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| **CANDIDATE CHANGE REQUEST** | | | | | | | | | | |
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|  | **26.346** | | | **CR** |  |  **rev** | **-** |  Current version: | **11.3.0** |  |
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| ***Title:***  | | 6330 code as MBMS Application Layer FEC | | | | | | | | |
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| ***Clauses affected:***  | | | 2, 7.2.2, 7.2.3, 7.2.7, 7.2.10.4, 7.2.12.1, 7.3.2.8, 7.3.3, 8.2.2.0, 8.2.2.10a, 8.2.2.15, 8.2.2.16 (new), Annex B (void) | | | | | | | |
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| **First Change** |

# 2 References

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

* References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.
* For a specific reference, subsequent revisions do not apply.
* For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

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| **End of First Change** |

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| **Second Change** |

### 7.2.2 Symbol Encoding Algorithm

The "Compact No-Code FEC scheme" - [12] (FEC Encoding ID 0, also known as "Null-FEC") shall be supported.

A UE that supports MBMS User Services shall support a compliant decoder for FEC Encoding ID 6 as defined in IETF RFC 6330 [X1]. The compliant decoder is defined in clause 5.8 of IETF RFC 6330 [X1].

Note that the example decoder described in clause 5.4 of IETF RFC 6330 [X1] fulfils this requirement.

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| **End of Second Change** |

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| **Third Change** |

### 7.2.3 Blocking Algorithm

In the case of the Compact No-Code FEC scheme [12] (FEC Encoding ID 0), then the "Algorithm for Computing Source Block Structure" described within the FLUTE specification (RFC 3926 [9]) shall be used.

In the case of FEC Encoding ID 6 as defined in IETF RFC 6330 [X1], then the algorithm defined in [X1] shall be used.

Clause 4.3 of IETF RFC6330 [X1] provides recommendations for the derivation of the three transport parameters, *T*, *Z* and *N*. The values of *N*, *Z*, *T* and *Al* should be set such that the sub-block size, *WS,* as at least 256 kByte and is at most 16 MByte. The recommended value for *Al* is 8 and for SS is 2.

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| **End of Third Change** |

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| **Fourth Change** |

### 7.2.7 Signalling of Parameters with Basic ALC/FLUTE Headers

FLUTE and ALC mandatory header fields shall be as specified in [9, 10] with the following additional specializations:

1. The length of the CCI (Congestion Control Identifier) field shall be 32 bits and it is assigned a value of zero (C=0).
2. The Transmission Session Identifier (TSI) field shall be of length 16 bits (S=0, H=1, 16 bits).
3. The Transport Object Identifier (TOI) field should be of length 16 bits (O=0, H=1).
4. Only Transport Object Identifier (TOI) 0 (zero) shall be used for FDT Instances.
5. The following features may be used for signalling the end of session and end of object transmission to the receiver:

- The Close Session flag (A) for indicating the end of a session.

- The Close Object flag (B) for indicating the end of an object.

In FLUTE the following applies:

1. The Sender Current Time present flag (T) shall be set to zero.
2. The Expected Residual Time present flag (R) shall be set to zero.
3. The LCT header length (HDR\_LEN) shall be set to the total length of the LCT header in units of 32-bit words.
4. For "Compact No-Code FEC scheme" [12], the FEC Payload ID shall be set according to RFC 3695 [13] such that a 16 bit SBN (Source Block Number) and then the 16 bit ESI (Encoding Symbol ID) are given.
5. For FEC Encoding ID 6 “”, the FEC Payload ID shall be set according to Section 3.3 of IETF RFC 6330 [X1]. .

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| **End of Fourth Change** |

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| **Fifth Change** |

#### 7.2.10.4 Example of FDT

<?xml version="1.0" encoding="UTF-8"?>

<FDT-Instance

xmlns="urn:IETF:metadata:2005:FLUTE:FDT"

xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"

xmlns:mbms2007="urn:3GPP:metadata:2007:MBMS:FLUTE:FDT"

xmlns:mbms2008="urn:3GPP:metadata:2008:MBMS:FLUTE:FDT\_ext"

xmlns:mbms2009="urn:3GPP:metadata:2009:MBMS:FLUTE:FDT\_ext" xmlns:sv="urn:3gpp:metadata:2009:MBMS:schemaVersion"

xsi:schemaLocation="urn:IETF:metadata:2005:FLUTE:FDT FLUTE-FDT-3GPP-Main.xsd"

FEC-OTI-FEC-Encoding-ID="6"

Complete="true"

Content-Encoding="gzip"

FEC-OTI-Encoding-Symbol-Length="512"

Expires="331129600">

mbms2008:FullFDT="true">

<File

Content-Type="application/sdp"

Content-Length="7543"

Transfer-Length="4294"

TOI="2"

FEC-OTI-Encoding-Symbol-Length="16"

FEC-OTI-Scheme-Specific-Info="AAEBBA=="

Content-Location="http://www.example.com/fancy-session/main.sdp"

mbms2009:Decryption-KEY-URI="http://www.example.com/key-uri">

<mbms2007:Cache-Control>

<mbms2007:Expires>30</mbms2007:Expires>

</mbms2007:Cache-Control>

<sv:delimiter>0</sv:delimiter>

<sv:delimiter>0</sv:delimiter> <MBMS-Session-Identity>93</MBMS-Session-Identity>

</File>

<File

Content-Type="String"

Content-Length="161934"

Transfer-Length="157821"

TOI="3"

FEC-OTI-Encoding-Symbol-Length="512"

Content-Location="http://www.example.com/fancy-session/trailer.3gp">

<sv:delimiter>0</sv:delimiter>

<sv:delimiter>0</sv:delimiter>

<MBMS-Session-Identity>93</MBMS-Session-Identity>

</File>

<sv:schemaVersion>2</sv:schemaVersion>

<sv:delimiter>0</sv:delimiter>

<MBMS-Session-Identity-Expiry value="3311288760">93</MBMS-Session-Identity-Expiry>

</FDT-Instance>

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| **End of Fifth Change** |

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| **Sixth Change** |

#### 7.2.12.1 General

This clause defines an FEC encoding scheme for the MBMS forward error correction code defined in [X1] for the download delivery method. This scheme is identified by FEC Encoding ID 6. The FEC Payload ID format and FEC Object Transmission Information format are as defined in [X1], sub-clauses 3.2 and 3.3 respectively.

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| **End of Sixth Change** |

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| **Seventh Change** |

#### 7.3.2.8 FEC capabilities and related parameters

A new FEC-declaration attribute is defined which results in, e.g.:

1. a=FEC-declaration:0 encoding-id=6

This attribute may be used on both session-level and media-level. Multiple instances are allowed to specify several different FEC declarations. The attribute is used on session level to define FEC declarations used by multiple media components. On media level it is used to define FEC declarations which are only valid for a single media component. If FEC declarations on both session and media level use the same reference number (fec-ref) then the media level declaration takes precedence for that media component. Each media component references one FEC declaration using the “a=FEC” attribute.

This attribute is optional to use for the download delivery method as the information will be available elsewhere (e.g. FLUTE FDT Instances). If this attribute is not used, and no other FEC-OTI information is signalled to the UE by other means, the UE may assume that support for FEC id 0 is sufficient capability to enter the session.

A new FEC-declaration reference attribute is defined which results in, e.g.:

1. a=FEC:0

This is a media-level only attribute, used as a short hand to reference one of one or more FEC-declarations.

The syntax for the attributes in ABNF [23] is:

fec-declaration-line = "a=FEC-declaration:" fec-ref SP fec-enc-id [";" SP fec-inst-id] CRLF

fec-ref = 1\*3DIGIT ; value is the SDP-internal identifier for FEC-declaration.

fec-enc-id = "encoding-id=" enc-id

enc-id = 1\*DIGIT ; value is the FEC encoding ID used

fec-inst-id = "instance-id=" inst-id

inst-id = 1\*DIGIT ; value is the FEC Instance ID used.

fec-line = "a=FEC:" fec-ref CRLF

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| **End of Seventh Change** |

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| **Eighth Change** |

### 7.3.3 SDP Examples for FLUTE Session

Here is a full example of SDP description describing a FLUTE session:

*v=0*

*o=user123 2890844526 2890842807 IN IP6 2201:056D::112E:144A:1E24*

*s=File delivery session example*

*i=More information*

*t=2873397496 2873404696*

*a=mbms-mode:broadcast* 123869108302929 *1*

*a=FEC-declaration:0 encoding-id=6*

*a=source-filter: incl IN IP6 \* 2001:210:1:2:240:96FF:FE25:8EC9*

*a=flute-tsi:3*

*m=application 12345 FLUTE/UDP 0*

*c=IN IP6 FF1E:03AD::7F2E:172A:1E24/1*

*b=64*

*a=lang:EN*

*a=FEC:0*

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| **End of Eighth Change** |

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| **Nineth Change** |

#### 8.2.2.0 Overview

The “MBMS FEC scheme” shall be the fully-specified FEC scheme defined in [106], section 6 with ID 2.

The source flows for the MBMS FEC scheme are UDP flows including RTP, RTCP, SRTP and MIKEY packets. The payload of such UDP packets constitute an Application Data Unit (ADU) as defined in RFC6363 [107]. The source data flow with which the ADUs are associated is the UDP flow identity of the corresponding UDP flow.

A UE that supports MBMS User Services shall support a decoder for the “MBMS FEC scheme”. The use of MBMS FEC by the sender is recommended, but it is permitted not to use it. In the case where the FEC is not used by the sender, the FEC Layer should not be used (i.e. RTP is mapped onto UDP directly).

The mechanism does not place any restrictions on the source data which can be protected together, except that the source data is carried over UDP. The data may be from several different UDP flows that are protected jointly.

A UE supporting the streaming delivery method shall support the packet format for FEC packets..

If any FEC source packets have been lost, but sufficient FEC source and FEC repair packets have been received, FEC decoding can be performed to recover the FEC source block. The original packets UDP payload and UDP flow identity can then be extracted from the source block and provided to the upper layer. If not enough FEC source and repair packets were received, only the original packets that were received as FEC source packets will be available. The rest of the original packets are lost.

A UE that supports MBMS User Services shall support a compliant decoder for FEC Encoding ID 6 as defined in IETF RFC 6330 [X1]. The compliant decoder is defined in clause 5.8 of IETF RFC 6330 [X1].

Note that the receiver must be able to buffer all the original packets and allow time for the FEC repair packets to arrive and FEC decoding to be performed before media playout begins. The min-buffer-time parameter specified in sub-clause 8.3.1.8 helps the receiver to determine a sufficient duration for initial start-up delay.

The protocol architecture is illustrated in figure 11.



Figure 11: FEC mechanism for the streaming delivery method interaction diagram

Figure 11 depicts how one or more out of several possible packet flows of different types (Audio, video, DIMS, text RTP and RTCP flows, MIKEY flow) are sent to the FEC layer for protection. The source packets are modified to carry the FEC payload ID and a new flow with repair data is generated. The receiver takes the source and repair packets and buffers them to perform, if necessary, the FEC decoding. After appropriate buffering received and recovered source packets are forwarded to the higher layers. The arrows in the figure indicate distinct data flows.

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| **End of Nineth Change** |

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| **Ten-th Change** |

#### 8.2.2.10a FEC Object Transmission information

The FEC Object Transmission information consists of:

* the maximum source block length, in symbols
* the symbol size, in bytes

The FEC Object Transmission information shall be the FEC Scheme Specific Information in section 6.2.1.2 of RFC6681 [106].

The Source Block Length signalled within the Repair FEC Payload ID of any packet of a stream shall not exceed the Maximum Source Block Length signalled within the FEC Object Transmission Information for the stream.

The FEC Object Transmission Information shall be communicated as described in sub-clause 8.2.2.14. Note, the FEC Object Transmission Information is only communicated in SDP.

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| **End of Ten-th Change** |

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| **Eleventh Change** |

#### 8.2.2.15 Signalling example for FEC

This sub-clause contains a complete signalling example for a MBMS multicast mode session using FEC with a Service description, a SDP for the streaming delivery method, a SDP for the FEC repair stream, and a security description.

The following is an example bundleDescription.

<?xml version="1.0" encoding="UTF-8"?>

<bundleDescription  
 xmlns="urn:3GPP:metadata:2005:MBMS:userServiceDescription"  
 xmlns:xsi="<http://www.w3.org/2001/XMLSchema-instance>"

fecDescriptionURI="http://www.example.com/3gpp/mbms/session1-fec.sdp">

<userServiceDescription

serviceId="urn:3gpp:0010120123hotdog">  
 <deliveryMethod  
 sessionDescriptionURI="<http://www.example.com/3gpp/mbms/session1.sdp>"

protectionDescriptionURI="http://www.example.com/3gpp/mbms/sec-descript"/>

</userServiceDescription>

</bundleDescription>

The security description has the URI: <http://www.example.com/3gpp/mbms/sec-descript>

<?xml version="1.0" encoding="UTF-8"?>

<securityDescription

xmlns="urn:3GPP:metadata:2005:MBMS:securityDescription"

xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"

confidentialityProtection="true"

integrityProtection="true"

uiccKeyManagement="true"

<keyManagement

waitTime="5"

maxBackOff="10">

<serverURI>http://register.example.com/</serverURI>

<serverURI>http://register2.example.com/</serverURI>

</keyManagement>

<keyId>

<mediaFlow flowID="FF1E:03AD::7F2E:172A:1E24/4002">

<MSK>

<keyDomainID>aMoM</keyDomainID>

<MSKID>aMoAAA==</MSKID>

</MSK>

</mediaFlow>

<mediaFlow flowID="FF1E:03AD::7F2E:172A:1E24/4004">

<MSK>

<keyDomainID>GM8M</keyDomainID>

<MSKID>aMkAAA==</MSKID>

</MSK>

</mediaFlow>

</keyId>

<fecProtection

fecEncodingId="2"

fecOtiExtension="ACAEAA=="/>

</securityDescription>

An example of how the SDP <http://www.example.com/3gpp/mbms/session1.sdp> could look for a session containing two media streams that are FEC protected. In this example we have assumed an audiovisual stream, using 56 kbps for video and 12 kbps for audio. In addition another 300 bits/second of RTCP packets from the source is used for the each of the sessions. Hence, the total media session bandwidth is 56+12+0.3+0.3 = 68.6 kbps.

v=0  
o=ghost 2890844526 2890842807 IN IP6 2001:210:1:2:240:96FF:FE25:8EC9  
s=3GPP MBMS Streaming SDP Example  
i=Example of MBMS streaming SDP file  
u=http://www.infoserver.example.com/ae600  
e=ghost@mailserver.example.com  
c=IN IP6 FF1E:03AD::7F2E:172A:1E24  
t=3034423619 3042462419

b=AS:62

b=TIAS: 60500

a=maxprate: 25

a=source-filter: incl IN IP6 \* 2001:210:1:2:240:96FF:FE25:8EC9

a=FEC-declaration:0 encoding-id=2

m=video 4002 UDP/MBMS-FEC/RTP/AVP 96

b=TIAS:55000

b=RR:0

b=RS:300

a=rtpmap:96 H263-2000/90000  
a=fmtp:96 profile=3;level=10  
a=framesize:96 176-144

a=FEC:0

a=maxprate:15

m=audio 4004 UDP/MBMS-FEC/RTP/AVP 98

b=TIAS: 11500

b=RR:0

b=RS:300

a=rtpmap:98 AMR/8000

a=fmtp:98 octet-align=1

a=FEC:0

a=maxprate:10

The FEC stream used to protect the above RTP sessions and a MIKEY key stream has the below SDP (http://www.example.com/3gpp/mbms/session1-fec.sdp):

v=0  
o=ghost 2890844526 2890842807 IN IP6 2001:210:1:2:240:96FF:FE25:8EC9  
s=3GPP MBMS Streaming FEC SDP Example  
i=Example of MBMS streaming SDP file  
u=http://www.infoserver.example.com/ae600  
e=ghost@mailserver.example.com  
c=IN IP6 FF1E:03AD::7F2E:172A:1E24  
t=3034423619 3042462419

b=AS:15

a=FEC-declaration:0 encoding-id=2

a=FEC-OTI-extension:0 ACAEAA==

a=mbms-repair: 0 min-buffer-time=2600

a=source-filter: incl IN IP6 \* 2001:210:1:2:240:96FF:FE25:8EC9

m=application 4006 UDP/MBMS-REPAIR \*

b=AS:15

a=FEC:0

a=mbms-flowid: 1=FF1E:03AD::7F2E:172A:1E24/4002, 2=FF1E:03AD::7F2E:172A:1E24/4003, 3=FF1E:03AD::7F2E:172A:1E24/4004, 4=FF1E:03AD::7F2E:172A:1E24/4005, 5=FF1E:03AD::7F2E:172A:1E24/2269

a=X-3gpp-FEC-Interleaving: 1="reverse", 2="ordered"

A more traditional FEC configuration is shown below. The audio and video media components use different FEC repair flows. The same principle can also be applied when bundling several user services together.

<?xml version="1.0" encoding="UTF-8"?>

<bundleDescription  
 xmlns="urn:3GPP:metadata:2005:MBMS:userServiceDescription"  
 xmlns:xsi="<http://www.w3.org/2001/XMLSchema-instance>"

fecDescriptionURI="http://www.example.com/3gpp/mbms/session2-fec.sdp">

<userServiceDescription

serviceId="urn:3gpp:0010120123hotdog">  
 <deliveryMethod  
 sessionDescriptionURI="<http://www.example.com/3gpp/mbms/session2.sdp>"/>

</userServiceDescription>

</bundleDescription>

The SDP file from above is modified to use two different FEC flows.

v=0  
o=ghost 2890844526 2890842807 IN IP6 2001:210:1:2:240:96FF:FE25:8EC9  
s=3GPP MBMS Streaming SDP Example  
i=Example of MBMS streaming SDP file  
u=http://www.infoserver.example.com/ae600  
e=ghost@mailserver.example.com  
c=IN IP6 FF1E:03AD::7F2E:172A:1E24  
t=3034423619 3042462419

b=AS:62

b=TIAS: 60500

a=maxprate: 25

a=source-filter: incl IN IP6 \* 2001:210:1:2:240:96FF:FE25:8EC9

m=video 4002 UDP/MBMS-FEC/RTP/AVP 96

b=TIAS:55000

b=RR:0

b=RS:300

a=FEC-declaration:0 encoding-id=2

a=rtpmap:96 H263-2000/90000  
a=fmtp:96 profile=3;level=10  
a=framesize:96 176-144

a=FEC:0

a=maxprate:15

m=audio 4004 UDP/MBMS-FEC/RTP/AVP 98

b=TIAS: 11500

b=RR:0

b=RS:300

a=FEC-declaration:1 encoding-id=2

a=rtpmap:98 AMR/8000

a=fmtp:98 octet-align=1

a=FEC:1

a=maxprate:10

The SDP file for the two FEC streams

v=0  
o=ghost 2890844526 2890842807 IN IP6 2001:210:1:2:240:96FF:FE25:8EC9  
s=3GPP MBMS Streaming FEC SDP Example  
i=Example of MBMS streaming SDP file  
u=http://www.infoserver.example.com/ae600  
e=ghost@mailserver.example.com  
t=3034423619 3042462419

b=AS:15

a=source-filter: incl IN IP6 \* 2001:210:1:2:240:96FF:FE25:8EC9

m=application 4006 UDP/MBMS-REPAIR \*

c=IN IP6 FF1E:03AD::7F2E:172A:1E24

b=AS:15

a=FEC-declaration:0 encoding-id=2

a=FEC-OTI-extension:0 ACAEAA==

a=mbms-repair: 0 min-buffer-time=2600

a=FEC:0

a=mbms-flowid: 1=FF1E:03AD::7F2E:172A:1E24/4002, 2=FF1E:03AD::7F2E:172A:1E24/4003

m=application 4008 UDP/MBMS-REPAIR \*

c=IN IP6 FF1E:03AD::7F2E:172A:1E24

b=AS:15

a=FEC-declaration:1 encoding-id=2

a=FEC-OTI-extension:1 ACAEAA==

a=mbms-repair: 1 min-buffer-time=2600

a=FEC:1

a=mbms-flowid: 3=FF1E:03AD::7F2E:172A:1E24/4004, 4=FF1E:03AD::7F2E:172A:1E24/4005

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| --- |
| **End of Eleventh Change** |

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| **Twelveth Change** |

#### 8.2.2.16 Parameter derivation algorithm (informative)

This sub-clause provides recommendations for the derivation of the transport parameter *T*. This recommendation is based on the following input parameters:

- *B* the maximum source block size, in bytes

- *P* the maximum repair packet payload size, in bytes, which is a multiple of *Al*

- *Al* the symbol alignment factor, in bytes

- *S*\_min the minimum symbol size in units of *Al*

- *K’\_*max the maximum number of source symbols per source block, equal to 56,403.

A requirement on these inputs is that ceil(*B*/*P*) ≤ *K’\_*max. Based on the above inputs, the transport parameter *T* is calculated as follows:

Let,

*G* = floor(*P*/(*S*\_min\**Al*)) - the approximate number of symbols per packet

*T =* floor(*P*/(*Al*·*G*))·*Al*

The value of *T* derived above should be considered as a guide to the actual value of *T* used. It may be advantageous to ensure that *T* divides into *P*, or it may be advantageous to set the minimum value *Al*\**S*\_min of *T* smaller to minimize wastage when full size repair symbols are used to recover partial source symbols at the end of lost source packets. Furthermore, the choice of *T* may depend on the source packet size distribution, e.g., if all source packets are the same size then it is advantageous to choose *T* so that the actual payload size of a repair packet *P’*, where *P’* is a multiple of *T*, is equal to (or as few bytes as possible larger than) the number of bytes each source packet occupies in the source block.

Recommended settings for the input parameters, *Al* and *S*\_min are as follows:

*Al* = 8 *S*\_min = 4

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| **End of Twelveth Change** |

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| **Thirteenth Change** |

Annex B:  
(void)

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| **End of Third Change** |