shall be capable of receiving and processing the Q_T message as defined in EN 300 175-3 [3], clause 7.2.3.4 with the following values.

Table 25: Values used within FP capabilities

MAC message	Field within the message	Standard values within the MAC message	Normative action/comment
<<FP capabilities>>			
	<Qh>	3	
	<a15>	0,1	Double slot (PT and FT shall support the value 1 if double slot is supported)
	<a17>	1	Full slot
	<a23>	1	Basic A-field setup
	<a24>	1	Advanced A-field setup
	<a27>	1	In minimum delay
	<a28>	0,1	In normal delay ((PT and FT shall support the value 1 if service is supported)
	<a29>	0,1	Ip_error_detect (PT and FT shall support the value 1 if service Ipq_error_detect is supported)

Higher layer information: the management entity in the FP supplies the MAC layer with a 16-bit SDU via the Management Entity (ME) SAP. The content of that SDU is placed in bits <a32> to <a47> of the Q_T message. At the PT the MAC layer passes the 16 bits out through the ME SAP to the management entity.

For the setting of the higher layer information bits see clause 7.3.9.1.

Default value: if the bit a33 in higher layer capabilities (see table 21 in clause 7.3.9.1) is set to value "1", the PT may assume the values of bits <a17>, <a23>, <a24> and <a27> as indicated in table 21 to be set to value "1". The FT shall set the respective values to "1".

7.6.3.4 Q_T – Extended Fixed Part capabilities

The FT shall be capable of sending and the PT shall be capable of receiving and processing the Q_T message as defined in EN 300 175-3 [3], clause 7.2.3.5 with the following values.

Table 26: Values used within Extended FP capabilities

MAC message	Field within the message	Standard values within the MAC message	Normative action/comment
<<FP capabilities>>			
	<Qh>	4	
	<a22>	0,1	Ipq services (value 1 only if service Ipq_error_detect is supported)
	<a23>	1	Extended FP capabilities part 2

Higher layer information: The management entity in the FP supplies the MAC layer with a 23-bit SDU via the Management Entity (ME) SAP. The content of that SDU is placed in bits <a25> to <a47> of the Q_T message. At the PT the MAC layer passes the 24 bits out through the ME SAP to the management entity.

No higher layer information for New Generation DECT; part 1 is broadcasted in Q_T- Extended Fixed part capabilities.

7.6.3.5 Q_T - Extended Fixed Part capabilities part 2

The FT shall be capable of sending and the PT shall be capable of receiving and processing the Q_T message as defined in EN 300 175-3 [3], clause 7.2.3.11 with the following values.

Table 27: Values used within Extended FP capabilities part 2

MAC message	Field within the message	Standard values within the MAC message	Normative action/comment
<<FP capabilities>>			
	<Qh>	C	
	<a12>	1	Long slot j=640
	<a13>	0,1	Long slot j=672 (if supported)

Higher layer information: The management entity in the FP supplies the MAC layer with a 24-bit SDU via the Management Entity (ME) SAP. The content of that SDU is placed in bits <a24> to <a47> of the Q_T message. At the PT the MAC layer passes the 24 bits out through the ME SAP to the management entity.

For the setting of the higher layer information bits see clause 7.3.9.2.

7.6.3.6 Q_T - SARI list contents

The FT may send and the PT shall be capable of receiving and processing (if broadcast by the FT) the Q_T message as defined in EN 300 175-3 [3], clause 7.2.3.6, and EN 300 175-6 [6], clauses 5.5, 5.5.1, 5.5.3 and 5.5.4.

This is relevant if the N_T message indicates SARI support.

Table 28: Values used within SARI list contents

MAC message	Field within the message	Standard values within the MAC message	Normative action/comment
<<SARI list contents>>			
	<Qh>	5	
	<SARI list length>	All	
	<TARIs yes/no>	All	The PP may ignore it if Tertiary Access Rights Identity (TARI) request is not supported (support of TARI is not required in GAP)
	<Black yes/no>	All	The PP shall be able of distinguishing ARI from black ARI even if TARI is not supported
	<ARI or black-ARI>	All	

7.6.4 Paging broadcast

The procedure shall be performed as defined in EN 300 175-3 [3], clause 9.1.3. SHORT page, ZERO page and FULL page formats shall be supported.

7.6.4.1 Short page, normal/extended paging

The following fields as defined in EN 300 175-3 [3], clauses 7.2.4.1.2, 7.2.4.2 and 7.2.4.3 shall be supported by the PT and the FT.

Table 29: Values used within short page message

MAC message	Field within the message	Standard values within the MAC message	Normative action/comment
<<Short page message>>			
	<Extend flag>	0, 1	PT shall support all values. Optional for the FT to support value 1
	<B_s SDU length indication>	"001"B	PT and FT shall support short page messages
	<20 bits of BS channel data>	All	Higher layer information
	<Information type>	1, 2, 5 and 9	The PT shall support values 1, 2, 5 and 9. FT shall support value 1 (see clause 7.6.4.4) if blind slot information available. The FT shall support value 9 (see clause 7.6.4.5) if bearer handover information available. Other values need not be supported by FT or PT
	<MAC layer information>	Corresponding information	Information type defined in the previous field

7.6.4.2 Zero page normal/extended paging

The following fields as defined in EN 300 175-3 [3], clauses 7.2.4.1.3, 7.2.4.2 and 7.2.4.3 in the zero page message, shall be supported by the PT and the FT.

Table 30: Values used within zero page message

MAC message	Field within the message	Standard values within the MAC message	Normative action/comment
<<Zero page message>>			
	<Extend flag>	0, 1	PT shall support all values. Optional for the FT to support value 1
	<B_s SDU length indication>	"000"B	PT shall support zero length page messages. The FT shall support if "Blind slot information" included
	< 20 least significant bits of RFPI>	All	May be ignored by PT
	<Information type>	0, 1, 2, 5, 9 and 14	The PT shall support values 0, 1, 2, 5 and 9. PT shall support value 14 if double slots are supported. FT shall support value 0 (see clause 7.6.4.4) if blind slot information for long slots is available. FT shall support value 1 (see clause 7.6.4.4) if blind slot information for full slots is available. The FT shall support value 9 (see clause 7.6.4.5) if bearer handover information available. FT shall support value 14 (see clause 7.6.4.5) if double slots are supported and blind slot information for double slots is available. Other values need not be supported by FT or PT
	<MAC layer information>	Corresponding information	Information type defined in the previous field

7.6.4.3 Full page, normal/extended paging

The following fields as defined in EN 300 175-3 [3], clauses 7.2.4.1.1 and 7.2.4.2, in the full page message, shall be supported by the PT and the FT.

Table 31: Values used within full page message

MAC message	Field within the message	Standard values within the MAC message	Normative action/comment
<<Full page message>>			
	<Extend flag>	0, 1	PT shall support all values. Optional for the FT to support value 1
	<B_s SDU length indication>	"010"B	PT and FT shall support full page messages
	<36 bits of BS channel data>	All	Higher layer information

7.6.4.4 Blind slot information

It is mandatory for RFP's that have blind slots, due to technological limitations such as a slow synthesizer. to periodically announce these blind slots (at least every 10 s). In the event the RFP announces blind slot information, such information may also include all blind slots due to an active bearer as well.

Not available (blind) slot means that the FP recommends the PP not to attempt a setup on this slot.

If the PP receives blind slot information, it is mandatory for that PP to use it in the process of channel selection. The PP does not have to wait for the blind slot information before making the channel selection.

FT with blind slot limitations shall announce their blind slots using the field MAC layer information and the information types: 0 for long slots, 1 for full slots and 14 for double slots (only if double slots are supported by the RFP).

The content of the MAC layer information field shall be as defined in EN 300 175 [5] clauses 7.2.4.3.2 (for long slot), 7.2.4.3.3 (for full slot) and 7.2.4.3.11 (for double slot).

7.6.4.5 Bearer handover information

It is mandatory for FTs not supporting bearer handover within the whole FT to periodically send the bearer handover information (at least every 10 s).

It is mandatory for PT to support the following values of field "Info type" (bits a36 to a39) for "Bearer handover information" (value "9" of <Information type> in the P_t message, see tables 29 and 30): "0000", "0001", "0010" and "0011".

7.6.5 Setup of advanced connection, advanced bearer setup (A-field)

The connection setup procedure shall be performed as defined in EN 300 175-3 [3], clauses 10.2.4.1 and 10.2.4.2 or 10.2.4.3.

The connection setup procedure described in EN 300 175-3 [3], clause 10.2.4.2 shall be used in all cases.

- PT initiated setup (all cases).
- FT initiated indirect setup (paging) (LCE code = "100"B).

The bearer setup procedure shall be performed in all cases as defined in EN 300 175-3 [3], clause 10.5.1.2.

The exchange of the messages "Attributes_T.req" and "Attributes_T.cfm" is mandatory in all cases. The PT shall send the "Attributes_T.req" message after reception of the "Bearer.cfm" as described in EN 300 175-3 [3], clause 10.5.1.2.1.

7.6.5.1 M_T message

The following fields as defined in EN 300 175-3 [3], clause 7.2.5.3 of in the MAC control (M_T) message shall be supported by the PT and the FT.

Table 32: Values used within M_T message

MAC message	Field within the message	Standard values within the MAC message	Normative action/comment
<<M_T message>>			
	<M_T header>	1	"Advanced connection control"
	<Command>	0	"Access_request"
		4	"Bearer_confirm"
		5	"Wait"
		6	"Attributes_T_request"
		7	"Attributes_T_confirm"
	<FMID>	All	
	<PMID>	All	(see clause 13.4 of EN 300 444 [12])

7.6.5.2 Associated procedures

7.6.5.2.1 Timer T200 management

T200: Connection setup timer;

Value: Refer to EN 300 175-3 [3], annex A;

Start: At the creation of a MBC;

Stop: The TBC reports "bearer_established" or on request for MAC connection release.

7.6.5.2.2 Counter N200 management

N200: Max. number bearer setup re attempts during connection setup;

Value: Refer to EN 300 175-3 [3], annex A;

Start: ACCESS_REQUEST is sent;

Change: A new ACCESS_REQUEST within the same connection setup attempt is sent;

Clear: The TBC reports "bearer_established" or on request for MAC connection release.

7.6.5.3 Exceptional cases

7.6.5.3.1 Bearer setup attempt fails N200+1 times

Error! Objects cannot be created from editing field codes.

Figure 9: Bearer setup attempt fails N200+1 times

7.6.5.3.2 Timer T200 expiry

Error! Objects cannot be created from editing field codes.

Figure 10: Timer T200 expiry

7.6.6 Connection type modification: basic to/from advanced

Connection type modification shall be performed as described in EN 300 175-3 [3], clause 10.3.3.

In addition to the connection type modification, if the codec change requires slot type modification, the slot change procedure (clause 7.6.7) shall be executed. The combined procedure (connection type + slot type modification) shall follow the specific provisions for this case described in EN 300 175-3 [3], clause 10.3.3.

NOTE: Clause D.1.7 (informative) shows examples of recommended implementation of this procedure combined with the "slot type modification" (see clause 7.6.7) for different use cases.

7.6.7 Slot type modification

After invocation of the NWK layer procedure for slot type modification (see clause 7.3.5), the modification shall be executed using the MAC layer procedure for slot type modification.

The MAC slot type change procedure shall be executed as described in EN 300 175-3 [3], clause 10.3.2.

The initiating side of the Network Layer procedure shall also initiate the slot type modification at MAC layer.

NOTE: Clause D.1.7 (informative) shows examples of recommended implementation of this procedure combined with the "connection type modification" (see clause 7.6.6) for different use cases.

7.6.7.1 Failure of slot type modification

On failure of the slot type modification the initiating side shall not release the connection, but shall keep the existing slot type, and shall report the failure to higher layers. The NWK layer shall handle the case as described in clause 7.3.5.1.

NOTE: See clause D.1.7 (informative) for examples of recommended implementation of this procedure combined with the "connection type modification" (see clause 7.6.6) for some failure use cases.

7.6.8 Service type modification

If the codec change requires a modification in the service type, the MAC service change procedure shall be executed as described in EN 300 175-3 [3], clause 10.3.2.1.

The initiating side of the Network Layer procedure shall also initiate the service type modification at MAC layer in order to change the audio codec.

7.6.9 ECN number modification

The ECN number modification procedure shall be executed as described in EN 300 175-3 [3], clause 10.3.2.3.

The ECN change procedure shall be used in the event that a higher layer procedure (such as the codec change) results in advanced to basic or basic to advanced connection modification, which would otherwise result in a conflict of ECN with the connection modification procedure.

The procedure shall be initiated by the same side that initiated the higher layer procedure.

In case of multiple connections between the same PT-FT pair, the ECN change procedure may be executed on an other connection different from the one that is performing the higher layer procedure.

7.6.10 Connection/bearer release

The procedure shall be performed as defined in EN 300 175-3 [3], clauses 10.4 and 10.7.2.1.

The procedure may be used if the connection is either, basic or advanced. The proper value shall be inserted in the M_T header.

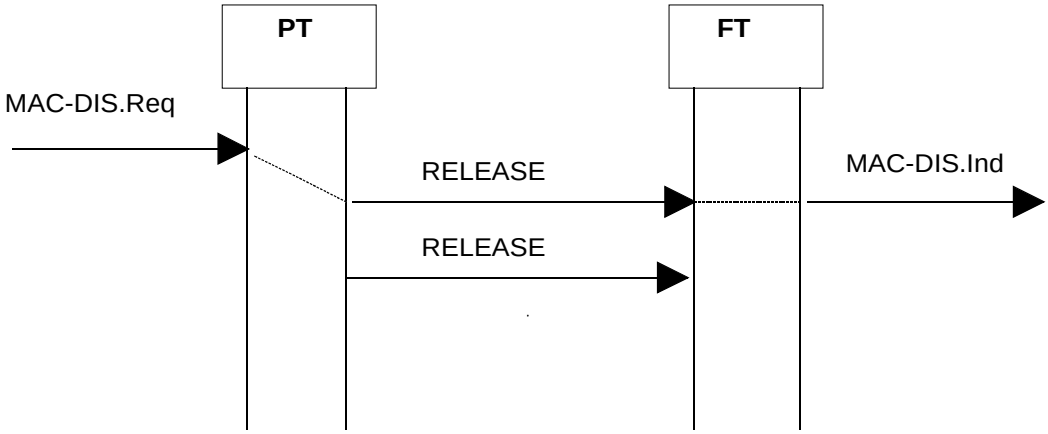


Figure 11: Bearer release

7.6.10.1 M_T message

The following fields as defined in EN 300 175-3 [3], clause 7.2.5.2 in the MAC control (M_T) message shall be supported by the PT and the FT.

Table 33: Values used within M_T message

MAC message	Field within the message	Standard values within the MAC message	Normative action/comment
<<M_T message>>			
	<M_T header>	0	Basic connection control
		1	Advanced connection control
	<Command>	15	Release
	<FMID>	All	
	<PMID>	All	(see clause 13.4 of EN 300 444 [12])

7.6.11 Bearer handover request

The procedure shall be performed as defined in EN 300 175-3 [3], clauses 10.6.2 and 10.5.1.1.

The procedure is equivalent for intra- and inter-cell handover.

The procedure may be used if the connection is either, basic or advanced. The proper value for the M_T header shall be used.

The FT should not release the old bearer within 10 ms after the establishment of the new bearer.

7.6.11.1 M_T message

The following fields as defined in EN 300 175-3 [3], clause 7.2.5.2 in the MAC control (M_T) message shall be supported by the PT and the FT.

Table 34: Values used within M_T message

MAC message	Field within the message	Standard values within the MAC message	Normative action/comment
<<M_T message>>			
	<M_T header>	0	"Basic connection control"
		1	"Advanced connection control"
	<Command>	1	"Bearer_handover_request"
		4	"Bearer_confirm"
		5	"Wait"
	<FMID>	All	
	<PMID>	All	(see clause 13.4 of EN 300 444 [12])

7.6.12 Connection handover request

The procedure shall be performed as defined in EN 300 175-3 [3], clauses 10.2.4.2 and 10.5.1.1.

The procedure may be used if the connection is either, basic or advanced. The proper value for the M_T header shall be used.

The procedure is equivalent for intra- and inter-cell handover.

7.6.12.1 M_T message

The following fields as defined in EN 300 175-3 [3], clause 7.2.5.2 in the MAC control (M_T) message shall be supported by the PT and the FT.

Table 35: Values used within M_T message

MAC message	Field within the message	Standard values within the MAC message	Normative action/comment
<<M_T message>>			
	<M_T header>	0	"Basic connection control"
		1	"Advanced connection control"
	<Command>	2	"Connection_handover_request". PT shall capable to send. FT shall be capable to process
		4	"Bearer_confirm"
		5	"Wait"
	<FMID>	All	
	<PMID>	All	(see clause 13.4 of EN 300 444 [12])

7.7 Physical layer (PHL) requirements

7.7.1 Modulation

The FT and PT shall support 2 level Gaussian Frequency Shift Keying (GFSK) modulation as defined by EN 300 175-2 [2] clause 5.

7.7.2 Slot type (Physical packets)

The FT and PT shall support Physical packet P32 (full slot) as defined by EN 300 175-2 [2], clause 4.4.2.

The FT and PT shall support Physical packet P00j (variable slot) as defined by EN 300 175-2 [2], clause 4.4.3, with a j value of j = 640.

The FT and PT may support Physical packet P00j (variable slot) as defined by EN 300 175-2 [2], clause 4.4.3, with a j value of j = 672.

The FT and PT may support Physical packet P80 (double slot) as defined by EN 300 175-2 [2], clause 4.4.4.

All requirements specified in EN 300 444 [12] (GAP), clause 11, shall apply.

All requirements specified in EN 300 175-2 [2] and EN 301 406 [11] (replacing TBR 006 [i.2]) for 2 level GFSK modulation shall apply.

7.8 Requirements regarding the speech transmission

7.8.1 General

The applicable requirements specified in EN 300 175-8 [8] and EN 300 176-2 [10] (previously covered by TBR 010 [i.3]) shall be applied.

7.8.2 Speech codecs

The FT and PT shall support ITU-T Recommendation G.726 [15] ADPCM narrow band codec, operating at 32 kbit/s rate, as defined by EN 300 175-8 [8], clause 5.1.

The FT and PT shall ITU-T Recommendation G.722 [17] wideband SB-ADPCM 7 kHz codec, operating at 64 kbit/s rate, as defined by EN 300 175-8 [8], clause 5.3.

The FT and PT may support ITU-T Recommendation G.711 [16] PCM narrow band codec, operating at 64 kbit/s rate, as defined by EN 300 175-8 [8], clause 5.2.

The FT and PT may support ITU-T Recommendation G.729.1 [18] wideband codec, operating at 32 kbit/s rate, as defined by EN 300 175-8 [8], clause 5.4.

The FT and PT may support MPEG-4 ER AAC-LD codec [20], operating at 32 kbit/s or 64 kbit/s rate, as defined by EN 300 175-8 [8], clause 5.5.

7.8.3 Audio performance requirements

New Generation DECT Portable Parts complying with the present specification shall implement at least two PP audio type specifications (see EN 300 175-8 [8], clause 7.2); one of them shall be a handset specification for narrowband 3,1 kHz service and the other a handset specification for wideband 7 kHz service. The PP may implement further types for handsfree devices or super-wideband services. See clause 5.6 for definition of the possible audio types and table 2 in clause 6.3 for the mapping between speech services and possible audio types.

New Generation DECT Fixed Parts complying with the present specification shall implement at least two FP audio type specifications (see EN 300 175-8 [8], clause 7.3), one of them shall be a FP specification for narrowband 3,1 kHz service and the other shall a FP specification for wideband 7 kHz service. In addition to that, the FP may support the internal call type (FP type 6a). The FPs may implement further types in the case of multiple network interfaces or internal conference bridge.

The implemented audio types (for PPs and FPs) shall fulfil the specific provisions given in clause 5.6 and the specification given in EN 300 175-8 [8] for each of them.

7.9 Management procedures

All procedures described in EN 300 444 [12] (GAP), clause 13 shall be supported.

7.10 Application procedures

All procedures described in EN 300 444 [12] (GAP), clause 14 shall be supported.

Annex A (informative): Audio codecs

A.1 Speech and audio coding

A.1.1 Overview

The basic codec for speech in the DECT standard is the "Adaptive Differential Pulse Code Modulation" (ADPCM) with 32 kbit/s as defined in ITU-T Recommendation G.726 [15]. It is of low complexity, offers a bandwidth of 3,1 kHz, introduces a very low delay of 0,125 ms and a quality slightly below the PSTN quality (ITU-T Recommendation G.711 [16] encoding) at 64 kbit/s.

Increasing the bandwidth from narrow band (300 Hz to 3 400 Hz) to at least to 150 Hz to 7 000 Hz range ("wide band") will allow to increase decisively the speech quality: voice better encoded on all its frequencies, with a feeling of more transparent communication, a greatly improved sensation of presence and an increased intelligibility and listening comfort.

Table A.1 reviews some speech and audio codecs.

Table A.1: Codec overview

	Type	Bandwidth [kHz]	Sampling rate [kHz]	Bit rate [kbit/s]	Frame [ms]
ITU-T Recommendation G.711 [16]	LOG PCM	0,3 to 3,4	8	64	0,125
ITU-T Recommendation G.726 [15]	ADPCM	0,3 to 3,4	8	16, 24, 32, 40	0,125
ITU-T Recommendation G.722 [17]	Sub-Band ADPCM	0,05 to 7	16	64, 56, 48	0,125
ITU-T Recommendation G.729.1 [18]	EV-CELP Time Domain Bandwidth Extension (TDBWE) Transform Coding (MDCT)	0,05 to 7	16	8, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32	20
MPEG-4 (ISO/IEC 14496-3 [20]) ER AAC-LD profile [19]	MPEG-4 Error Resilient (ER), Advanced Audio Coding (AAC) Low Delay (LD)	up to 20	up to 48	range of bit rates (around 24 to 96)	10 to 20 (depends on sampling rate)

A.1.2 Narrow band speech coding

ITU-T Recommendation G.726 [15] narrow band codec is mandatory for New Generation DECT in order to ensure interoperability with existing DECT systems.

ITU-T Recommendation G.711 [16] narrow band codec is optional for New Generation DECT in order to improve the quality of narrow band communications: slightly higher intrinsic voice quality, better robustness to transmission errors and no transcoding for PSTN calls.

Table A.2: ITU-T Narrow band Speech codec for New Generation DECT

Standard	***ITU-T Recommendation G.726 [15]***	***ITU-T Recommendation G.711 [16]***
	ADPCM	LOG PCM
Date	*1990*	*1972*
Bandwidth	*300 Hz to 3 400 kHz*	*300 Hz to 3 400 kHz*
Sampling rate	*8 kHz*	*8 kHz*
Bit rate(kbit/s)	*16, 24, 32, 40*	*64*
Embedded Scalability	*No*	*No*
Type	*ADPCM*	*LOG PCM*
Frame size	*0,125 ms*	*0,125 ms*
Algorithmic Delay	*0,125 ms*	*0,125 ms*
Complexity	*12 MIPS*	*0,01 MIPS*
RAM (kBytes)	*1*	*≈ 0*

A.1.3 Wideband Speech coding

ITU-T Recommendation G.722 [17] codec is chosen as mandatory wideband codec for New Generation DECT in order to greatly increase the voice quality by extending the bandwidth from narrow band to wideband.
ITU-T Recommendation G.722 [17] provides a high wideband quality at a bit rate of 64 kbit/s with low complexity and very low delay.

In addition, ITU-T Recommendation G.729.1 [18] codec is recommended as an optional codec for wideband speech to provide even higher wideband quality and better robustness to frames/packets losses than ITU-T Recommendation G.722 [17] at much lower dynamically adaptable bit rates. This allows a better transport efficiency on the network side and over the DECT air interface (fits in one single current DECT slot). In addition, it is seamless interoperable with largely deployed ITU-T Recommendation G.729 [i.9] based VoIP networks and terminals.
ITU-T Recommendation G.729.1 [18] encodes signals in frames of 20 ms. It is a scalable codec operating at bitrates of 8 kbit/s and from 12 kbit/s to 32 kbit/s per steps of 2 kbit/s, both in narrowband or in wideband from 14 kbit/s.

Table A.3: ITU-T Wideband Speech codec for New Generation DECT

Standard	**ITU-T Recommendation G.722 [17]**	**ITU-T Recommendation G.729.1 [18]**
	SB-ADPCM	*G.729 EV*
Date	*1988*	*2006*
Bandwidth	*50 Hz to 7 kHz*	*50 Hz to 4 kHz* *50 Hz to 7 kHz (bit rates ≥ 14 kbit/s)*
Sampling rate	*16 kHz*	*8kHz / 16kHz*
Bit rate(kbit/s)	*64, 56, 48*	*8, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32*
Embedded Scalability	*Yes*	*Yes (interoperable at 8 kbit/s with G.729)*
Type	*Sub-Band ADPCM*	*EV-CELP* *Time Domain Bandwidth Extension (TDBWE)* *Transform Coding (MDCT)*
Frame size	*0,125 ms*	*20 ms*
Algorithmic Delay	*1,625 ms*	*48,9375 ms*
Complexity	*10 MIPS*	*35,8 WMOPS based on new STL2005* *(34,7 WMOPS based on STL2000)*
RAM (kBytes)	*1*	*17,4*

PLC (Packet loss Concealment) ITU-T Recommendation G.722 [17] Appendix III and IV [NG1.S7):
Appendices III and IV describe packet loss concealment solutions extending ITU-T Recommendation G.722 [17] decoder. These algorithms may be optionally implemented to improve voice quality in degraded transmission conditions where packets/frames may be lost (in the IP network or on the DECT air interface). Both appendices meet the same quality requirements but address two different quality/complexity trade offs:

- Appendix III aims at maximizing the robustness at a price of additional complexity (+0,1 to 0,2 MOS in comparison with appendix IV in degraded conditions).
- Appendix IV proposes an optimized complexity/quality trade off with almost no additional complexity compared with ITU-T Recommendation G.722 [17] normal decoding (0,07 WMOPS).

Since ITU-T Recommendation G.722 [17] does not incorporate any mechanism to cope with lost frames/packets, the use of a PLC algorithm is strongly recommended to avoid annoying effects in case of packet/frame losses.

NOTE: ITU-T Recommendation G.729.1 [18] already incorporates a high efficiency packet loss concealment mechanism.

Table A.4: ITU-T Recommendation G.722 [17] PLC Appendices for New Generation DECT

PLC	Appendix III	Appendix IV
Date	*2006*	*2006*
Type	*Full band waveform extrapolation Re-encoding and signal monitoring, re-phasing and time warping*	*Split-band waveform extrapolation Partial state reset, cross fading*
Packetization size/ms		
Complexity Observed Worst Case in WMOPS (based on STL2005)	*5,87 WMOPS (10 ms packets) 5,60 WMOPS (20 ms packets)*	*3,18 WMOPS (10 ms packets) 3,15 WMOPS (20 ms packets)*
Total RAM (10 ms packets) (Static + Scratch) Total RAM (20 ms packets) (Static + Scratch) In 16 bits Words	*2 184 (10 ms packets) (1 118 + 826) 1 944 (20 ms packets) (1 118 + 1066)*	*1 659 (10 ms packets) (967 + 692) 1 659 (20 ms packets) (967 + 963)*
Program ROM (in number of basic-ops and function calls)	*2 410*	*1 061*
Table ROM (in 16 bits Words	*1 414*	*882*

To handle several codecs (at least ITU-T Recommendation G.726 [15] and ITU-T Recommendation G.722 [17]), New Generation DECT will support a codec selection and switching mechanism. This may consequently allow the use of other codecs that could be recommended in next releases as additional optional codecs according to future application or interoperability needs.

A.1.4 Super-wideband speech and audio coding

The MPEG-4 ER AAC-LD 64 kbit/s audio codec [19], [20] is recommended as an optional codec for super-wideband speech. In order to provide high quality for music streaming or other multimedia applications mixing speech and music, the bandwidth can be further extended to super-wideband (50 Hz to 14 kHz) and above (up to full audio bandwidth (20 Hz to 20 000 Hz). The codec may be also suitable for wideband speech.

MPEG-4 ER AAC-LD is designed for high quality communication application including all kind of audio signals e.g. speech and music. It provides an audio bandwidth of 14 kHz at a bitrate of 64 kbit/s. MPEG 4 ER AAC-LD (Error resilient, Low Delay profile) is standardized as an audio profile [19] of MPEG-4 (ISO/IEC 14496-3 [20]). The frame size is 10 ms and the algorithmic delay 20 ms. It may also be optionally used in 32 kbit/s mode. It provides a recommended bandwidth of 11,5 kHz. The frame size is 20 ms and the algorithmic delay 40 ms.

Table A.5: MPEG-4 ER AAC-LD Audio codec for NG DECT

Standard	***MPEG-4 ER AAC- LD 32 kbit/s***	***MPEG-4 ER AAC-LD 64 kbit/s***
Date	*2000/2006*	*2000/2006*
recommended Bandwidth	*11,5 kHz*	*14 kHz*
Sampling rate	*24 kHz*	*48 kHz*
Bit rate(kbit/s)	*32*	*64*
Embedded Scalability	*no*	*no*
Type	*perceptual audio codec*	*perceptual audio codec*
Frame size	*20 ms (480 samples)*	*10 ms (480 samples)*
Algorithmic Delay	*40 ms*	*20 ms*
example Complexity	*~13 MIPS (encoder)* *~5 MIPS (decoder)*	*~25 MIPS (encoder)* *~10 MIPS (decoder)*
example RAM (kBytes)	*~28 kbyte (encoder)* *~13 kbyte (decoder)* *IO Buffer not included*	*~28 kbyte (encoder)* *~13 kbyte (decoder)* *IO Buffer not included*

As for wideband speech codec, the codec selection and switching mechanism may allow the use of other configurations or other optional super-wideband speech and audio codecs according to the applications or interoperability needs.

Annex B (normative): Audio patterns to indicate IP packet losses on the DECT link

B.1 Audio patterns to indicate IP packet losses.

The following annex is applicable for:

- New Generation DECT FP connected to a VoIP network (directly or through a gateway) with audio frames coming from the VoIP network decoded in the PT (no transcoding done between the network and the DECT link).

B.1.1 Insertion of audio patterns

Upon detection of a packet loss or a corrupted IP packet, the FP shall insert an appropriate audio pattern on the DECT link in direction of the Portable part.

These patterns may be repeated as many times as necessary on the DECT link to replace the faulty IP packet. For example if a 20 ms RTP VoIP packet is lost. The pattern shall be inserted twice on the DECT link.

B.1.2 Reception of audio patterns

Upon reception of these patterns in the PT:

- If a PLC is available on the PT with the current activated codec, the PT should activate it.
- If no PLC is available on the PT, the PT should decode this pattern as normal audio frame in the decoder.

However, it is recommended to use standardized PLC mechanism in order to improve audio robustness to packet losses.

It is not recommended to use these patterns in the PT to FT direction as the PT should always be able to provide correct audio frames as soon as the U-plane is established on the DECT link.

B.1.3 Contents of the audio patterns

The following patterns were chosen because:

- They correspond to 10 ms of audio decoded signal (20 ms for 20 ms audio framed codec).
- They generate a very low energy decoded signal if no PLC mechanism is available on the terminal.

Their occurrence in normal audio encoded bitstream is quite impossible.

For MPEG-4 ER AAC-LD, the pattern is a standard conform MPEG-4 ER AAC-LD frame. If no PLC mechanism is available on the terminal side, the pattern forces the decoder to fade out smoothly within 10 ms (20 ms at 32 kbps). The same pattern can be used for both, the 64 kbit/s and 32 kbit/s service. The transport format is a MPEG-4 Access Unit.

B.1.4 Packet loss patterns for ITU-T Recommendation G.722

ITU-T Recommendation G.722 [17] packet loss pattern. 640 bits. To be inserted in 1 long slot.

```
/* Pattern is 0xFF (repeated 80 times) */
Pattern[80] ={
0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF};
```

B.1.5 Packet loss patterns for ITU-T Recommendation G.711

ITU-T Recommendation G.711 A-law [16] packet loss. 640 bits. To be inserted in 1 long slot.

```
/* Pattern is 0xD5 (repeated 24 times), 0x55 (repeated 32 times), 0xD5 (repeated 24 times) */
Pattern[80] ={
0xD5, 0xD5, 0xD5, 0xD5, 0xD5, 0xD5, 0xD5, 0xD5,
0xD5, 0xD5, 0xD5, 0xD5, 0xD5, 0xD5, 0xD5, 0xD5,
0xD5, 0xD5, 0xD5, 0xD5, 0xD5, 0xD5, 0xD5, 0xD5,
0x55, 0x55, 0x55, 0x55, 0x55, 0x55, 0x55, 0x55,
0x55, 0x55, 0x55, 0x55, 0x55, 0x55, 0x55, 0x55,
0x55, 0x55, 0x55, 0x55, 0x55, 0x55, 0x55, 0x55,
0x55, 0x55, 0x55, 0x55, 0x55, 0x55, 0x55, 0x55,
0xD5, 0xD5, 0xD5, 0xD5, 0xD5, 0xD5, 0xD5, 0xD5,
0xD5, 0xD5, 0xD5, 0xD5, 0xD5, 0xD5, 0xD5, 0xD5,
0xD5, 0xD5, 0xD5, 0xD5, 0xD5, 0xD5, 0xD5, 0xD5};
```

ITU-T Recommendation G.711 μ-law [16] packet loss. 640 bits. To be inserted in 1 long slot.

```
/* Pattern is 0xFF (repeated 24 times), 0x7F (repeated 32 times), 0xFF (repeated 24 times) */
Pattern[80] ={
0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
0x7F, 0x7F, 0x7F, 0x7F, 0x7F, 0x7F, 0x7F, 0x7F,
0x7F, 0x7F, 0x7F, 0x7F, 0x7F, 0x7F, 0x7F, 0x7F,
0x7F, 0x7F, 0x7F, 0x7F, 0x7F, 0x7F, 0x7F, 0x7F,
0x7F, 0x7F, 0x7F, 0x7F, 0x7F, 0x7F, 0x7F, 0x7F,
0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF};
```

B.1.6 Packet loss patterns for ITU-T Recommendation G.726

ITU-T Recommendation G.726 [15].

No pattern is proposed for the reason that a transcoding is done in the Fixed part, so the PLC is not done in the PP.

B.1.7 Packet loss patterns for ITU-T Recommendation G.729.1

ITU-T Recommendation G.729.1 [18] packet loss. 640 bits. To be inserted in 2 full slots. Audio frames are 20ms.

The payload format described in Annex C.1 "transport of the ITU-T Recommendation G.729.1 [18] audio frame in full-slot mode" shall be used. The following patterns must replace the faulty packets in the coded bitstream in case of packet loss:

First full slot

In the first full slot, bad frame indicator is set BFI=1, First frame part: FPA1=0 FPA2=0, Parity even is set PA=1.

```
Pattern[40] ={ in full slot1
0x81, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00};
```

Second full slot

In the second full slot, bad frame indicator is set BFI=1, second frame part: FPA1=0 FPA2=1, Parity even is not set PA=0.

```
Pattern[40] ={ in full slot2
0x03, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00};
```

B.1.8 Packet loss patterns for MPEG-4 ER AAC-LD

MPEG-4 ER AAC-LD, 64 kbit/s

MPEG-4 ER AAC-LD packet loss pattern. 640 bits. To be inserted in 1 long slot (64 kbit/s). Audio frames are 10 ms.

```
Pattern[80]={
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x02,0x32,
0x92,0x0A,0x6A,0x2A,0xFA,0x62,0x7A,0x9A,0x9D,0x2D,
0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,
0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,
0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,
0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,
0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,
0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x28,0x00};
```

MPEG-4 ER AAC-LD, 32 kbit/s

MPEG-4 ER AAC-LD packet loss pattern. 640 bits. To be inserted in 2 full slots (32 kbit/s).Audio frames are 20 ms.

First full slot

```
Pattern[40]={in full slot1
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x02,0x32,
0x92,0x0A,0x6A,0x2A,0xFA,0x62,0x7A,0x9A,0x9D,0x2D,
0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,
0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D};
```

Second full slot

```
Pattern[40]={in full slot2
0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,
0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,
0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,
0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x2D,0x28,0x00};
```

Annex C (normative): Configuration signalling for specific codecs

C.1 MPEG-4 ER AAC-LD configuration signalling

If the MPEG-4 ER AAC-LD voice service is used as a communication service, some out of band signalling increases the interoperability between FP and the IP world. Therefore the following two <<IWU to IWU>> elements shall be used to signal the available capabilities. The first <<IWU to IWU>> element shall be used to signal the supported capabilities of the device (MPEG4CapabilityElement) and the second element shall be used to signal the selected configuration (MPEG4ConfigurationElement).

Both elements contain level and transport format information whereas AudioSpecificConfig (ASC) is transmitted only within the MPEG4ConfigurationElement.

- **Level:** Used Low Delay AAC Profile level.
- **Transport format:** RFC 3640 [i.7] transmits plain MPEG-4 access units whereas in RFC 3016 [i.8] LATM transport format is used. Both formats can be converted into each other. To avoid the conversion process transmission of both formats over the New Generation DECT link is possible.
- **AudioSpecificConfig:** The usage of ER tools is signalled within ASC. In packet oriented IP transmission ER tools are normally not used up to now. This has to be signalled to the decoder. The AudioSpecificConfig is included in the RTP Payload format description RFC 3640 [i.7]/RFC 3016 [i.8]. With it, the FP can directly transmit the AudioSpecificConfig to the IP world and back to the PP. Thus the transportation of the AudioSpecificConfig is possible.

The <<IWU to IWU>> Elements has to be transmitted in certain messages if the IE <<Codec List>> (EN 300 175-5 [5]) includes MPEG-4 ER AAC-LD. The format of both <<IWU to IWU>> Elements differs only in the occurrence of the AudioSpecificConfig. The ASC occurrence depends on the length of the corresponded <<IWU TO IWU>> Element. The length of the MPEG-4 Capability Element is 4 octets while the MPEG4 ConfigurationElement which includes an ASC exceeds 4 octets.

C.1.1 <<IWU to IWU>> element to signal the supported capabilities (MPEG4CapabilityElement)

If a new PP is registered at the FP side it is important for both, PP and FP, to get information about the MPEG-4 ER AAC-LD capability of the responding part. Therefore it is possible to determine the fitting configuration during a call establishment without any further negotiation process.

The following <<IWU to IWU>> Element will handle the signalling of the supported capability and shall be used in the MM-Messages <<LOCATE-REQUEST>>, <<LOCATE-ACCEPT>>, <<ACCESS-RIGHTS-REQUEST>>, <<ACCESS-RIGHTS-ACCEPT>>.

In case of default configuration according to table C.1, no MPEG4CapabilityElement shall be sent.

Information element coding:

<table>
<tr><th>Bit:</th><th>8</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>Octet:</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>0</td><td colspan="7"><< IWU to IWU>> (0x77)</td><td>1</td></tr>
<tr><td></td><td colspan="8">Length of Contents (L)</td><td>2</td></tr>
<tr><td></td><td>1</td><td>S/R</td><td colspan="6">Protocol Discriminator
(0x25 MPEG-4 ER AAC-LD Configuration Description)</td><td>3</td></tr>
<tr><td></td><td colspan="4">Transport format capability</td><td colspan="4">MPEG-4 ER AAC-LD Level capability</td><td>4</td></tr>
</table>

The "Transport format capability" field contains the supported transport formats and shall be interpreted as follows:

Bit:	8	7	6	5	Octet
	reserved	reserved (e.g. MPEG-4 LOAS AudioPointerStream())	MPEG-4 LOAS AudioSyncStream()	MPEG-4 Access Units (content of er_raw_data_block())	4

Whereas MPEG-4 LOAS AudioSyncStream() and MPEG-4 Access Unit capability is mandatory for a New Generation DECT device which supports MPEG-4 ER AAC-LD.

The content of the "MPEG-4 ER AAC-LD Level capability" field describes the supported Low Delay AAC Profile level [19]. Higher levels also include the support of lower levels:

MPEG-4 ER AAC-LD Level capability Coding (Octet 4):

Bits	**4 3 2 1**	**Meaning**
	0 0 0 0	reserved for ETSI use
	0 0 0 1	ISO/IEC 14496-3:2005 [19] Low Delay AAC Profile level 1
	all other values	reserved

Table C.1: Default Coding of MPEG4CapabilityElement

Octet	Information Element Field	Field Value
4	MPEG-4 ER AAC-LD Level capability	ISO/IEC 14496-3:2005 [19] Low Delay AAC Profile level 1 (="0001"B)
4	Transport format capability	Bit 5 MPEG-4 Access Units = 1 Bit 6 MPEG-4 LOAS 1 AudioSyncStream() = 1

C.1.2 <<IWU to IWU>> element to signal the used Configuration (MPEG4ConfigurationElement)

During the connection establishment between PP, FP and the IP world, the selected transport format and the selected Low Delay AAC Profile level [19] is signalled. Furthermore the transport of the AudioSpecficConfig (detailed description can be found in [20]) is used to signal MPEG-4 ER AAC-LD error resilience tools. If the IE <<Codec List>> provides MPEG-4 ER AAC-LD, the following <<IWU to IWU>> element has to be used in the following messages:

Messages:

<<CC-SETUP>>, <<CC-CONNECT>>, <<CC-INFO>>, <<CC-SETUP-ACK>>, <<CC-CALL-PROC>>, <<CC-ALERTING>>,<<IWU-INFO>>,<<CC-SERVICE-CHANGE>>.

Information element coding:

Bit:	8	7	6	5	4	3	2	1	Octet:
	0	<< IWU to IWU>> (0x77)							**1**
	Length of Contents (L)								**2**
	1	S/R	Protocol Discriminator (0x25 MPEG-4 ER AAC-LD Configuration)						**3**
	Transport format				MPEG-4 ER AAC-LD Level				**4**
	content of AudioSpecificConfig								**5**
									…
									L+2

The "Transport format" field contains the selected transport format and should be interpreted as follows:

Bit:	8	7	6	5	Octet
	reserved	reserved (Audio Pointer stream)	MPEG-4 LOAS AudioSyncStream()	MPEG-4 Access Units (content of er_raw_data_block())	4

Whereas only one bit of these fields is set to signal the used transport format. The content of the "MPEG-4 ER AAC-LD Level" describes a value indicating which Low Delay AAC Profile Level [19] is used.

MPEG-4 ER AAC-LD Level Coding (Octet 4):

Bits	**4 3 2 1**	**Meaning**
	0 0 0 0	reserved for ETSI use
	0 0 0 1	ISO/IEC 14496-3:2005 [19] Low Delay AAC Profile level 1
	all other values	reserved

The Octets 5 to L+2 contains the AudioSpecificConfig [20].

Annex D (informative): Recommended implementation of procedures

D.1 Examples of implementation of specific procedures

D.1.1 General

In the following clauses, several examples are depicted.

It has to be noted that the sequences are only examples, it cannot be mandatory that the message flows shall always be exactly in the described way.

For example it should remain in the hand of each device whether a service is confirmed at the latest possibility with CC_CONNECT or in an earlier message with the consequence that a service negotiation might be more probable.

Also it should remain in the hand of each base station, whether CALL-PROCEEDING is sent or directly CC-CONNECT.

Also it should remain in the hand of each device, in which situation it establishes a long-slot connection or prefers to establish a full-slot connection, perhaps at the risk that connection modification will be more probable.

Therefore the diagrams can only be used as recommendations.

The connection of the U-Plane is not marked in the diagrams, but done as usually in DECT with sending/receiving of CC-CONNECT for outgoing calls and with sending/receiving CC-CONNECT-ACK for incoming calls. In addition to this, the IE <<Progress Indicator>> can be sent from FP to PP in order to connect the U-Plane.

Where the diagrams contain "paging for longslot", it should be kept in mind, that the FP are only paging for the establishment of the slot type "long slot" in case the PP indicated the support of the corresponding long slot format in the terminal capabilities.

D.1.2 Outgoing wideband call

D.1.2.1 Outgoing wideband call, no codec list, ITU-T Recommendation G.722 chosen

Use case: User requests a wideband call and the network supports it.

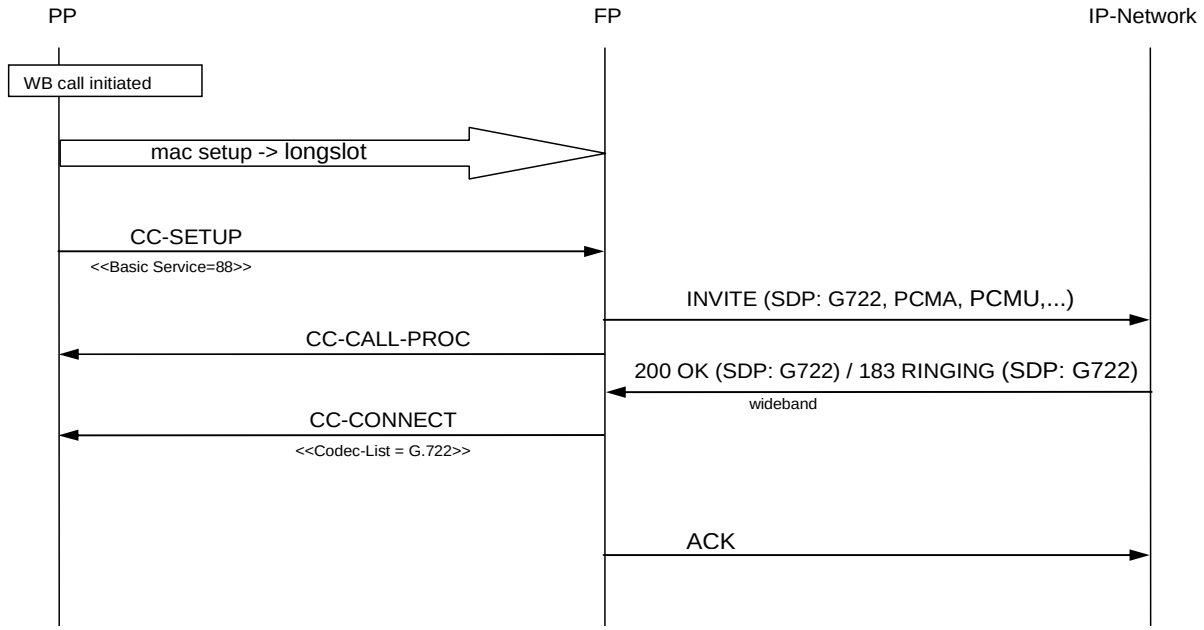


Figure D.1: Outgoing wideband call, no codec list, ITU-T Recommendation G.722 [17] chosen

The use of the basic service "wideband speech default setup attributes" implies the offer of the codec-list indicated in the last (location) registration or at subscription registration. Since in this example no other Codec List shall be indicated, the IE <<Codec-List>> can be omitted in CC-SETUP.

In a response message (here CC-CONNECT), the peer entity confirms the chosen service with <<Codec-List>>.

The following tables are showing the IE codings for this example:

Table D.1: Values used within the {CC-SETUP} message

Information element	Information Element Coding	Field within the information element	Standard values within the field/information element	Normative action/comment
<< Basic Service >>	e0 88			
		<< Call class >>	1000	Normal call setup
		<< Basic Service >>	1000	Wideband speech default setup attributes

Table D.2: Values used within the {CC-CONNECT} message

Information element	Information Element Coding	Field within the information element	Standard values within the field/information element	Normative action/comment
<<Codec-List>>	7c 04 90 03 00 81			
		<< Negotiation indicator>>		
		<<1st codec identifier>>	0000011	ITU-T Recommendation G.722 [17]
		<< MAC service >>	0000	In_ min_delay
		<< C-Plane routing >>	000	Cf never
		<< Slot size >>	0001	long slot

D.1.2.2 Outgoing Call Wideband, codec list, negotiation results in Wideband

Use case: User requests a wideband call but specifies another NB codec in the SETUP (instead of ITU-T Recommendation G.726 [15]), but network only supports ITU-T Recommendation G.722 [17].

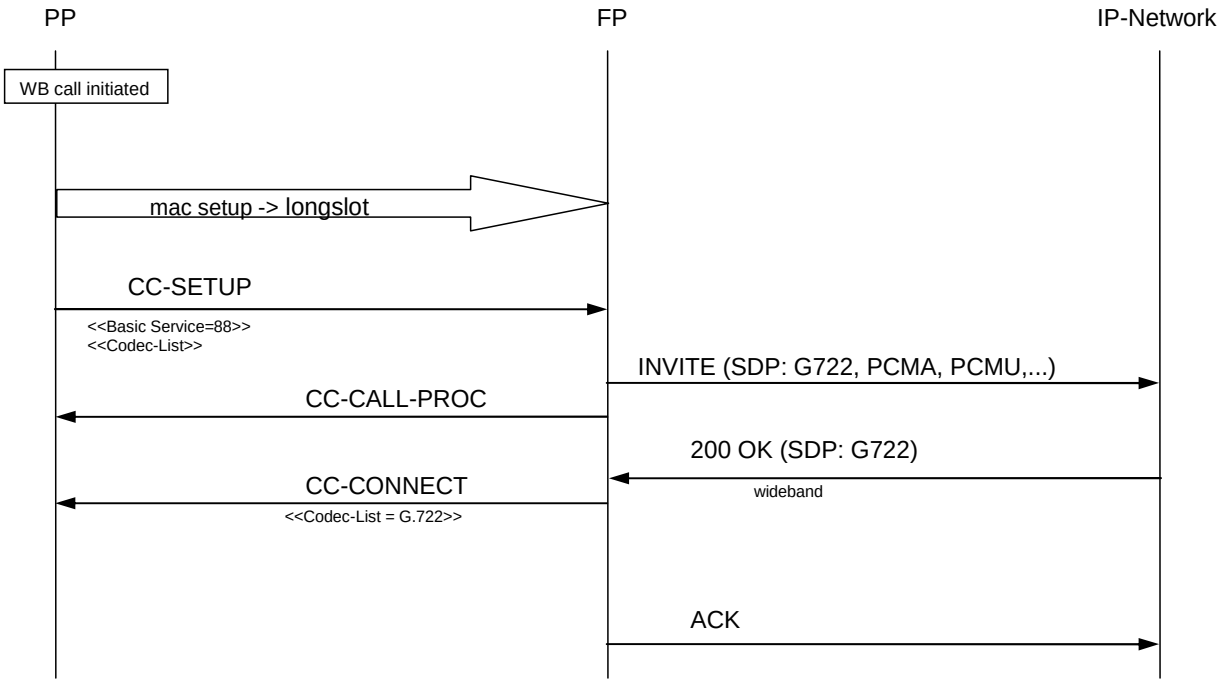


Figure D.2: Outgoing Call Wideband, codec list, negotiation results in Wideband

Table D.3: Values used within the {CC-SETUP} message

Information element	Information Element Coding	Field within the information element	Standard values within the field/information element	Normative action/comment
<< Basic Service >>	e0 88			
		<< Call class >>	1000	Normal call setup
		<< Basic Service >>	1000	Wideband speech default setup attributes
<<Codec-List>>	7c 07 90 03 00 01 02 00 84			
		<< Negotiation indicator>>		
		<<1st codec identifier>>	0000011	ITU-T Recommendation G.722 [17]
		<< MAC service >>	0000	In_ min_delay
		<< C-Plane routing >>	000	Cf never
		<< Slot size >>	0001	long slot
		<<2nd codec identifier>>	0000100	ITU-T Recommendation G.711 [16]
		<< MAC service >>	0000	In_ min_delay
		<< C-Plane routing >>	000	Cf never
		<< Slot size >>	0001	long slot
		<<3rd codec identifier>>	0000010	G.726
		<< MAC service >>	0000	In_ min_delay
		<< C-Plane routing >>	000	Cf never
		<< Slot size >>	0100	Full slot

Here, a new codec-list is offered in the CC-SETUP.

Again, in a response message (here CC-Connect), the peer entity confirms the chosen service with the IE <<Codec-List>>.

Table D.3 shows the IE codings for this example.

D.1.2.3 Outgoing call with progress indicator with negotiation results in CC-INFO

Use case: User requests a wideband call and Fixed Part uses Progress indicator messages.

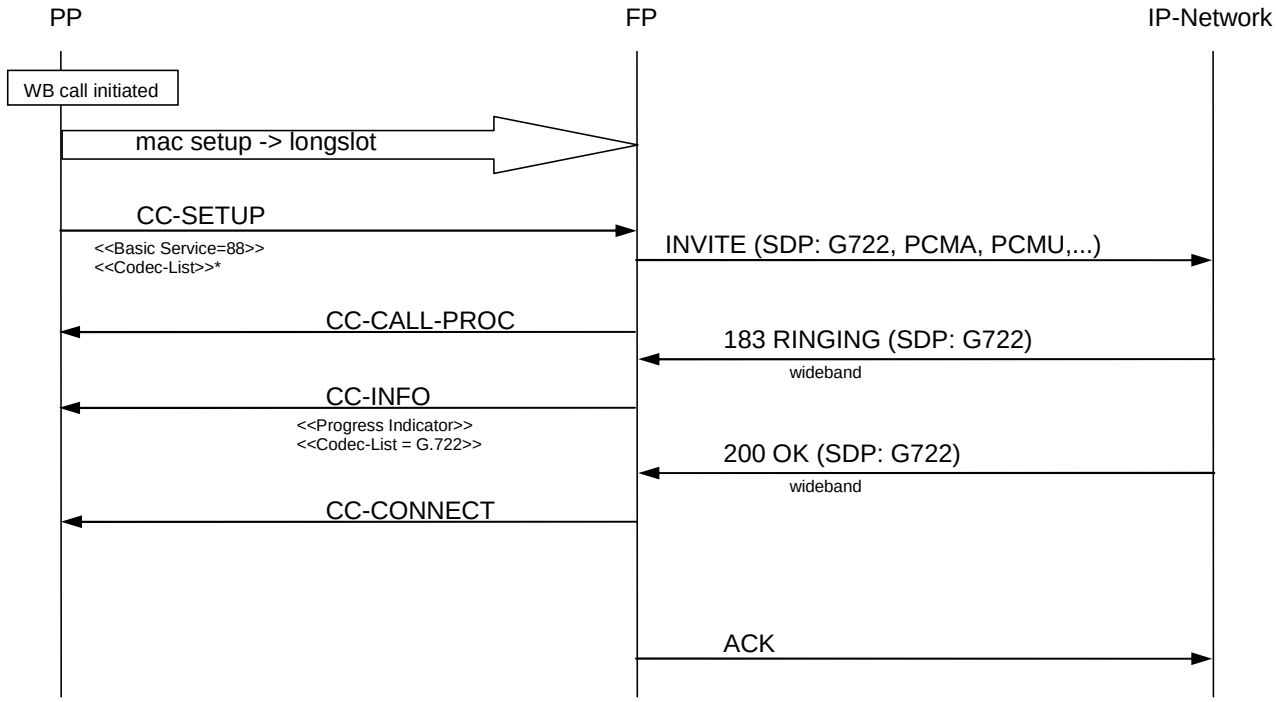


Figure D.3: Outgoing call with progress indicator with negotiation results in CC-INFO

In case the IE <<Progress Indicator>> is used to connect the U-Plane before {CC-CONNECT}, the service shall be confirmed at latest in the same message.

If the service negotiation via the network interface results in the need to change the codec in DECT again, this has to be done with the service change procedure (before or after CC-CONNECT).

D.1.2.4 Outgoing call with progress indicator; with negotiation results in CC-INFO codec change in 200 OK

Use case: User requests outgoing wideband call but the codec changes between RINGING and OK messages on the IP network.

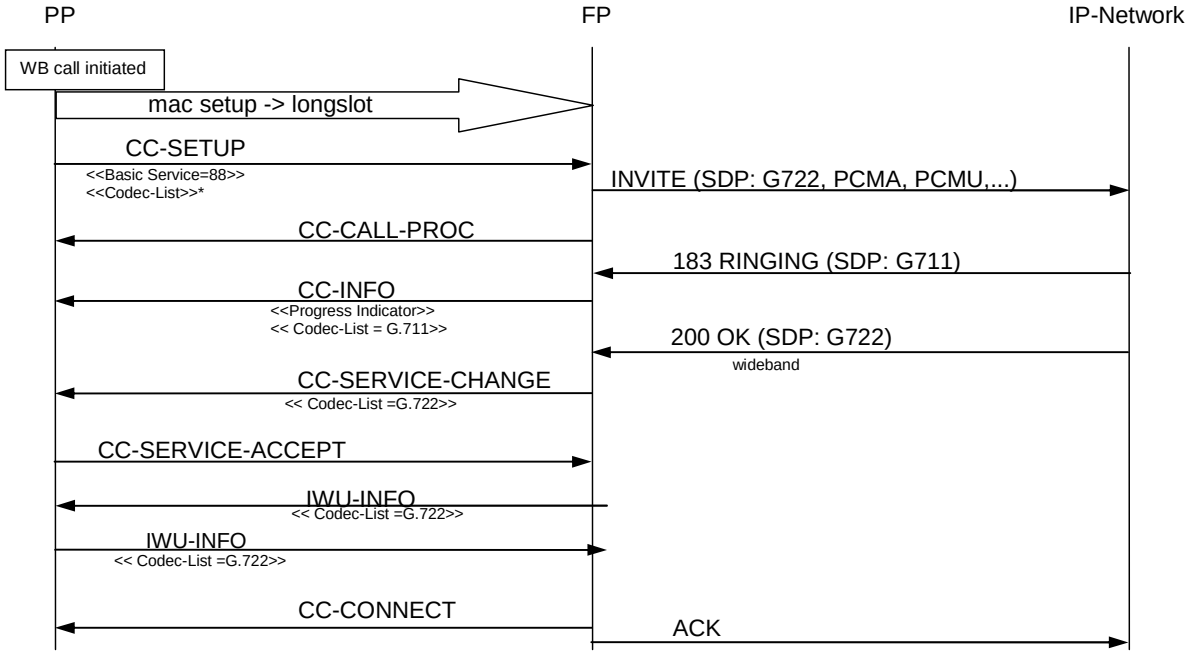


Figure D.4: Outgoing call with progress indicator; with negotiation results in CC-INFO codec change in 200 OK

In this case the codec is changed but the slot format remains unchanged. {IWU-INFO}is exchanged although before CONNECT.

D.1.2.5 Outgoing Call Wideband, negotiation results in Narrowband

Use case: user requests wideband outgoing call but the IP network does not support wide band.

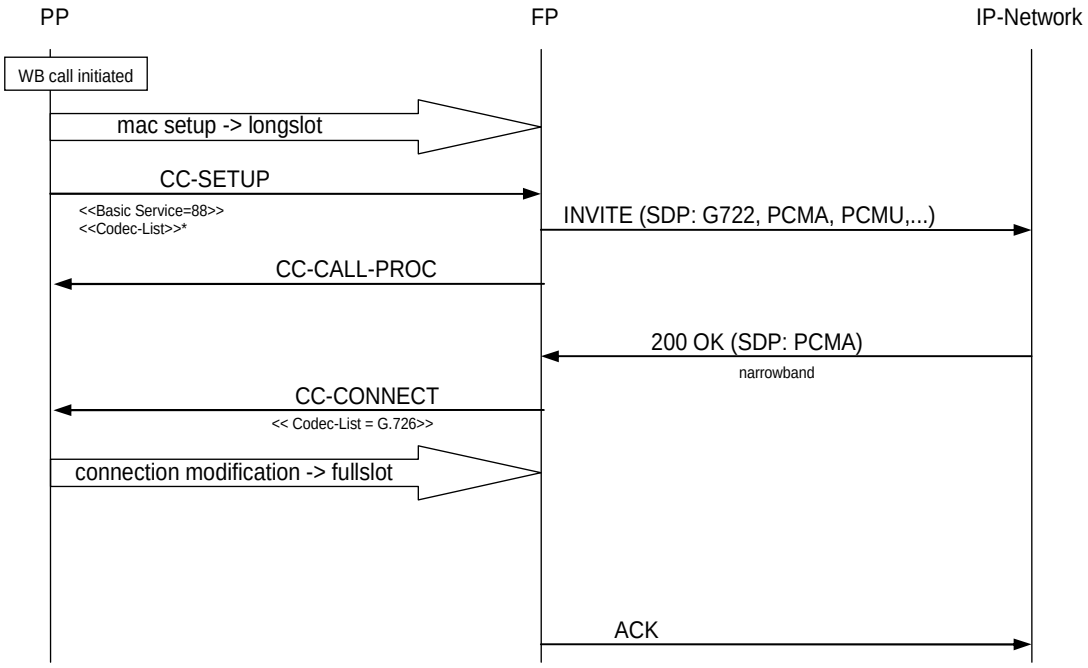


Figure D.5: Outgoing Call Wideband, negotiation results in Narrowband

D.1.2.6 Outgoing Call Wideband, negotiation results in longslot

Use case: User requests outgoing wideband call but establishes the radio link in full-slot.

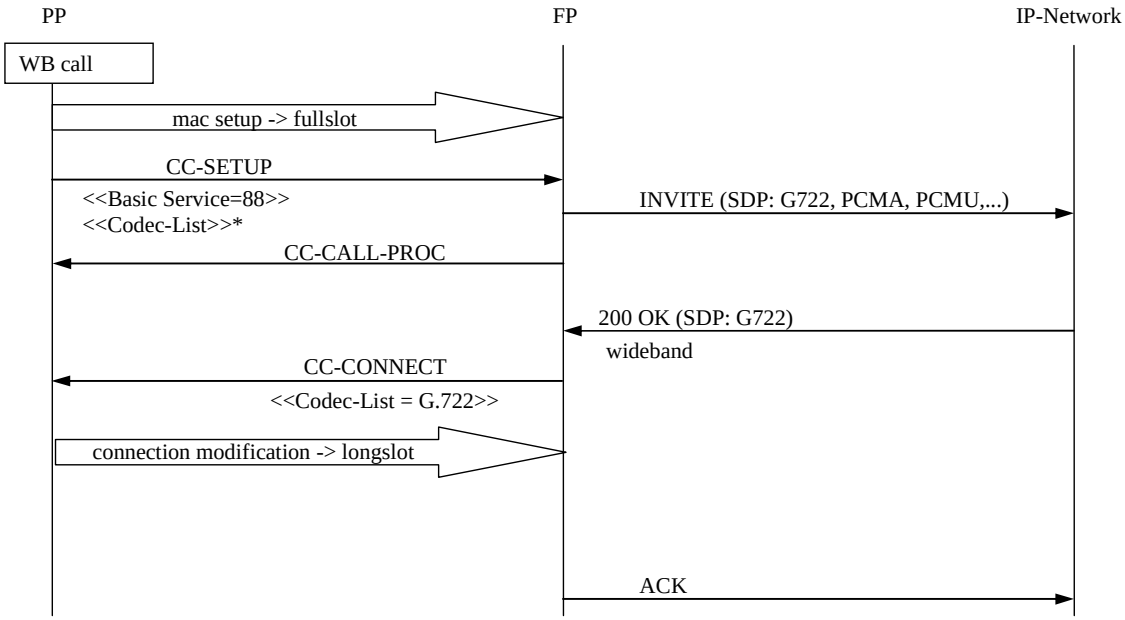


Figure D.6: Outgoing Call Wideband, negotiation results in longslot

It is also possible to establish a full slot connection during call establishment and modify it to a long slot connection after negotiation, if necessary. However it is not recommended, since it might be possible that modification from fullslot to longslot fails due to limited MAC resources (result would appear in the connection attributes of the CC-CONNECT message)

D.1.3 Incoming Call Wideband

D.1.3.1 Incoming Call Wideband, negotiation results in Wideband

Use case: Explicit in the figures title.

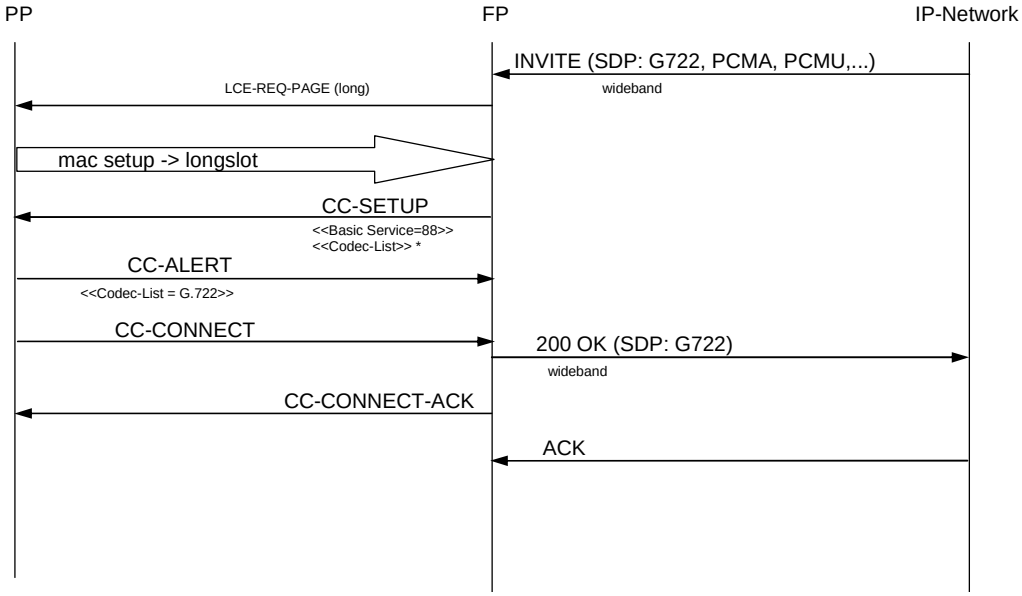


Figure D.7: Incoming Call Wideband, negotiation results in Wideband

D.1.3.2 Incoming Call Wideband, negotiation results in Narrowband

Use case: User receives incoming call in wideband preferred but a narrow band connection is set up (for example if we pickup the call on a NB handset).

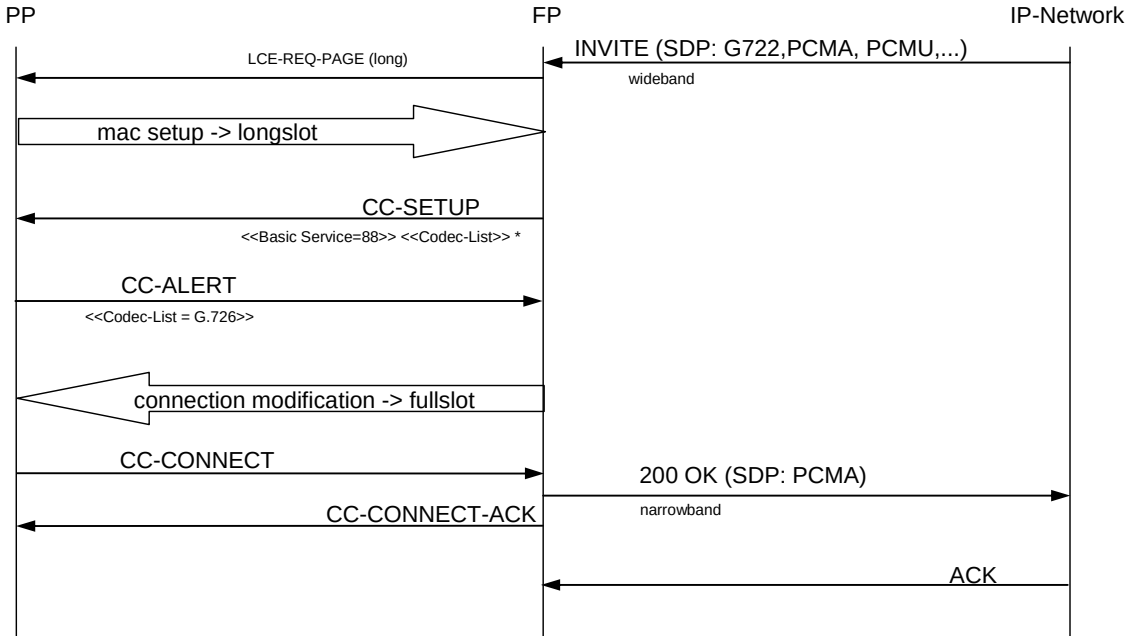


Figure D.8: Incoming Call Wideband, negotiation results in Narrowband

D.1.3.3 Incoming Call Wideband, No SDP Offer in Invite, negotiation results in Narrowband

Use case: User receives an incoming call, FP proposes to establish in WB but network forces narrow-band.

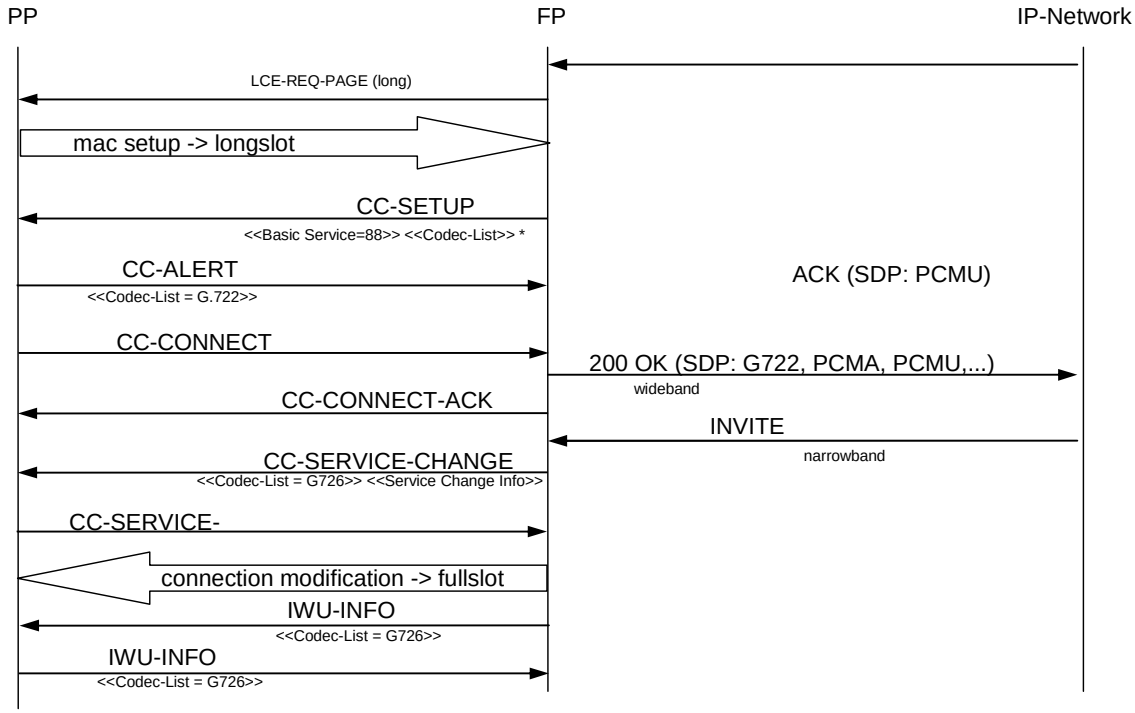


Figure D.9: Incoming Call Wideband, No SDP Offer in Invite, negotiation results in Narrowband

In this case the FP has to assume a service in order to be able to propose one to the PP in the {CC-SETUP} message.

D.1.4 Service Change

D.1.4.1 Service Change from Wideband to Narrowband; re-negotiation initiated from IP-Network

Use case: network requests a codec change (for example call waiting).

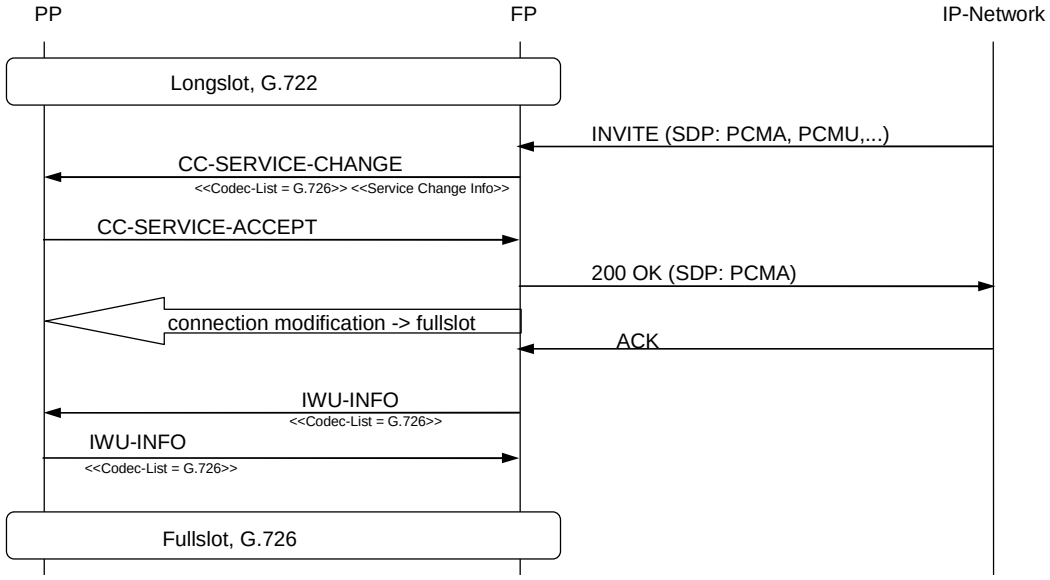


Figure D.10: Service Change from Wideband to Narrowband; re-negotiation initiated from IP-Network

The peer side can either accept the proposal by answering CC-SERVICE-ACCEPT or reject it with CC-SERVICE-REJECT. In the latter case there will be no changes. In the first case the side indicated as master in the IE <<Service change info>> will initiate the agreed changes.

Table D.3: Values used in the {CC-SERVICE-CHANGE} message

Information element	Information Element Coding	Field within the information element	Standard values within the field/information element	Normative action/comment
<<Codec-List>>	7c 04 90 02 00 84			
		<< Negotiation indicator>>		
		<<2nd codec identifier>>	0000010	ITU-T Recommendation G.726 [15]
		<< MAC service >>	0000	In_ min_delay
		<< C-Plane routing >>	000	Cf never
		<< Slot size >>	0100	Full slot
<< Service Change Info >>	16 01 9d	< coding standard >	00	Dect
		< Master >	1	Receiving side (always PP)
		< Change mode >	1101	Audio codec change

Table D.4: Values used within both {IWU-INFO} messages

Information element	Information Element Coding	Field within the information element	Standard values within the field/information element	Normative action/comment
<<Codec-List>>	7c 04 90 02 00 84			
		<< Negotiation indicator>>		
		<<2nd codec identifier>>	0000010	ITU-T Recommendation G.726 [15]
		<< MAC service >>	0000	In_ min_delay
		<< C-Plane routing >>	000	Cf never
		<< Slot size >>	0100	Full slot

D.1.4.2 Service Change from Wideband to Narrowband; re-negotiation initiated from FP

Use case: FP requests codec change on IP network in order to change the radio format on the DECT link (release radio resources for example).

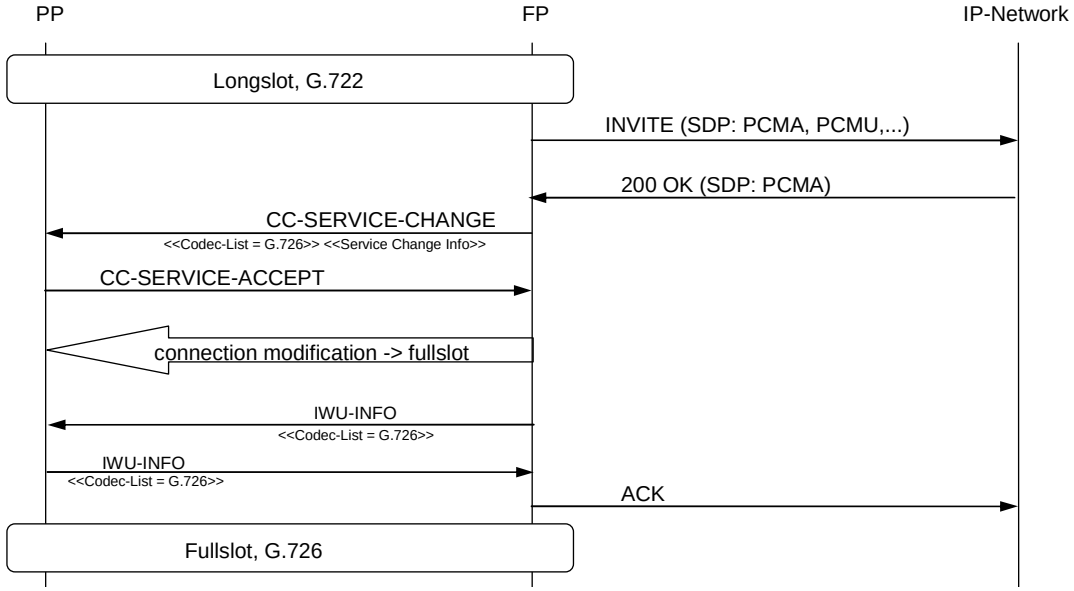


Figure D.11: Service Change from Wideband to Narrowband; re-negotiation initiated from FP

D.1.4.3 Service Change from Wideband to Narrowband; PP initiated; IP Network accepts Narrowband Codec

Use case (example): user connects a narrow-band headset on the PP during an established wideband call.

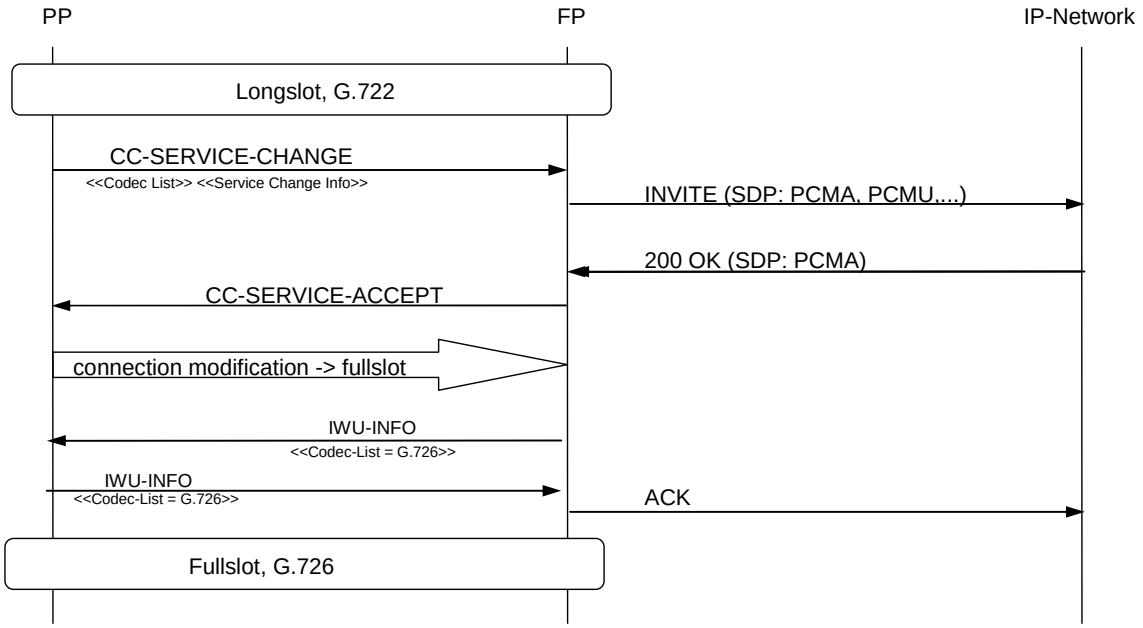


Figure D.12: Service Change from Wideband to Narrowband; PP initiated; IP Network accepts Narrowband Codec

D.1.4.4 Service Change from Wideband ITU-T Recommendation G.722 to Narrowband; PP initiated; IP Network does not accept Narrowband Codec

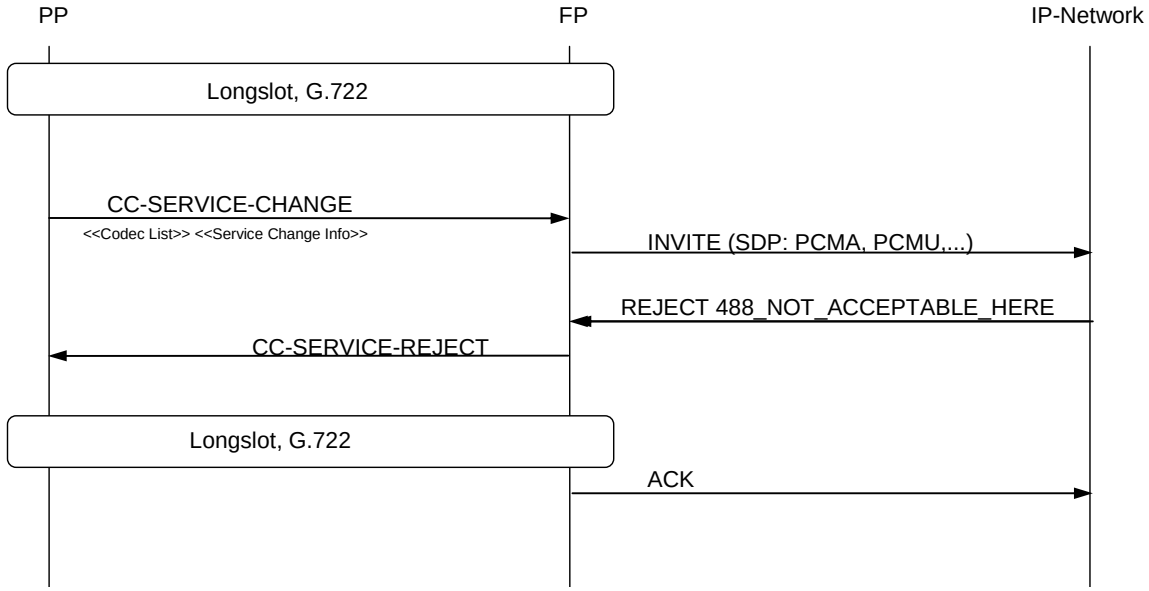


Figure D.13: Service Change from Wideband ITU-T Recommendation G.722 [17] to Narrowband; PP initiated; IP Network does not accept Narrowband Codec

Use case: User connects a NB headset during established call on the PP, but the codec is refused by the network.

D.1.5 Internal Call

D.1.5.1 Intercom Call, PP2 confirms Wideband

Use case: user requests a wideband intercom call and is successful because the other PP supports wideband.

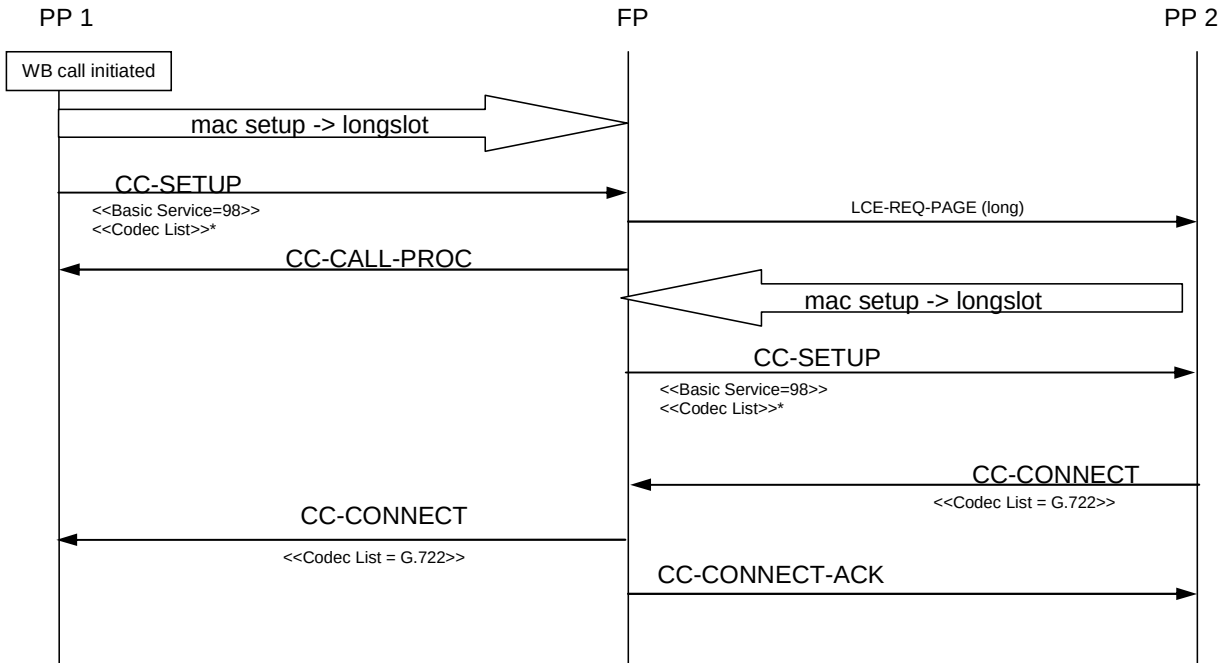


Figure D.14: Intercom Call, PP2 confirms Wideband

D.1.5.2 Intercom Call, PP2 confirms narrowband

Use case: user requests a wideband intercom call but other PP refuses wideband (narrowband headset connected to a wideband PP for example). Intercom call established in narrowband.

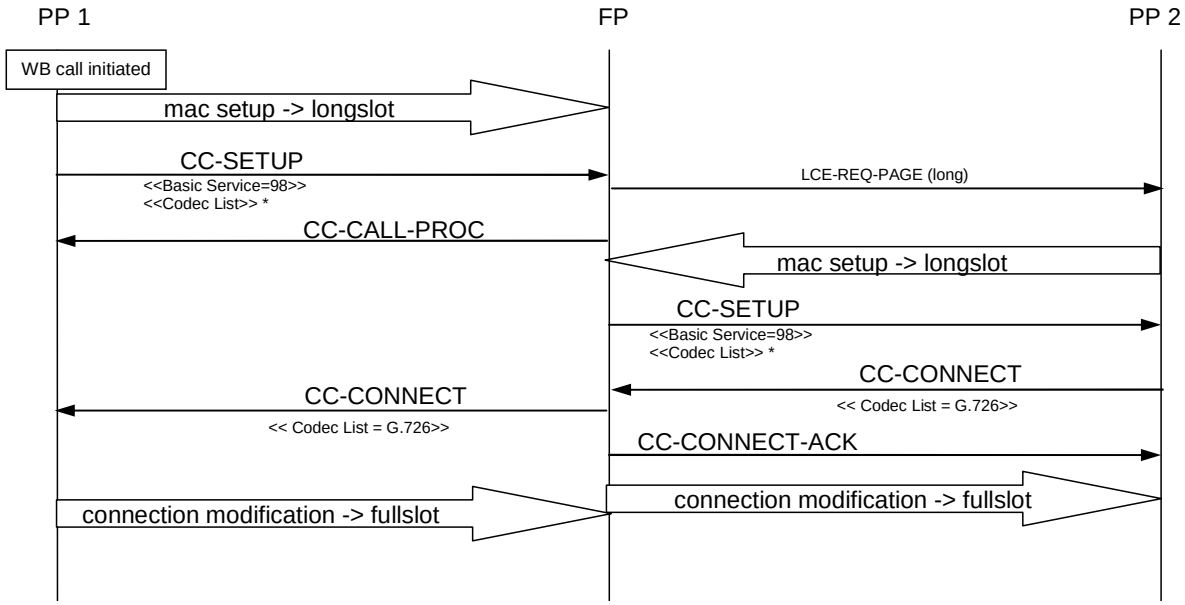


Figure D.15: Intercom Call, PP2 confirms narrowband

D.1.5.3 Intercom Call with Interworking: WB Handset -> NB Handset

Use case: User requests an intercom call between New Generation DECT PP1 to a standard DECT PP2 on the same FP.

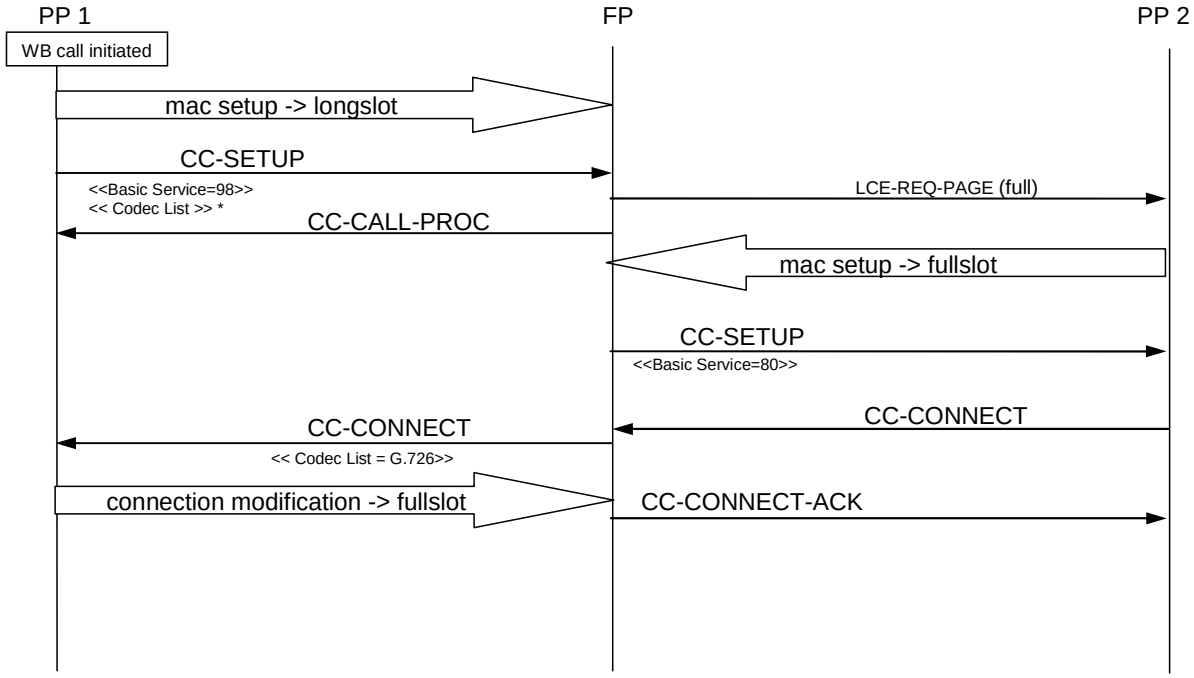


Figure D.16: Intercom Call with Interworking: WB Handset -> NB Handset

Other use case: User requests an intercom call between New Generation DECT PP1 to a standard DECT PP2 on the same FP, but FP requests to change radio format earlier than CONNECT message.

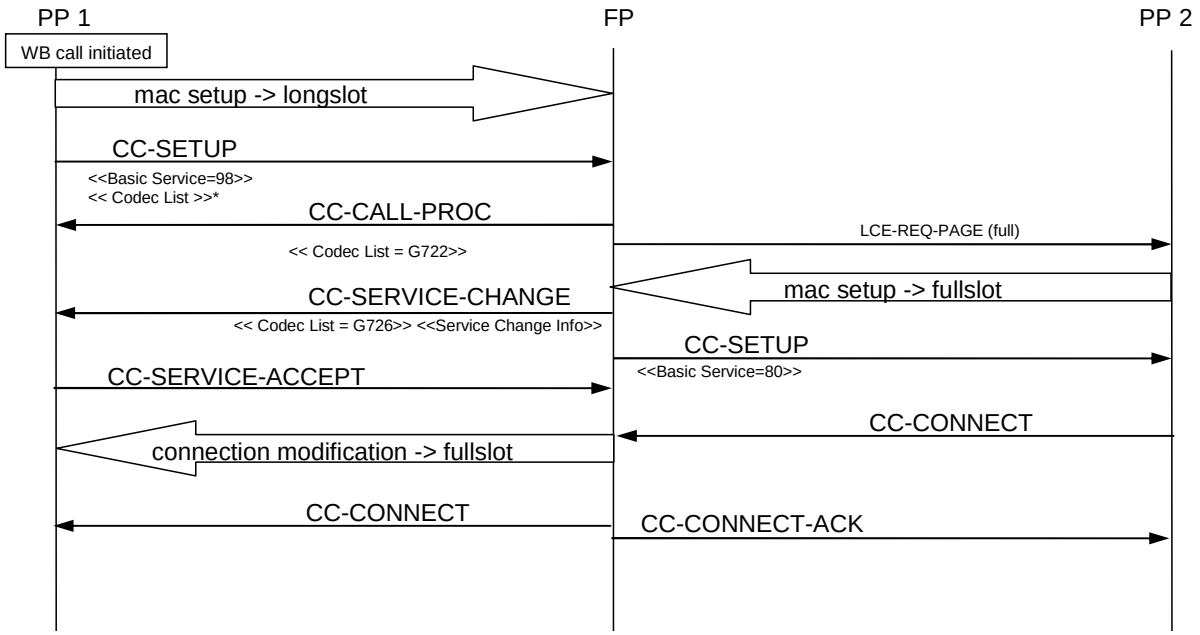


Figure D.17: Intercom Call with Interworking: WB Handset -> NB Handset, alternative procedure

D.1.5.4 Internal Call transfer, WB -> NB

Use case: New Generation DECT PP1 in communication, PP1 initiates an internal call with New Generation DECT PP2, PP2 switches to narrowband due to narrowband headset use.

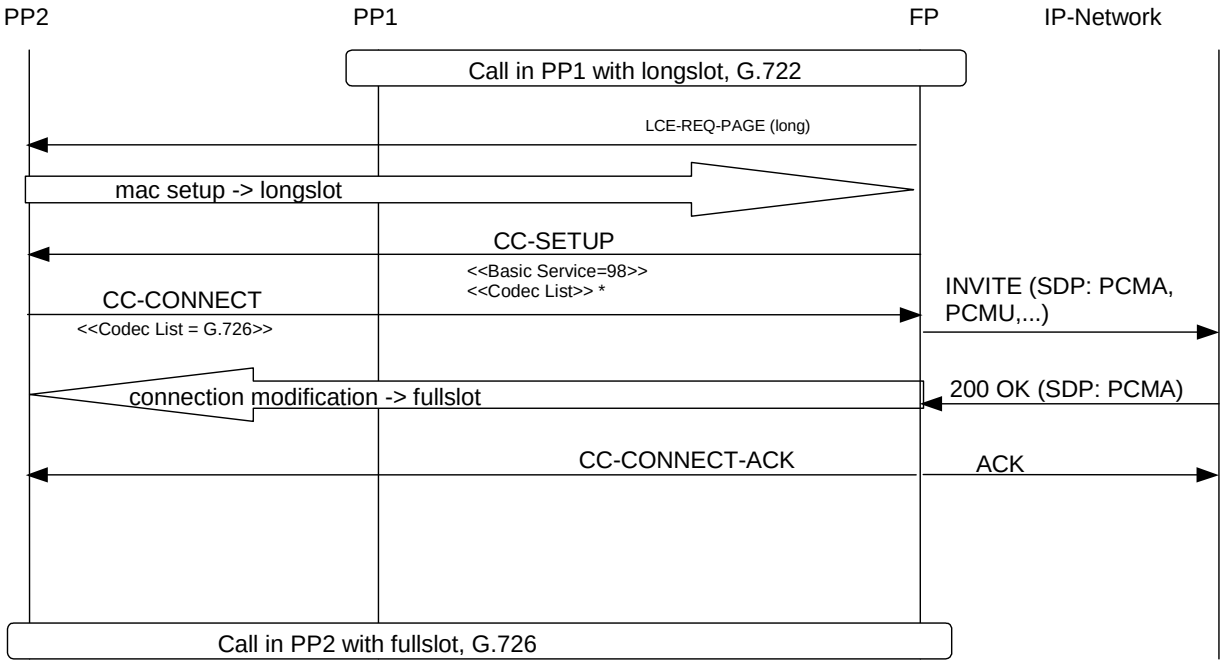


Figure D.18: Internal Call transfer between two NG PPs, initiated as WB and switched later to NB

Other use case: New Generation DECT PP1 in communication, PP1 initiates an internal call with standard DECT PP2, call established in narrowband.

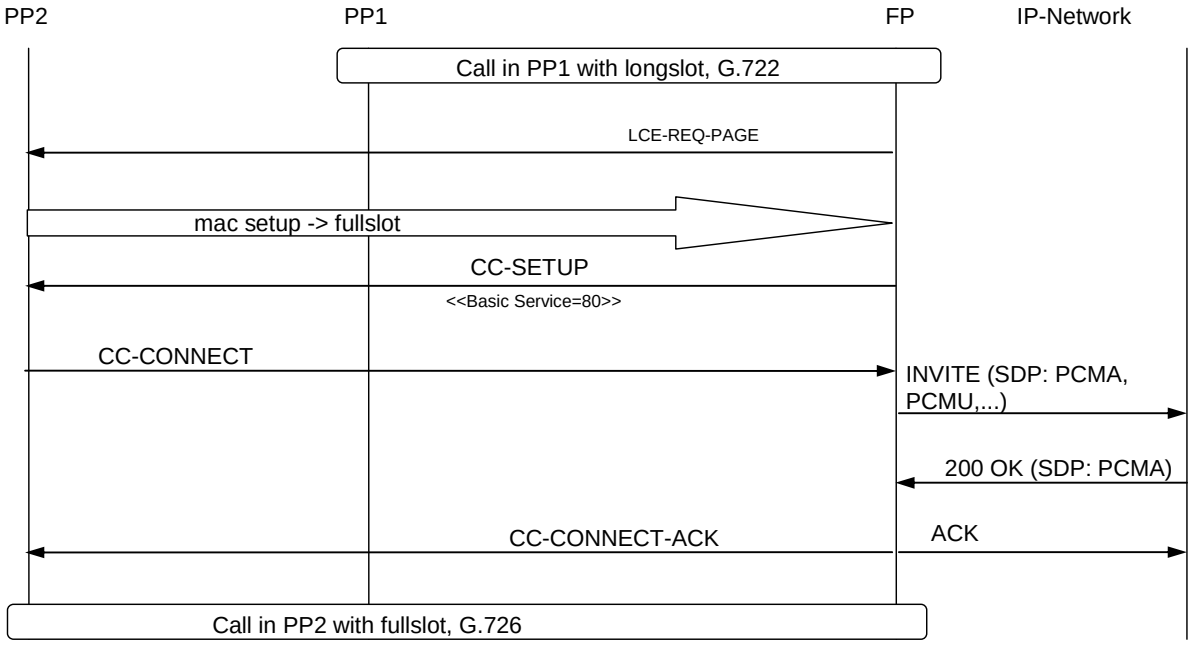


Figure D.19: Internal Call transfer from a NG PP to a PP which does not support wideband

D.1.5.5 Internal Call transfer, NB -> WB

Use case: New Generation DECT PP1 transfers a call to a New Generation DECT PP2.

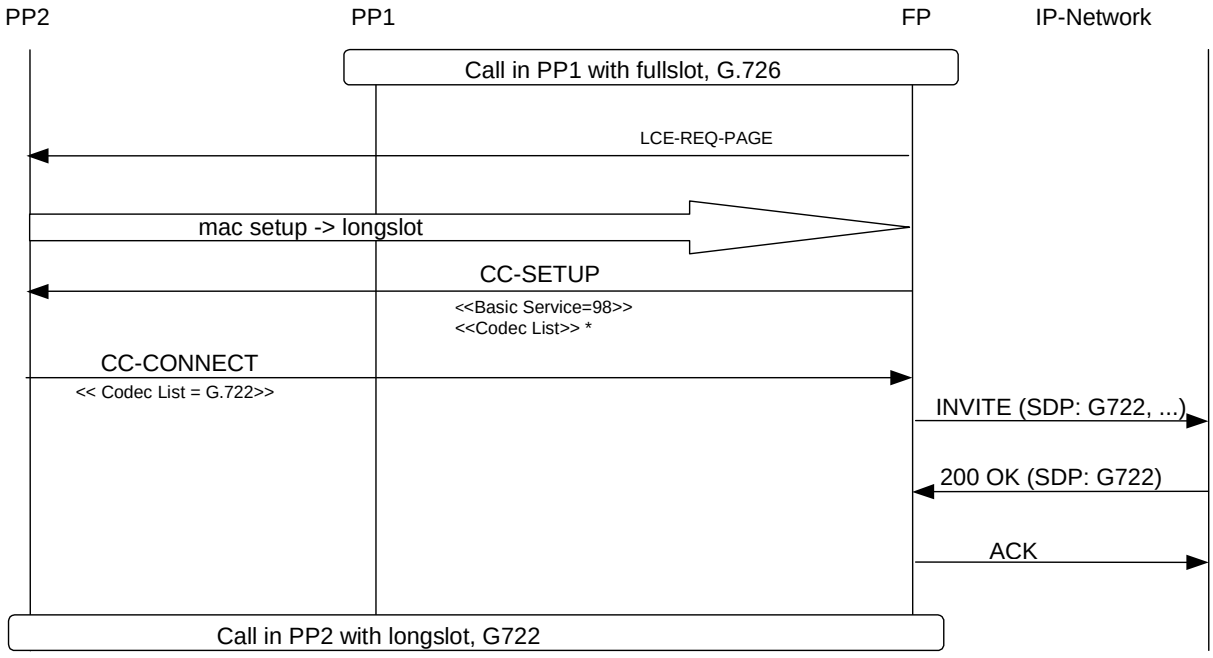


Figure D.20: Internal Call transfer, NB -> WB

D.1.5.6 Internal Call transfer, NB -> WB, IP negotiation results in NB

Use case: New Generation DECT PP1 transfers a narrowband external call to New Generation DECT PP2, requests on IP for wideband is refused by the network. External call is transferred in the same codec: narrowband.

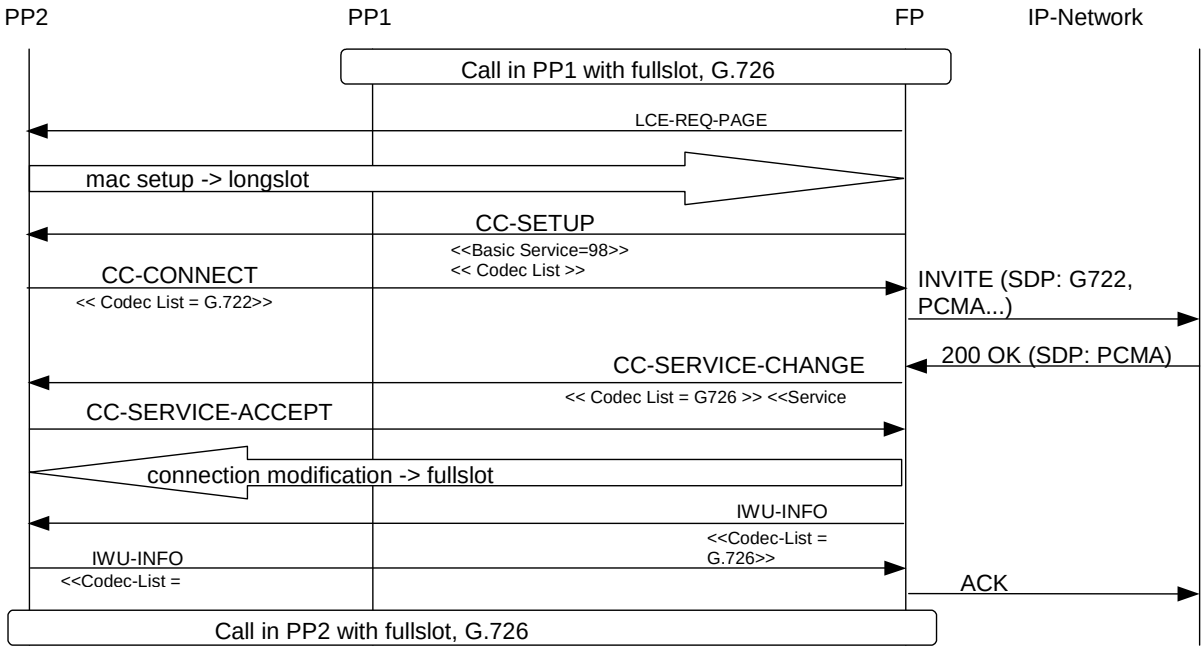


Figure D.21: Internal Call transfer, NB -> WB, IP negotiation results in NB

D.1.6 Special cases

D.1.6.1 Service Change from Wideband to Narrowband with Call Waiting

Use case: User accepts a call waiting from IP-Network.

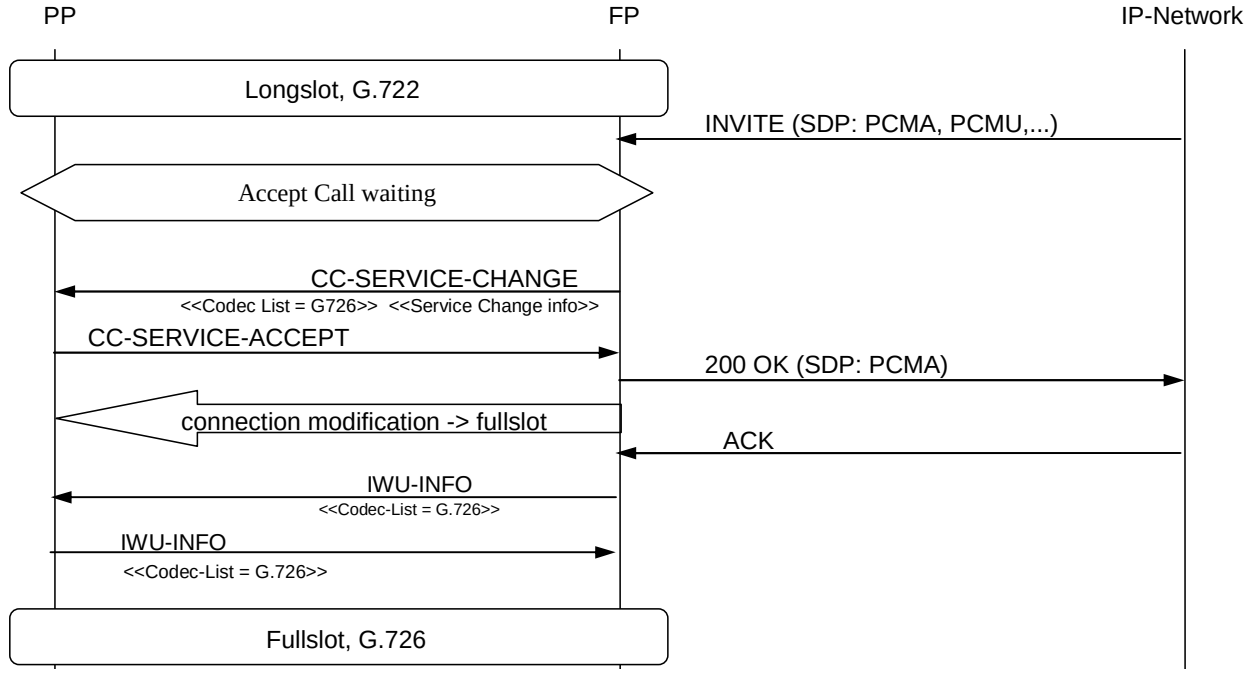


Figure D.22: Service Change from Wideband to Narrowband with Call Waiting

D.1.6.2 Service Change from Wideband to Narrowband with Call Hold

Use case: User requests a call hold during a wideband call and requests a new call setup in narrowband accepted by the IP network.

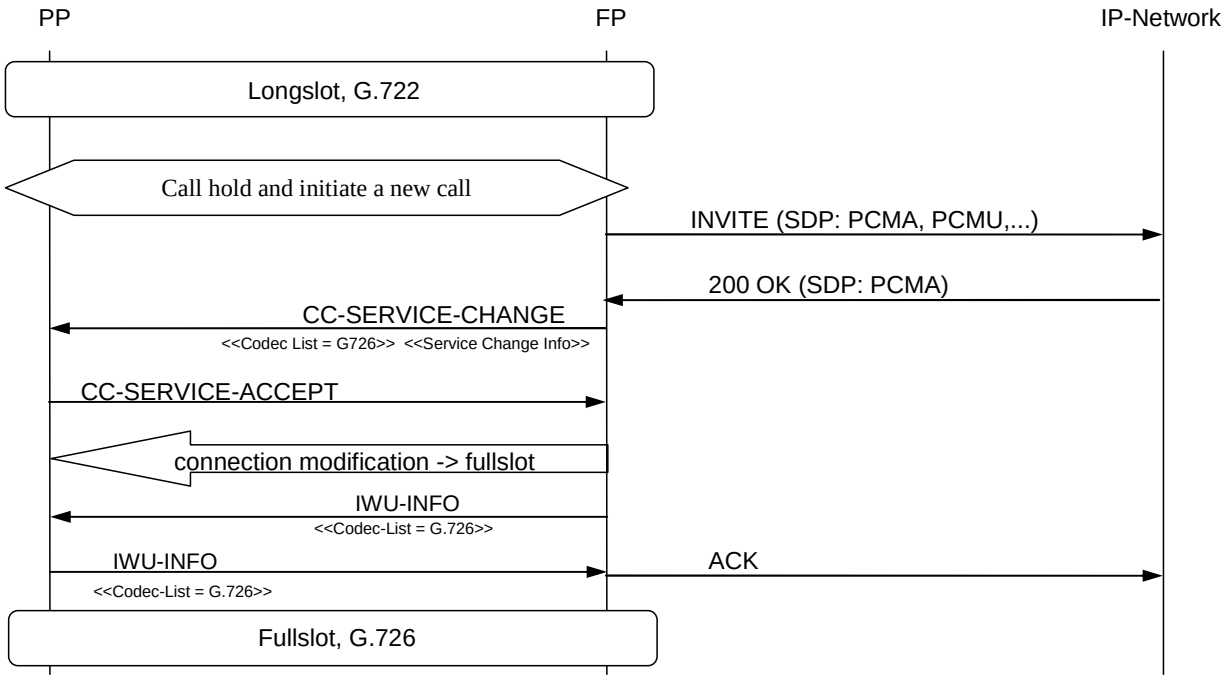


Figure D.23: Service Change from Wideband to Narrowband with Call Hold

D.1.6.3 Service Change from Wideband to Narrowband; Network layer Acknowledgment

Use case: Change codec or audio format during a communication without audio artefacts.

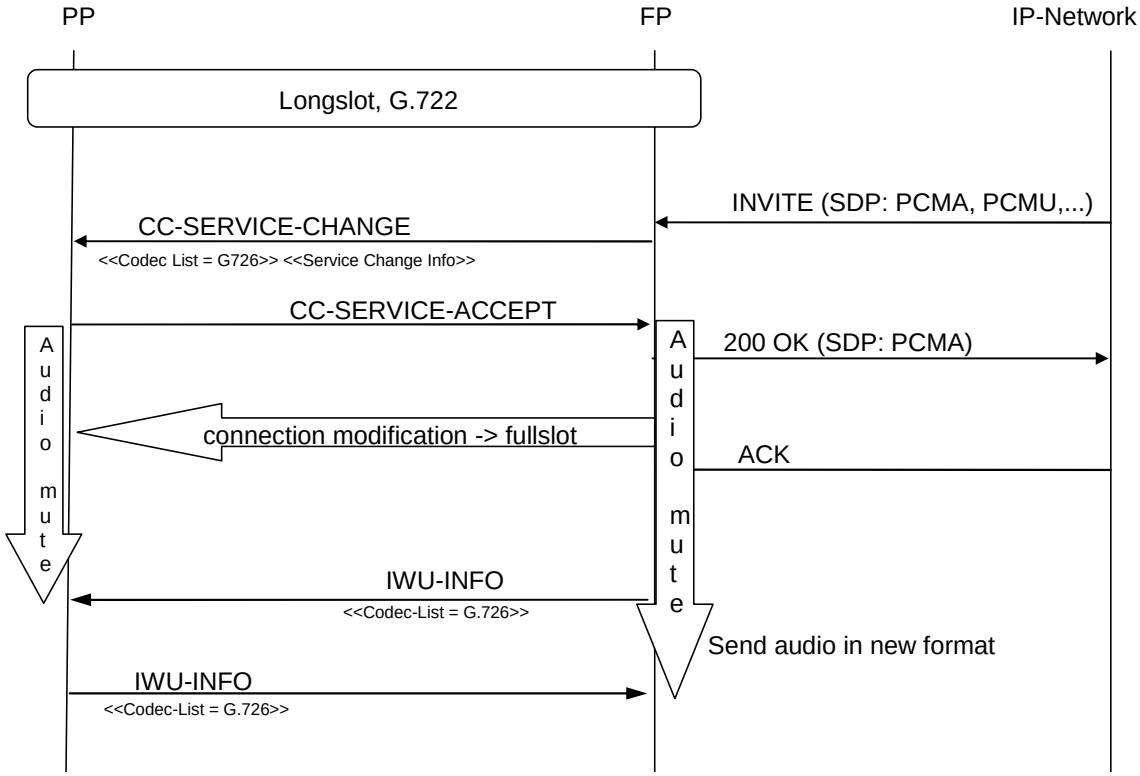


Figure D.24: Service Change from Wideband to Narrowband; Network layer Acknowledgment

The IWU-INFO is sent by both sides. The service change from Narrowband to Wideband is performed in the same way.

D.1.6.4 Service Change from Narrowband to Wideband fails; Network layer Acknowledgment

Use case: Failure in change of codec or audio format during a communication without audio artefacts.

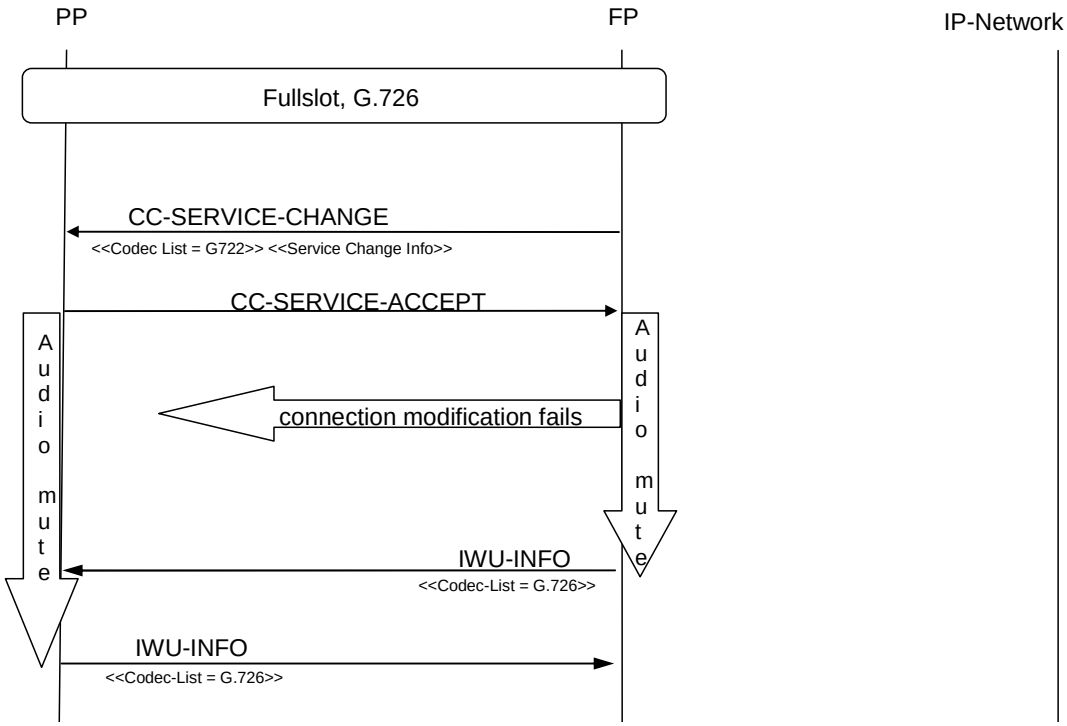


Figure D.25: Service Change from Narrowband to Wideband fails; Network layer Acknowledgment

The IWU-INFO is sent by both sides. The service change from Narrowband to Wideband is performed in the same way.

D.1.6.5 Outgoing Call, slot type modification fails

Use case: Slot type modification after negotiation fails.

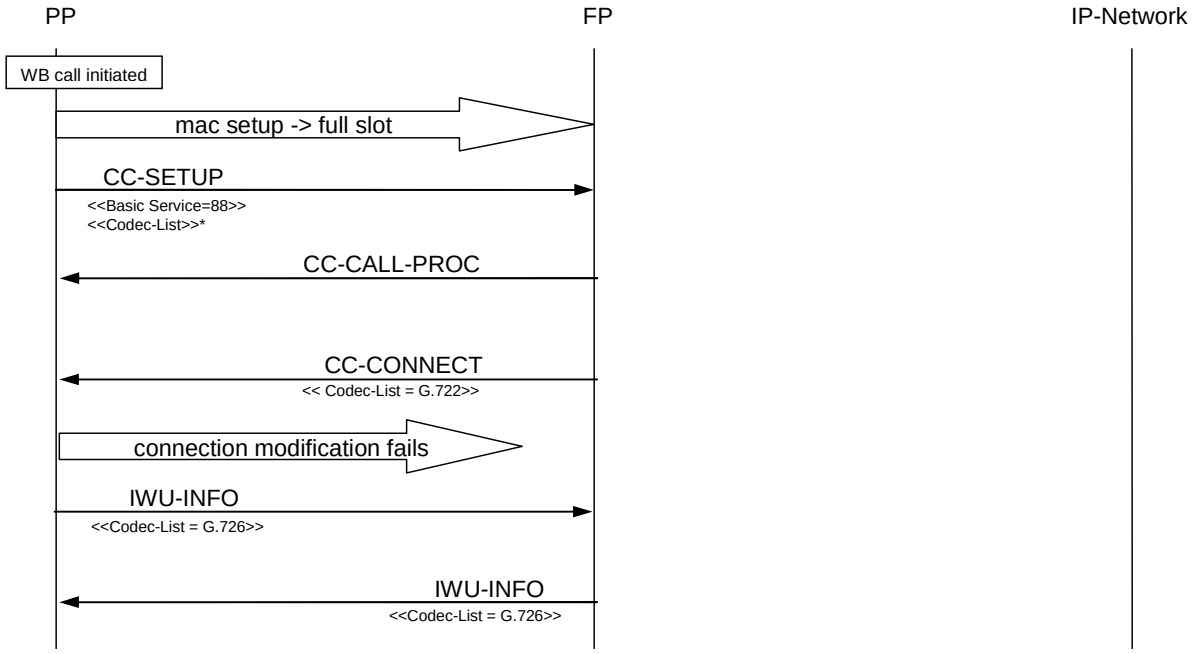


Figure D.26: Outgoing Call, slot type modification fails

D.1.7 Slot type and/or connection type modification

D.1.7.1 General

This clause shows recommended flowcharts for different use cases of slot type modification combined with connection type modification basic to advanced and vice versa.

Basic connections are only used for narrowband G.726 service, which uses full slot, MAC service I_N_minimum_delay and no C_F. This ensures backcompatibility with GAP devices. For any other service (including the G.729.1 and MPEG at 32 kb/s), advanced connection should be used.

NOTE: The following notation is used in figures:

- BC_Message_name = Mt message, Basic Connection control set.
- AC_Message_name = Mt message, Advanced Connection control set.

D.1.7.2 FT initiated connection modification

D.1.7.2.1 FT initiated connection modification (full slot In_minimum -> long slot In_minimum)

Modification scenario example: narrowband (G726) → wideband (G722).

a) Usual case: connection modification successful, initial connection is basic connection.

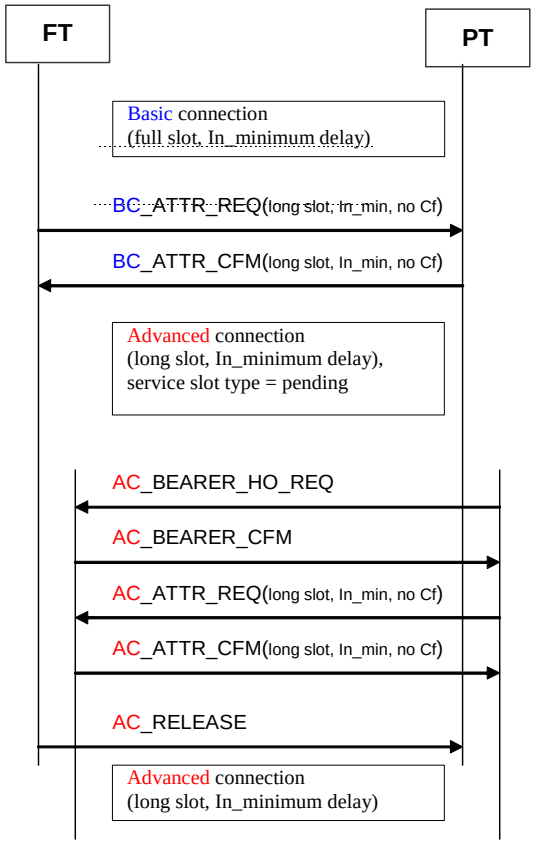


Figure D.27: Successful FT initiated connection modification (full slot In_minimum -> long slot In_minimum), initial connection is a basic connection

b) FT initiated connection modification failed.

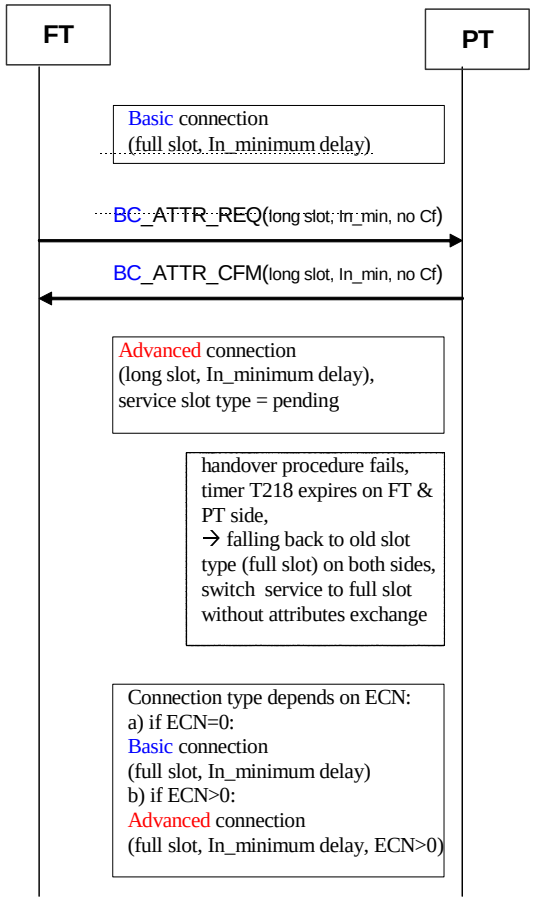


Figure D.28: FT initiated connection modification failed (full slot In_minimum -> long slot In_minimum)

c) Successful FT initiated connection modification. Initial connection is "advanced" (ECN>0).

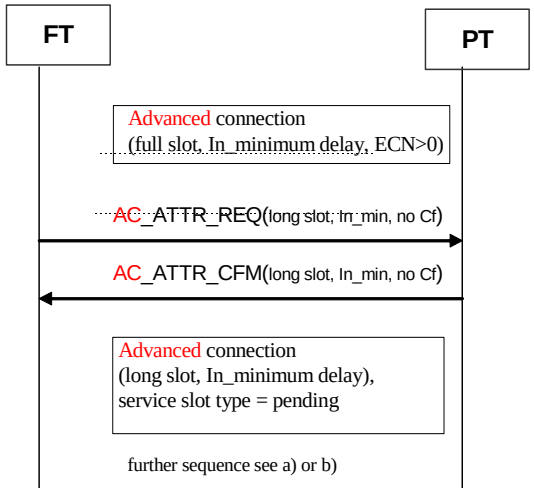


Figure D.29: Successful FT initiated connection modification (full slot In_minimum -> long slot In_minimum), initial connection is an advanced connection

D.1.7.2.2 FT initiated connection modification (full slot In_minimum -> long slot In_normal)

Modification scenario example: narrowband (G726) → wideband (MPEG4 64 kbit/s).

a) FT initiated connection modification successful.

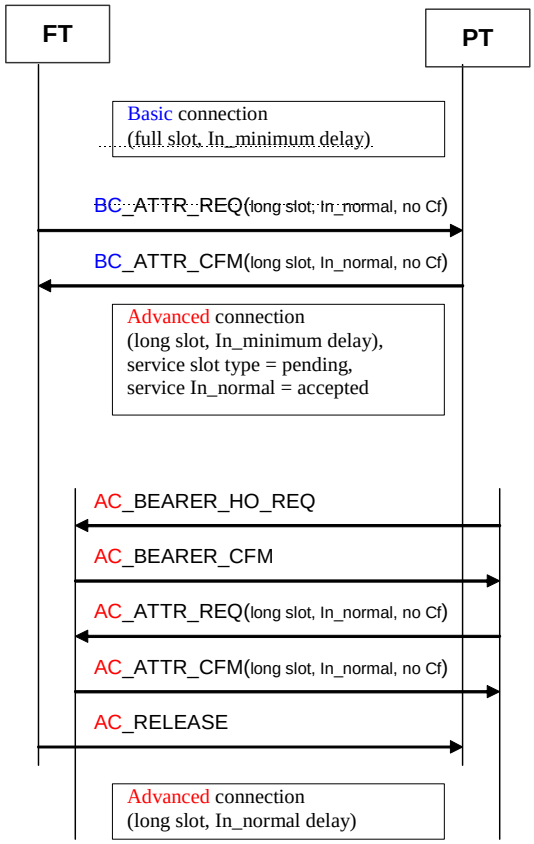
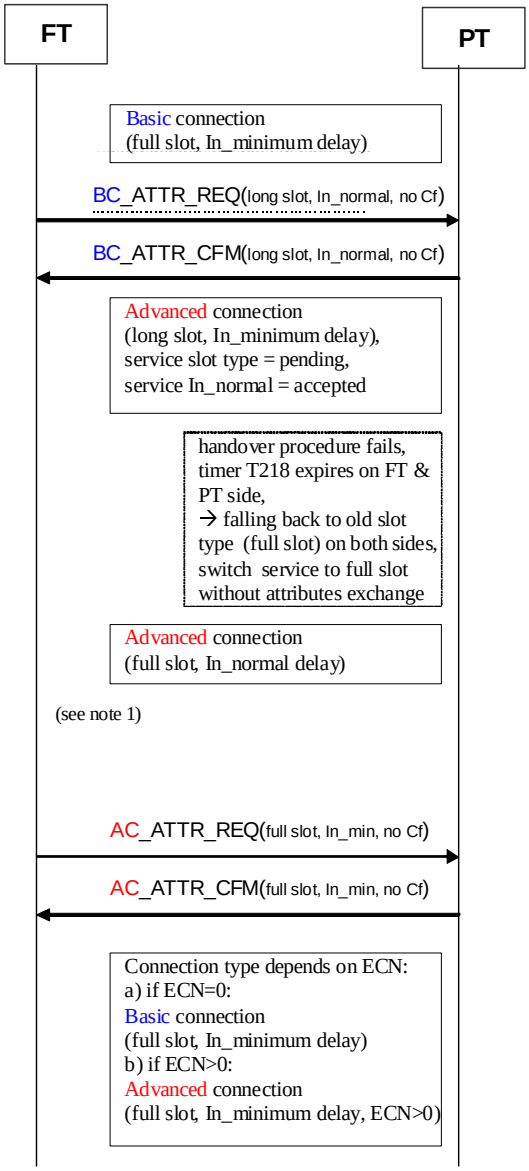


Figure D.30: Successful FT initiated connection modification (full slot In_minimum -> long slot In_normal_delay): initial connection is basic

b) FT initiated connection modification failed.



NOTE 1: After falling back to old slot type the initiating side starts a connection modification attributes exchange to leave the undefined/undesired state.

NOTE 2: Instead of switching back to the old service the initiating side (-> FT) may start again a slot modification to long slot. In this case the FT starts with a attributes exchange AC_ATTR_REQ(long slot, In_normal, no Cf) on the old bearer.

Figure D.31: FT initiated connection modification failed (full slot In_minimum -> long slot In_normal_delay)

c) FT initiated connection modification beginning with "advanced" (ECN>0).

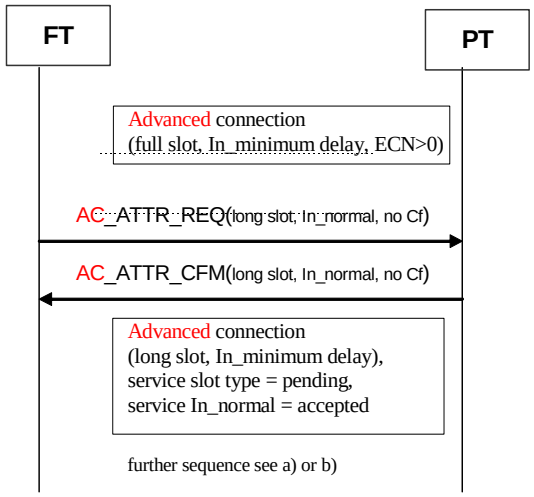


Figure D.32: Successful FT initiated connection modification (full slot In_minimum -> long slot In_normal_delay): initial connection is advanced

D.1.7.2.3 FT initiated connection modification (long slot In_minimum -> full slot In_minimum)

Modification scenario example: wideband (G722) → narrowband (G726).

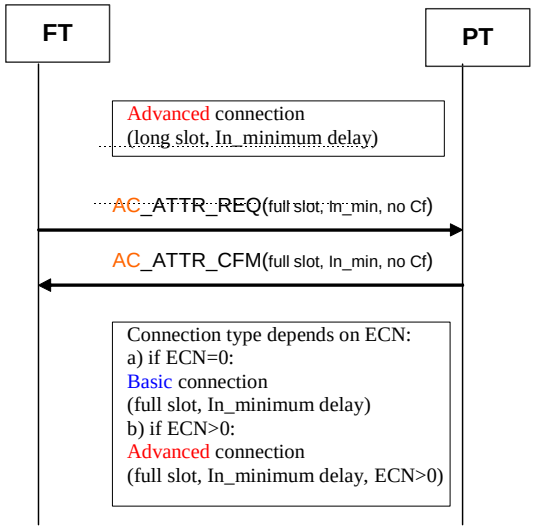


Figure D.33: FT initiated connection modification (long slot In_minimum -> full slot In_minimum)

D.1.7.2.4 FT initiated connection modification (long slot In_normal -> full slot In_minimum)

Modification scenario example: wideband (MPEG4 64kbit/s) → narrowband (G726).

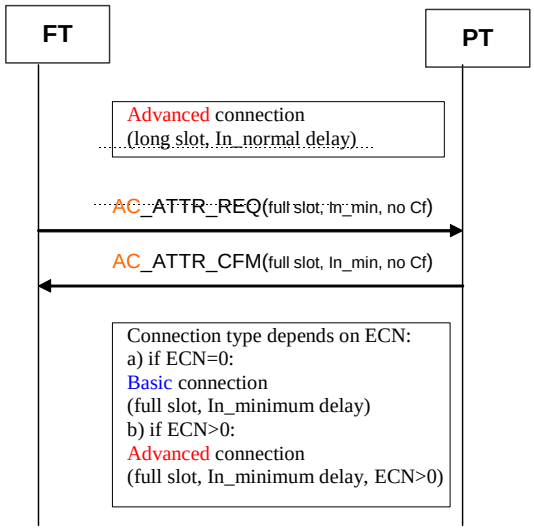


Figure D.34: FT initiated connection modification (long slot In_normal -> full slot In_minimum)

D.1.7.3 PT initiated connection modification

D.1.7.3.1 PT initiated connection modification (full slot In_minimum -> long slot In_minimum)

Modification scenario example: narrowband (G726) → wideband (G722).

a) PT initiated connection modification successful. Initial connection is basic.

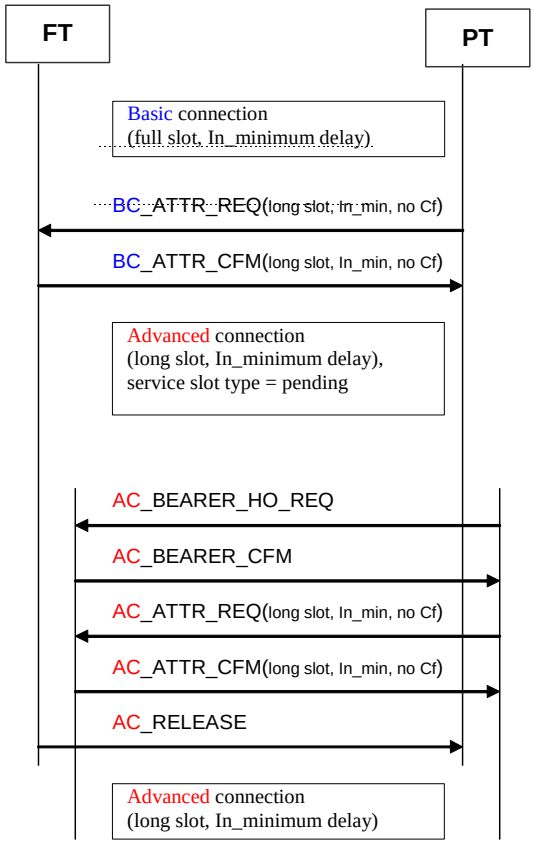


Figure D.35: Successful PT initiated connection modification (full slot In_minimum -> long slot In_minimum); initial connection is basic

b) PT initiated connection modification failed.

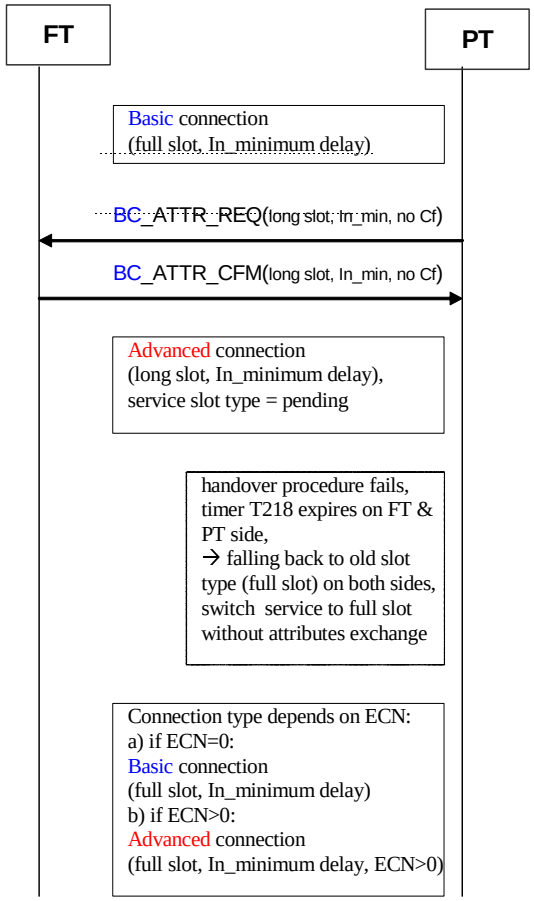


Figure D.36: PT initiated connection modification failed (full slot In_minimum -> long slot In_minimum)

c) PT initiated connection modification successful. Initial connection is advanced (ECN>0).

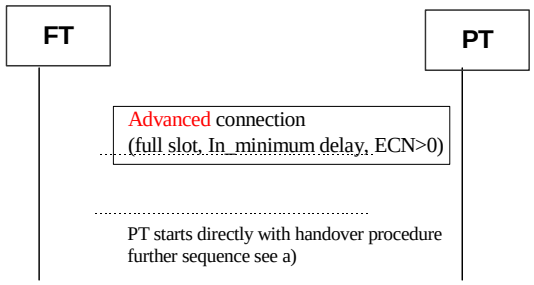


Figure D.37: Successful PT initiated connection modification (full slot In_minimum -> long slot In_minimum); initial connection is advanced

D.1.7.3.2 PT initiated connection modification (full slot In_minimum -> long slot In_normal)

Modification scenario example: narrowband (G726) → wideband (MPEG4 64kbit/s).

a) PT initiated connection modification successful. Initial connection is basic.

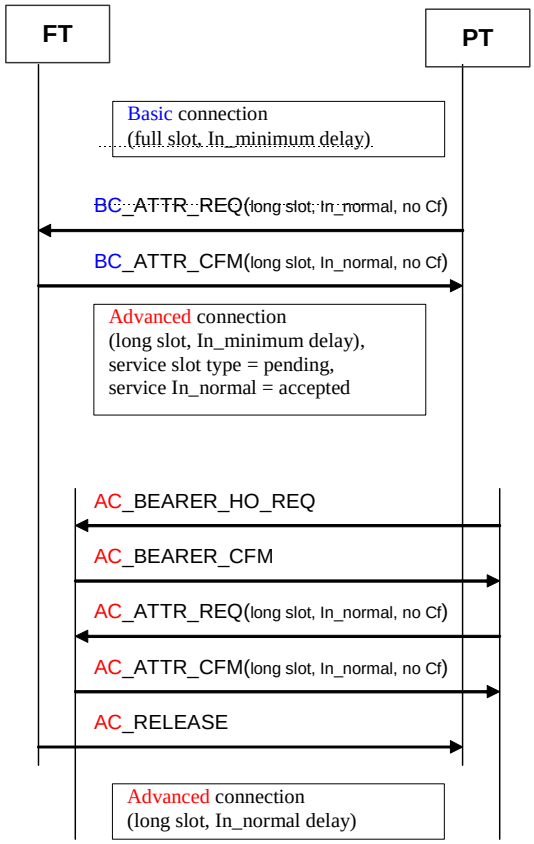
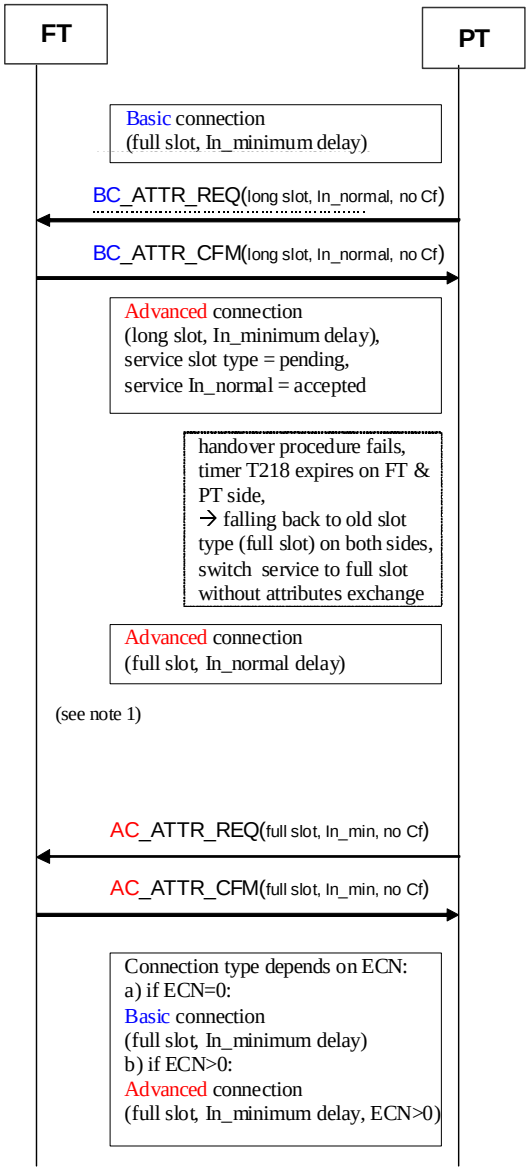


Figure D.38: Successful PT initiated connection modification (full slot In_minimum -> long slot In_normal); initial connection is basic

b) PT initiated connection modification failed.



NOTE 1: After falling back to old slot type the initiating side starts a connection modification attributes exchange to leave the undefined/undesired state.

NOTE 2: Instead of switching back to the old service the initiating side (-> PT) may start again a slot modification to long slot. In this case the PT can start directly a handover procedure, a attributes exchange on the old bearer is not necessary (still advanced connection).

Figure D.39: PT initiated connection modification (full slot In_minimum -> long slot In_normal) failed

c) PT initiated connection modification successful. Initial connection is advanced (ECN>0).

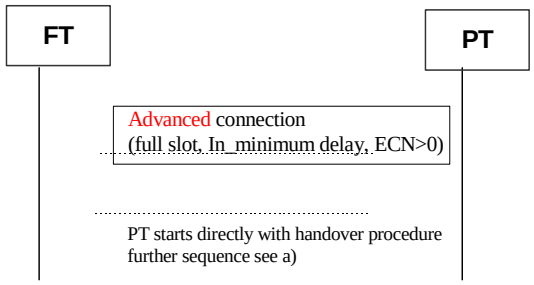


Figure D.40: Successful PT initiated connection modification (full slot In_minimum -> long slot In_normal); initial connection is advanced

D.1.7.3.3 PT initiated connection modification (long slot In_minimum -> full slot In_minimum)

Modification scenario example: wideband (G722) → narrowband (G726).

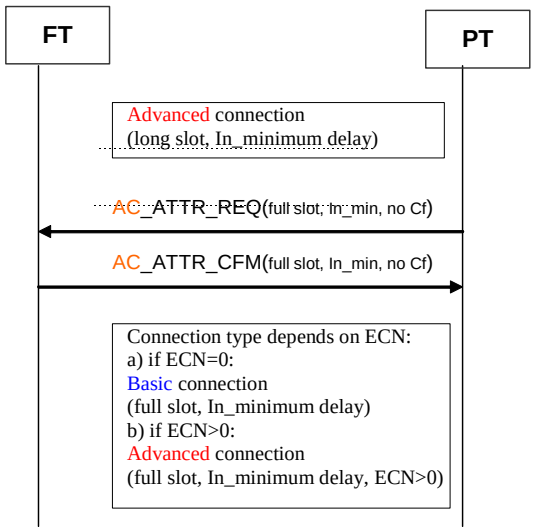


Figure D.41: PT initiated connection modification (long slot In_minimum -> full slot In_minimum)

D.1.7.3.4 PT initiated connection modification (long slot In_normal -> full slot In_minimum)

Modification scenario example: wideband (MPEG4 64kbit/s) → narrowband (G726).

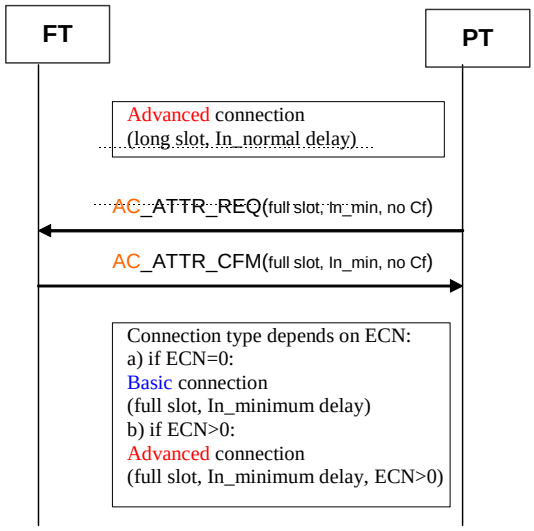


Figure D.42: PT initiated connection modification (long slot In_normal -> full slot In_minimum)

D.2 Examples of implementation of procedures for MPEG-4 ER AAC-LD voice service

D.2.1 MPEG-4 ER AAC-LD voice service codec configuration and negotiation process

In annex C, the signalling of the MPEG-4 ER AAC-LD configuration using two <<IWU to IWU>> elements is defined. The following informative flowcharts describe the handling of the codec configuration and negotiation process in case of a MPEG-4 ER AAC-LD voice service selection. Furthermore the Session Initiation Protocol (RFC 3261 [i.10]) for call establishment of the Voice over IP call is assumed.

D.2.1.1 Transmitting non default configuration using <<LOCATE-REQUEST>>, <<LOCATE-ACCEPT>> Message

Use case: Explicit in the figures title.

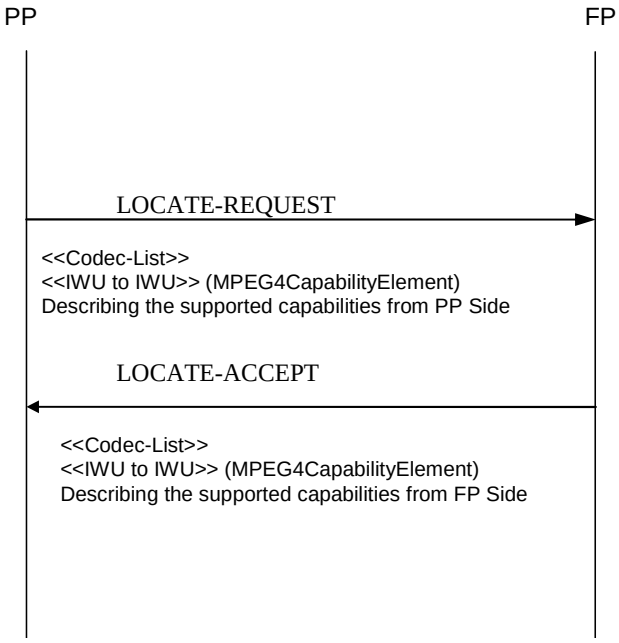


Figure D.43: Transmitting non default configuration using <<LOCATE-REQUEST>>, <<LOCATE-ACCEPT>> Message

D.2.1.2 Transmitting non default configuration using <<ACCESS-RIGHTS-REQUEST>>, << ACCESS-RIGHTS-ACCEPT>> Message

Use case: Explicit in the figures title.

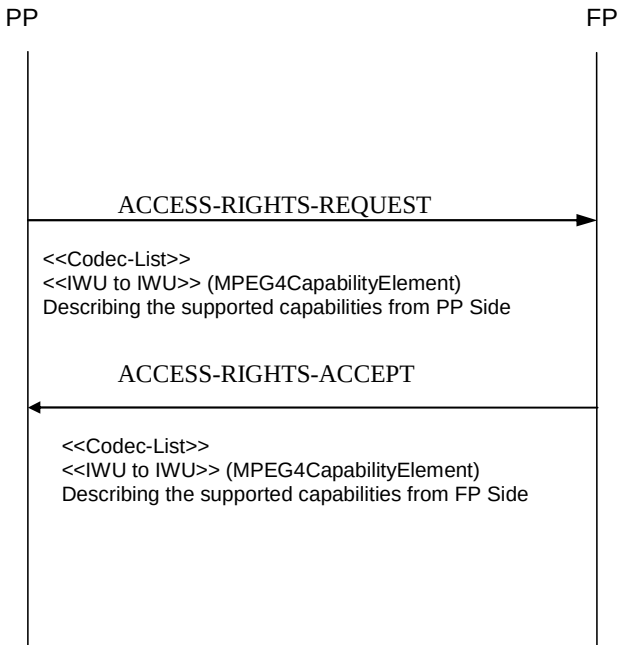


Figure D.44: Transmitting non default configuration using <<ACCESS-RIGHTS-REQUEST>>, << ACCESS-RIGHTS-ACCEPT>> Message

D.2.1.3 Outgoing Call Super-wideband, codec MPEG-4 ER AAC-LD

Use case: Explicit in the figures title.

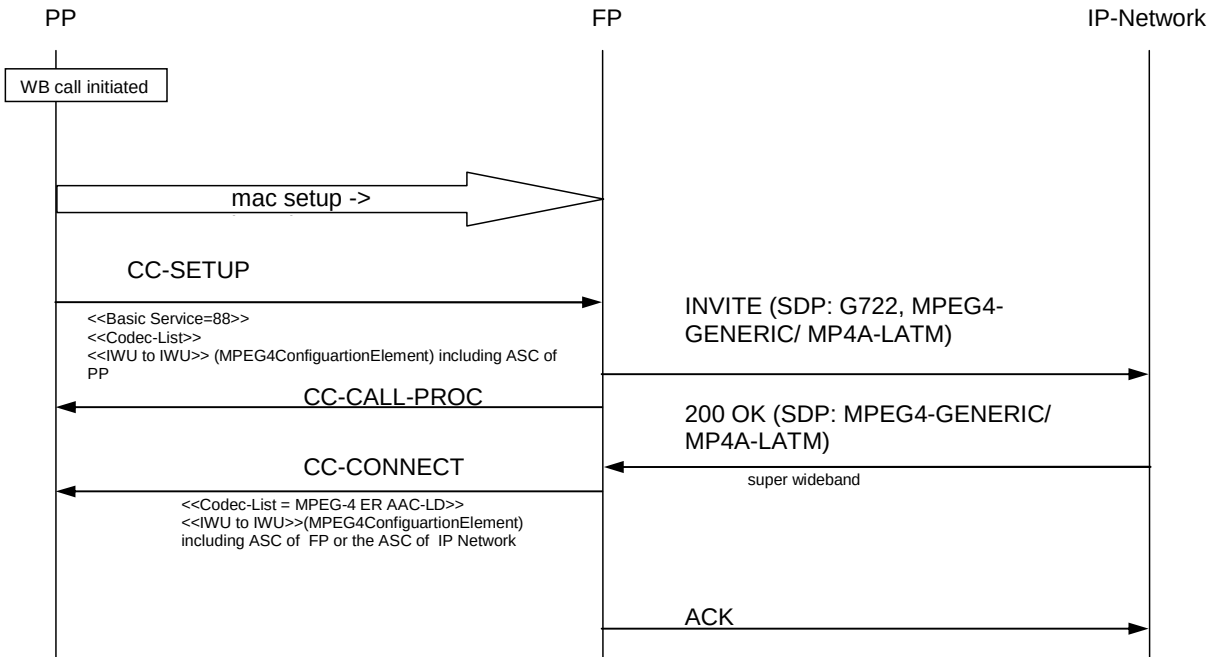


Figure D.45: Outgoing Call Super-wideband, codec MPEG-4 ER AAC-LD

D.2.1.3.1 Outgoing Call Super-wideband, INVITE command: AudioSpecificConfig()

In the MPEG4-GENERIC/MP4A-LATM part of the SDP content (during the INVITE command) the AudioSpecificConfig() (ASC) of the PP or the FP has to be transmitted to signal the used MPEG-4 ER AAC-LD configuration. The SDP content during the INVITE command can be described as follow.

G.722 [17] codec part:

```
m=audio 49230 RTP/AVP 9
a=rtpmap:9 G722/8000
```

The description for MPEG-4 ER AAC-LD can be transmitted using two different RFCs (RFC 3016 [i.8] and RFC 3640 [i.7]):

RFC 3640 [i.7]:

```
m=audio 49230 RTP/AVP 96
a=rtpmap:96 mpeg4-generic/48000/1
a=fmtp:96 streamtype=5; profile-level-id=52; mode=AAC-hbr;
config=ASC; sizeLength=13; indexLength=3; indexDeltaLength=3; constantDuration=480;
```

RFC 3016 [i.8]:

```
m=audio 49230 RTP/AVP 96
a=rtpmap:96 MP4A-LATM/48000
a=fmtp:96 profile-level-id=52; bitrate=64000; cpresent=0;
config=ASC;
```

D.2.1.3.2 Outgoing Call Super-wideband, OK command: AudioSpecificConfig()

In the MPEG4-GENERIC/MP4A-LATM part of the SDP content (during the OK command) the AudioSpecificConfig() (ASC) of the IP remote station has to be transmitted to signal the used MPEG-4 ER AAC-LD configuration. The SDP content during the OK command can be described as follow.

RFC 3640 [i.7]:

```
m=audio 49230 RTP/AVP 96
a=rtpmap:96 mpeg4-generic/48000/1
a=fmtp:96 streamtype=5; profile-level-id=52; mode=AAC-hbr;
config=ASC; sizeLength=13; indexLength=3; indexDeltaLength=3; constantDuration=480;
```

RFC 3016 [i.8]:

```
m=audio 49230 RTP/AVP 96
a=rtpmap:96 MP4A-LATM/48000
a=fmtp:96 profile-level-id=52; bitrate=64000; cpresent=0;
config=ASC;
```

D.2.1.4 Incoming Call Super-wideband, codec MPEG-4 ER AAC-LD

Use case: Explicit in the figures title.

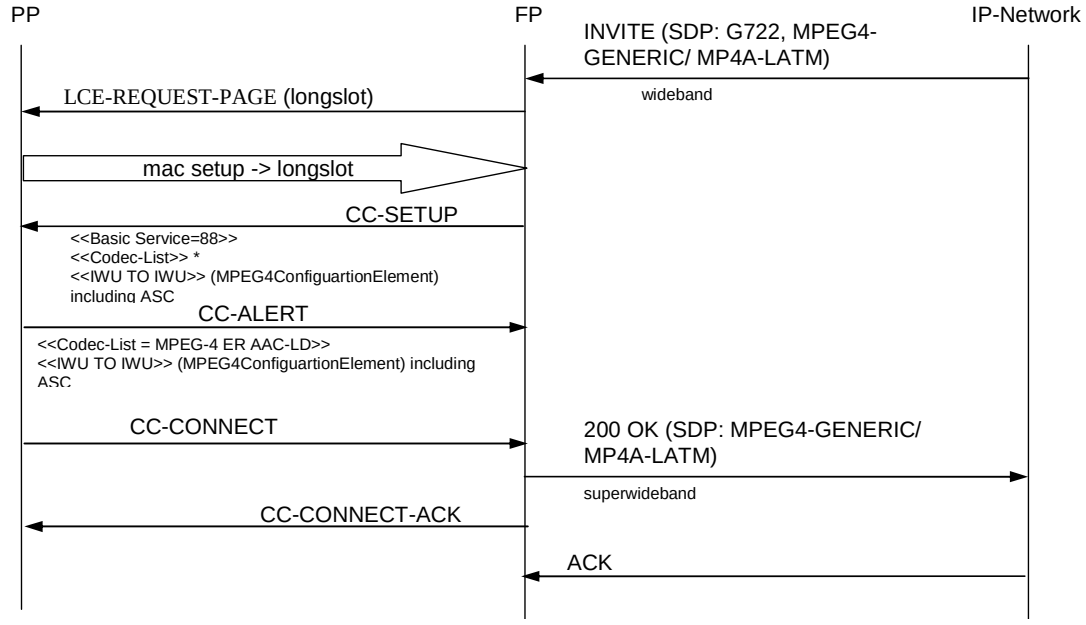


Figure D.46: Incoming Call Super-wideband, codec MPEG-4 ER AAC-LD

D.2.1.4.1 Incoming Call Super-wideband, INVITE command: AudioSpecificConfig()

In the MPEG4-GENERIC/MP4A-LATM part of the SDP content (during the INVITE command), the `AudioSpecificConfig()` (ASC) of the IP remote station or the FP has to be transmitted to signal the used MPEG-4 ER AAC-LD configuration. The SDP content during the INVITE command can be described as follow.

ITU-T Recommendation G.722 [17] codec part:

```
m=audio 49230 RTP/AVP 9
a=rtpmap:9 G722/8000
```

The description for MPEG-4 ER AAC-LD can be transmitted using two different RFCs (RFC 3016 [i.8] and RFC 3640 [i.7]):

RFC 3640[i.7]:

```
m=audio 49230 RTP/AVP 96
a=rtpmap:96 mpeg4-generic/48000/1
a=fmtp:96 streamtype=5; profile-level-id=52; mode=AAC-hbr;
config=ASC; sizeLength=13; indexLength=3; indexDeltaLength=3; constantDuration=480;
```

RFC 3016 [i.8]:

```
m=audio 49230 RTP/AVP 96
a=rtpmap:96 MP4A-LATM/48000
a=fmtp:96 profile-level-id=52; bitrate=64000; cpresent=0;
config=ASC;
```

D.2.1.4.2 Incoming Call Super-wideband, OK command: AudioSpecificConfig()

In the MPEG4-GENERIC/MP4A-LATM part of the SDP content (during the OK command) the `AudioSpecificConfig()` (ASC) of the PP has to be transmitted to signal the used MPEG-4 ER AAC-LD configuration. The SDP content during the OK command can be described as follows:

RFC 3640 [i.7]:

```
m=audio 49230 RTP/AVP 96
a=rtpmap:96 mpeg4-generic/48000/1
a=fmtp:96 streamtype=5; profile-level-id=52; mode=AAC-hbr;
config=ASC; sizeLength=13; indexLength=3; indexDeltaLength=3; constantDuration=480;
```

RFC 3016 [i.8]:

```
m=audio 49230 RTP/AVP 96
a=rtpmap:96 MP4A-LATM/48000
a=fmtp:96 profile-level-id=52; bitrate=64000; cpresent=0;
config=ASC;
```

Annex E (informative): Services and features defined in other specifications

E.1 Services and features defined in EN 300 444 (GAP)

The following informative annex shows the features and MAC/DLC services defined in EN 300 444 [12] (GAP), many of them are reused in the present specification. This list is informative, and shows the status in EN 300 444 [12] V1.5.1. In case of changes or divergences the original definitions at EN 300 444 [12] (GAP) shall rule.

E.1.1 GAP Network (NWK) features (clause 4.1 of EN 300 444)

outgoing call [N.1]: Call initiated at a DECT PP.

off-hook [N.2]: Ability to indicate the action of going off-hook, e.g. to start call setup or accept a call.

on-hook (FULL Release) [N.3]: Ability to indicate the action of going on-hook (e.g. to terminate a call) and fully release the radio resource.

dialled digits (basic) [N.4]: Capability to dial digits 0 to 9, *, #.

register recall [N.5]: Ability of the PP to request the invocation of the supplementary service "register recall" over the DECT interface and the ability of the FP to transmit the request to the local network.
Register recall means to seize a register (with dial tone) to permit input of further digits or other action.

go to DTMF signalling (defined tone length) [N.6]: Go to DTMF signalling with defined tone length.

pause (dialling pause) [N.7]: Ability to generate or indicate a dialling pause, e.g. to await further dial tone.

incoming call [N.8]: Call received at a DECT PP.

authentication of PP [N.9]: Process by which the identity of a DECT PP is checked by the FP.

authentication of user [N.10]: Process by which the identity of a user of a DECT PP is checked by the FP. The User Personal Identification (UPI), a personal identification of 0 to 8 digits, manually entered by the user, is used for user authentication.

location registration [N.11]: Facility whereby a PP can be registered with a FP or a cluster of FPs such that incoming calls, radio pages or messages may be routed to it.

on-air key allocation [N.12]: Capability to transform Authentication Code (AC) into User Authentication Key (UAK) using the key allocation procedure.

identification of PP [N.13]: Ability for the FP to request and PP to provide specific identification parameters.

service class indication/assignment [N.14]: Assignment by the FP to PP of the service class and indication to the FP by the PP of the contents of its service class.

alerting [N.15]: Activates or deactivates alerting at the PP using any appropriate indication.

ZAP [N.16]: Ability first to assign and then to re-program the account data held in the PP so that access rights may be suspended subject to the conditions set by the service provider being met, coupled with the ability to re-program the account data again to reinstate access rights once these conditions have been met.
One ZAP field shall be provided per account field. The PP has the right to authenticate the FP prior to the execution of ZAP suspend.

encryption activation FT initiated [N.17]: Activation of the encryption process requested by FT.

subscription registration procedure on-air [N.18]: Standardized procedure for loading subscription registration data into a PP in real time over the air-interface.

link control [N.19]: Ability to request, accept, maintain and release a data link for the purposes of a NWK layer procedure.

terminate access rights FT initiated [N.20]: Ability of the FP to delete a subscription in the PP.

partial release [N.21]: Ability to release an established or in progress Call Control (CC) call whilst retaining the radio resource for the purpose of accessing further services.

go to DTMF (infinite tone length) [N.22]: Go to DTMF signalling, indicating infinite DTMF tone duration.

go to pulse [N.23]: Go to pulse (decadic) signalling.

signalling of display characters [N.24]: Transmission to the PP of characters to be displayed on the user's PP display (if provided).

display control characters [N.25]: Characters sent to the PP to control the user's display in the PP (if provided). Such characters include cursor control, clear screen, home, flash, inverse video, etc.

authentication of FT [N.26]: Process by which the identity of a FP is checked by the PP.

encryption activation PT initiated [N.27]: Activation of the encryption process suggested by PT.
The real time start of ciphering is done in the MAC layer and is always initiated by the PT.

encryption deactivation FT initiated [N.28]: Deactivation of the encryption process requested by FT.
The real time stop of ciphering is done in the MAC layer and is always initiated by the PT.

encryption deactivation PT initiated [N.29]: Deactivation of the encryption process suggested by PT.
The real time stop of ciphering is done in the MAC layer and is always initiated by the PT.

Calling Line Identification Presentation (CLIP) [N.30]: Ability to provide the calling party number to the called party before accepting the call.

internal call [N.31]: Call between 2 users that does not make use of the local network resources.
This is typically useful in residential environments.

service call [N.32]: Call initiated by a DECT PT for entering of FT related service and adjustment procedures in a transparent way.
After having sent the service call indication, the PT behaves according to the rules of a normal call.

Enhanced U-plane connection [N.33]: Ability of the FT to initiate connection of the U- plane during call establishment or release e.g. to facilitate the provision of in band tones or announcements.

Calling Name Identification Presentation (CNIP) [N.34]: Ability to provide the calling party name to the called party before accepting the call.

E.1.2 GAP Speech coding and audio features (clause 4.2 of EN 300 444)

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

G.726 32 kbit/s ADPCM [SC.1]: ITU-T Recommendation G.726 [15] narrow band codec as defined by EN 300 175-8 [8], clause 5.1.

PP audio type 1a ("classic GAP" handset) [SC.2]: Audio specification for a general purpose 3,1 kHz telephony handset as defined by EN 300 175-8 [8], clause 7.2.3.

PP audio type 1b ("improved GAP" handset) [SC.3]: Audio specification for a general purpose 3,1 kHz telephony handset with improved TCLw, as defined by EN 300 175-8 [8], clause 7.2.4. It is compatible with VoIP and long delay networks.

PP audio type 1c (HATS tested, 3,1 kHz handset) [SC.4]: Audio specification for a general purpose 3,1 kHz telephony handset based on the new HATS methodology, as defined by EN 300 175-8 [8], clause 7.2.5. It includes strong echo suppression (TCLw) requirements and is compatible with VoIP and long delay networks.

PP audio type 1d (HATS tested, 3,1 kHz "improved" handset) [SC.5]: Audio specification for a general purpose 3,1 kHz telephony handset based on the new HATS methodology with improved quality, as defined by EN 300 175-8 [8], clause 7.2.6. It includes strong echo suppression (TCLw) requirements and is compatible with VoIP and long delay networks. This type has a more demanding acoustic specification, providing superior subjective quality. In practice, this means better electro-acoustic components (speaker, microphone), electronics and signal processing.

PP audio type 3a (HATS tested, 3,1 kHz handsfree) [SC.6]: Audio specification for a Narrowband (3,1 kHz) handsfree device as defined by EN 300 175-8 [8], clause 7.2.7. This type applies to handsfree devices operating with an open loudspeaker and microphone. The type applies to either:

1) specific PPs designed to operate in handsfree mode;

2) standard handset implementing types 1a, 1b, 1c or 1d, but with the option to operate in handsfree mode; and

3) handsfree accessory devices connected to a handset by any wired or wireless technology.

It provides (300 Hz - 3,4 kHz) frequency range, and it is defined based on HATS methodology.

PP audio type 3b (HATS tested, 3,1 kHz "improved" handsfree) [SC.7]: Audio specification for a Narrowband (3,1 kHz) handsfree device, improved quality version, as defined by EN 300 175-8 [8], clause 7.2.8. This type applies to handsfree devices operating with an open loudspeaker and microphone. The type applies to either:

1) specific PPs designed to operate in handsfree mode;

2) standard handset implementing types 1a, 1b, 1c or 1d, but with the option to operate in handsfree mode; and

3) handsfree accessory devices connected to a handset by any wired or wireless technology.

It provides (300 Hz - 3,4 kHz) frequency range, and it is defined based on HATS methodology. This type has a more demanding acoustic specification, providing superior subjective quality. In practice, this means better electro-acoustic components (speaker, microphone), electronics and signal processing.

FP audio type 1a ("classic ISDN" 3,1 kHz) [SC.8]: Audio specification for a DECT FP supporting narrowband service and providing a digital 64 kbit/s G.711 interface, typically (but not necessarily) an ISDN connection, classic specification, as defined by EN 300 175-8 [8], clause 7.3.2. It is recommended to use FP type 1b instead of type 1a.

FP audio type 1b ("new ISDN" 3,1 kHz) [SC.9]: Audio specification for a DECT FP supporting narrowband service and providing a digital 64 kbit/s G.711 interface, typically (but not necessarily) an ISDN connection, new specification, as defined by EN 300 175-8 [8], clause 7.3.3. It is recommended to use FP type 1b instead of type 1a.

PP echo canceller for FP [SC.10]: Auxiliary feature for FPs consisting on echo canceller for handling the echo generated by PPs type 1a. As defined by EN 300 175-8 [8], clause 7.4.2. Only narrowband echo cancellation capability is required.

PP echo suppressor for FP [SC.11]: Auxiliary feature for FPs consisting on echo suppressor for handling the echo generated by PPs type 1a. As defined by EN 300 175-8 [8], clause 7.4.3. Only narrowband capability is required.

FP audio type 2 (analog PSTN 3,1 kHz) [SC.12]: Audio specification for a DECT FP supporting narrowband service and providing an analog 2-wire PSTN interface. As defined by EN 300 175-8 [8], clause 7.3.4.

FP audio type 3 (VoIP 3,1 kHz) [SC.13]: Audio specification for a DECT FP supporting narrowband service and providing a VoIP interface, with codecs G.711 (typically) or G.726 on top of it. As defined by EN 300 175-8 [8], clause 7.3.5.

FP audio type 5a (internal call) [SC.14]: This type of audio specification applies to the case of internal call inside a DECT FP or a DECT system without any external interface. This type applies to any service. As defined by EN 300 175-8 [8], clause 7.3.8.

FP audio type 5b (internal conference) [SC.15]: This type of audio specification applies to the case of 3-party or multi-party conference inside a DECT FP or a DECT system with or without an external interface. Applies to any service. As defined by EN 300 175-8 [8], clause 7.3.9.

Adaptive volume control for FP [SC.16]: Accessory feature for FPs consisting on an adaptive volume control depending on the level of environmental noise at the PP. The gain variation shall be symmetrical. As described in EN 300 175-8 [8], (detailed descriptions for each type of FP in clause 7.6, and examples of settings in annex D).

E.1.3 GAP Application features (clause 4.3 of EN 300 444)

AC to bitstring mapping [A.1]: Mapping of the AC into a bitstring.

multiple subscription registration [A.2]: Ability of PP to store more than one subscription.

manual entry of the Portable Access Rights Key (PARK) [A.3]: Ability of the PP to accept a manual entry of the PARK for ensuring attachment to the right FP in a physical area covered by many providers.

terminal identity number assignment in mono-cell system [A.4]: Ability to assign to each PT a terminal identity number.

E.1.4 DLC service definitions (clause 5.1 of EN 300 444)

LAPC class A service and Lc [D.1]: Single frame acknowledged C-plane data link service providing a single data link between one FT and one PT.
The higher layer information is segmented (if necessary) and transmitted in numbered frames. The Lc provides frame delimiting, transparency and frame synchronization.

C_S channel fragmentation and recombination [D.2]: Lc service providing channel dependant fragmentation (by means of dividing a LAPC data unit into more than one service data units for delivery to the MAC layer C_S logical channel) and recombination (by means of joining several service units received from the MAC layer C_S logical channel into a LAPC data unit).

broadcast Lb service [D.3]: Simplex point-to-multipoint transmission using simple fixed length DLC frames providing a restricted broadcast service in direction FP to PP(s).

intra-cell voluntary connection handover [D.4]: Internal handover process provided and initiated by the DLC layer (e.g. as a result of continued poor quality of service from the MAC layer), whereby one set of DLC entities (C-plane and U-plane) can re-route data from one MAC connection to a second new MAC connection in the domain of the same cell, while maintaining the service provided to the NWK layer.

intercell voluntary connection handover [D.5]: Internal handover process provided and initiated by the DLC layer (e.g. as a result of continued poor quality of service from the MAC layer), whereby one set of DLC entities (C-plane and U-plane) can re-route data from one MAC connection to a second new MAC connection not in the domain of the same cell, while maintaining the service provided to the NWK layer.

encryption activation [D.6]: Transporting the NWK layer encryption request and the cipher key to the MAC layer, thereby enabling the encryption process in the MAC layer.

LU1 TRansparent UnProtected service (TRUP) class 0/min_delay [D.7]: Transparent unprotected service introducing minimum delay between the higher layers and the MAC layer.
May be used for speech and non-speech applications. Speech transmission shall only use the class 0/min_delay operation over a single bearer MAC connection. Data integrity is not guaranteed. No error protection is applied, and octets may be lost, erroneous or duplicated. The continuous higher layer data is fragmented for delivery to the I_N logical channel in the transmission direction, and recombined from the I_N logical channel in the receiving direction.

FU1 [D.8]: Offers a defined fixed length frame structure and buffering functions for transmission of U-plane data to the MAC layer (at the transmit side) or accept of data from the MAC layer (at the receiving side) on demand and with minimum delay. Used for speech but may be used for more general data purposes.

encryption deactivation [D.9]: Transporting the NWK layer encryption deactivation request to the MAC layer, thereby disabling the encryption process in the MAC layer.

E.1.5 GAP MAC service definitions (clause 5.2 of EN 300 444)

general [M.1]: Set of basic requirements regarding data formats, multiplexing, CRC usage, scanning and locking, which are prerequisites to communication between peer MAC entities.

continuous broadcast [M.2]: Simplex service from FT to PT whereby the FT maintains at least one bearer with continuous transmissions.
The PT can use the information carried in this bearer to lock to the FT and to obtain knowledge about the FT.

paging broadcast [M.3]: Service whereby the identities of specific PTs can be broadcast by the FT. This service is normally used by the FT to request a specific PT to set up a link to the FT.

basic connection [M.4]: Service providing connection between FT and PT consisting of one full slot duplex bearer supporting the In_minimum_delay data service (i.e. speech).
Only one basic connection may exist between a FT and particular PT (except during connection handover). The service includes the means for setting-up and releasing the required bearer(s).

C_S higher layer signalling [M.5]: Low rate connection oriented data service with ARQ using the C_S channel to transfer higher layer signalling data.

quality control [M.6]: Provides means for monitoring and controlling the radio link quality.

encryption activation [M.7]: Service providing means for enabling the encryption whereby on demand all higher layer data (including speech) is transferred across the AI in an encrypted form.
Always initiated by the PT.

extended frequency allocation [M.8]: Service which allows a FT to support frequencies in addition to the standard DECT frequencies.

bearer handover - intra-cell [M.9]: Internal MAC process whereby data transfer (C channel and I channel) is switched from one duplex bearer to another in the domain of the same cell while maintaining the service to the DLC layer.

bearer handover - inter-cell [M.10]: Internal MAC process whereby data transfer (C channel and I channel) is switched from one duplex bearer to another not in the domain of the same cell while maintaining the service to the DLC layer.

connection handover - intra-cell [M.11]: In the MAC layer, it is the process enabling setting up a new basic connection in the domain of the same cell to support connection handover at the DLC layer.

connection handover - inter-cell [M.12]: In the MAC layer, it is the process enabling setting up a new basic connection not in the domain of the same cell to support connection handover at the DLC layer.

Secondary Access Rights Identity (SARI) support [M.13]: Ability to support, in addition to the primary Access Rights Identity (ARI), secondary ARIs that the FT broadcasts less frequently than PARIs.
These may be used to reflect an inter-operators agreement allowing a portable to access more than one operator or services through FT.

encryption deactivation [M.14]: Service providing means for disabling the encryption whereby on demand the process of transmitting higher layer data (including speech) across the AI in encrypted form is to be cancelled (a connection release automatically disables ciphering).

E.2 GAP Feature/service to procedure mapping tables

The following informative annex shows the features/service to procedure mapping tables as defined in EN 300 444 [12] (GAP), that are reused in the present specification (unless other specification is given). This list is informative, and shows the status in EN 300 444 [12]. In case of changes or divergences the original tables at EN 300 444 [12] (GAP) shall rule.

E.2.1 GAP NWK feature to procedure mapping table (clause 6.8.1 of EN 300 444)

Table E.1: NWK feature to procedure mapping (table 5 of EN 300 444 [12])

Feature/Procedure mapping					
			Status		
Feature	Procedure	Reference	PT	FT	
				R/B	P
N.1 Outgoing call		4.1	M	M	M
	Outgoing call request	8.2	M	M	M
	Overlap sending	8.3	M	O	O
	Outgoing call proceeding	8.4	M	O	O
	Outgoing call confirmation	8.5	M	O	O
	Outgoing call connection	8.6	M	M	M
	Sending keypad information	8.10	M	M	M
N.2 Off Hook		4.1	M	M	M
	Outgoing call request	8.2	M	M	M
	Incoming call connection	8.15	M	M	M
N.3 On Hook (full release)		4.1	M	M	M
	Normal call release	8.7	M	M	M
	Abnormal call release	8.8	M	M	M
N.4 Dialled digits (basic)		4.1	M	M	M
	Sending keypad information	8.10	M	M	M
N.5 Register recall		4.1	M	O	O
	Sending keypad information	8.10	M	M	M
N.6 Go to DTMF signalling (defined tone length)		4.1	M	O	M
	Sending keypad information	8.10	M	M	M
N.7 Pause (dialling pause)		4.1	M	O	O
	Sending keypad information	8.10	M	M	M
N.8 Incoming call		4.1	M	M	M
	Incoming call request	8.12	M	M	M
	Incoming call confirmation	8.13	M	M	M
	PT alerting	8.14	M	M	M
	Incoming call connection	8.15	M	M	M
N.9 Authentication of the PP		4.1	M	O	M
	Authentication of PT	8.24	M	M	M
N10 Authentication of the user		4.1	M	O	O
	Authentication of user	8.25	M	M	M
N.11 Location registration		4.1	M	O	M
	Location registration	8.28	M	M	M
	Location update	8.29	M	O	O
	Terminal Capability indication	8.17	O	O	O
N.12 On air key allocation		4.1	M	O	O
	Key allocation	8.32	M	M	M
N.13 Identification of PP		4.1	M	O	O
	Identification of PT	8.22	M	M	M
N.14 Service class indication/assignment		4.1	M	O	M
	Obtaining access rights	8.30	M	M	M
	Terminal Capability indication	8.17	O	O	O
	Authentication of PT	8.24	M	M	M
N.15 Alerting		4.1	M	M	M
	PT alerting	8.14	M	M	M
N.16 ZAP		4.1	M	O	O
	Obtaining access rights	8.30	M	M	M
	Terminal Capability indication	8.17	O	O	O
	Incrementing the ZAP value	8.26	M	M	M
	Authentication of FT	8.23	O	M	M
N.17 Encryption activation FT initiated		4.1	M	O	M
	Cipher-switching initiated by FT	8.33	M	M	M
	Storing the Derived Cipher Key (DCK)	8.27	M	M	M

Feature/Procedure mapping					
			Status		
Feature	Procedure	Reference	PT	FT	
				R/B	P
N.18 Subscription registration user procedure on-air		4.1	M	M	M
	Obtaining access rights	8.30	M	M	M
	Terminal Capability indication	8.17	O	O	O
N.19 Link control		4.1	M	M	M
	Indirect FT initiated link establishment	8.35	M	M	M
	Direct PT initiated link establishment	8.36	M	M	M
	Link release "normal"	8.37	M	M	M
	Link release "abnormal"	8.38	M	M	M
	Link release "maintain"	8.39	M	M	M
N.20 Terminate access rights FT initiated		4.1	M	O	O
	FT terminating access rights	8.31	M	M	M
	Authentication of FT	8.23	O	M	M
N.21 Partial release		4.1	O	O	O
	Partial release	8.9	M	M	M
N.22 Go to DTMF (infinite tone length)		4.1	O	O	O
	Sending keypad information	8.10	M	M	M
N.23 Go to Pulse		4.1	O	O	O
	Sending keypad information	8.10	M	M	M
N.24 Signalling of display characters		4.1	O	O	O
	Display	8.16	M	M	M
	Terminal capability indication	8.17	M	M	M
N.25 Display control characters		4.1	O	O	O
	Display	8.16	M	M	M
	Terminal capability indication	8.17	M	M	M
N.26 Authentication of FT		4.1	O	O	O
	Authentication of FT	8.23	M	M	M
N.27 Encryption activation PT initiated		4.1	O	O	O
	Cipher-switching initiated by PT	8.34	M	M	M
	Storing the DCK	8.27	M	M	M
N.28 Encryption deactivation FT initiated		4.1	O	O	O
	Cipher-switching initiated by FT	8.33	M	M	M
N.29 Encryption deactivation PT initiated		4.1	O	O	O
	Cipher-switching initiated by PT	8.34	M	M	M
N.30 Calling Line Identification Presentation (CLIP)		4.1	O	O	O
	Incoming call request	8.12	M	M	M
	Calling Line Identification Presentation	8.41	M	M	M
N.31 Internal call		4.1	O	O	O
	Internal call setup	8.18	M	M	M
	Internal call keypad	8.19	M	O	O
	Internal call CLIP	8.43	O	O	O
	Internal call CNIP	8.44	O	O	O
N.32 Service call		4.1	O	O	O
	Service call setup	8.20	M	M	M
	Service call keypad	8.21	M	O	O
N.33 Enhanced U- plane connection		4.1	O	O	O
	Enhanced FT initiated U- plane connection	8.40	M	M	M
N.34 Calling Name Identification Presentation (CNIP)		4.1	O	O	O
	Calling Name Identification Presentation (CNIP) Indication	8.42	M	M	M

E.2.2 GAP DLC service to procedure mapping table (clause 6.8.2 of EN 300 444)

Table E.2: DLC service to procedure mapping (table 6 of EN 300 444 [12])

Service/Procedure mapping					
			Status		
Service	**Procedure**	**Reference**	**PT**	**FT**	
				R/B	**P**
D.1 LAPC class A service and Lc		5.1	M	M	M
	Class A link establishment	9.1	M	M	M
	Class A acknowledged information transfer	9.2	M	M	M
	Class A link release	9.3	M	M	M
	Class A link re-establishment	9.4	M	M	M
D.2 C_S channel fragmentation and recombination		5.1	M	M	M
	C_S channel fragmentation and recombination	9.5	M	M	M
D.3 Broadcast Lb service		5.1	M	M	M
	Normal broadcast	9.6	M	M	M
D.4 Intra-cell voluntary connection handover		5.1	M	C601	C601
	Class A basic connection handover	9.7	M	M	M
D.5 Inter-cell voluntary connection handover		5.1	M	O	O
	Class A basic connection handover	9.7	M	M	M
D.6 Encryption activation		5.1	M	C603	M
	Encryption switching	9.8	M	M	M
D.7 LU1 TRUP Class 0/min_delay		5.1	M	M	M
	U-plane Class 0/min delay	9.9	M	M	M
D.8 FU1		5.1	M	M	M
	FU1 frame operation	9.10	M	M	M
D.9 Encryption deactivation		5.1	C602	C602	C602
	Encryption switching	9.8	M	M	M
C601: IF service M.9 THEN O ELSE M; C602: IF feature N.29 OR N.28 THEN M ELSE I; C603: IF feature N.17 OR N.27 THEN M ELSE I.					

E.2.3 GAP MAC service to procedure mapping table (clause 6.8.3 of EN 300 444)

Table E.3: MAC service to procedure mapping (table 7 of EN 300 444 [12])

Service/Procedure mapping					
			Status		
Service	Procedure	Reference	PT	FT	
				R/B	P
M.1 General		5.2	M	M	M
	General	10.1	M	M	M
M.2 Continuous broadcast		5.2	M	M	M
	Downlink broadcast	10.2	M	M	M
	Higher Layer capability FP broadcast	13.6	M	M	M
M.3 Paging broadcast		5.2	M	M	M
	Paging broadcast	10.3	M	M	M
	Higher Layer capability FP broadcast	13.6	M	M	M
M.4 Basic connections		5.2	M	M	M
	Setup of basic connection, basic bearer setup (A-field)	10.4	M	M	M
	Connection/bearer release	10.5	M	M	M
M.5 C_S higher layer signalling		5.2	M	M	M
	C_S channel data	10.8	M	M	M
	Q2 bit setting	10.9	M	M	M
M.6 Quality control		5.2	M	M	M
	RFPI handshake	10.10	M	M	M
	Antenna diversity	10.11	M	O	O
	Sliding collision detection	10.12	O	M	M
M.7 Encryption activation		5.2	M	C704	M
	Encryption process - initialization and synchronization	10.13	M	M	M
	Encryption mode control	10.14	M	M	M
	Handover encryption process	10.15	M	M	M
M.8 Extended frequency allocation		5.2	M	O	O
	Extended frequency allocation	10.16	M	M	M
M.9 Bearer handover, intra-cell		5.2	M	C701	C701
	Bearer handover request	10.6	M	M	M
M.10 Bearer handover, inter-cell		5.2	M	O	O
	Bearer handover request	10.6	M	M	M
M.11 Connection handover, intra-cell		5.2	M	C702	C702
	Connection handover request	10.7	M	M	M
M.12 Connection handover, inter-cell		5.2	M	O	O
	Connection handover request	10.7	M	M	M
M.13 SARI support		5.2	M	O	O
	Downlink broadcast	10.2	M	M	M
	Higher Layer capability FP broadcast	13.6	M	M	M
M.14 Encryption deactivation		5.2	C703	C703	C703
	Encryption mode control	10.14	M	M	M
C701: IF service M.11 THEN O ELSE M; C702: IF service M.9 THEN O ELSE M; C703: IF feature N.29 OR N.28 THEN M ELSE I; C704: IF feature N.17 OR N.27 THEN M ELSE I.					

E.2.4 GAP Application feature to procedure mapping table (clause 6.8.4 of EN 300 444)

Table E.4: Application feature to procedure mapping table (table 8 of EN 300 444 [12])

Feature/Procedure mapping					
			Status		
Feature	Procedure	Reference	PT	FT	
				R/B	P
A.1 AC to bitstring mapping		4.3	M	C801	M
	AC to bitstring mapping	14.2	M	M	M
A.2 Multiple subscription registration		4.3	M	N/A	N/A
	Subscription control	14.1	M	N/A	N/A
A.3 Manual entry of the PARK		4.3	O	N/A	N/A
	Manual entry of the PARK	14.3	M	N/A	N/A
A.4 Terminal identity number assignment in mono cell system		4.3	O	O	N/A
	Terminal identity number assignment	14.4	O	O	N/A
C801: IF feature N.9 OR N.10 OR N.12 OR N.26 THEN M ELSE N/A.					

Annex F (informative): Bibliography

- ISO/IEC 8073 (1997): "Information technology - Open Systems Interconnection - Protocol for providing the connection-mode transport service".
- ETSI EN 301 649: "Digital Enhanced Cordless Telecommunications (DECT); DECT Packet Radio Service (DPRS)".
- ETSI EN 300 176-1: "Digital Enhanced Cordless Telecommunications (DECT); Test specification; Part 1: Radio".
- IETF RFC 4749: "RTP Payload Format for the G.729.1 Audio Codec".

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