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Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) —

Part 7: Location referencing container (TPEG2-LRC)

Systèmes intelligents de transport — Informations sur le trafic et le tourisme via le groupe expert du protocole de transport, génération 2 (TPEG2) —

Partie 7: Conteneur de référencement d'emplacement (TPEG2-LRC)

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

A list of all parts in the ISO 21219 series can be found on the ISO website.

Introduction

History

TPEG technology was originally proposed by the European Broadcasting Union (EBU) Broadcast Management Committee, who established the B/TPEG project group in the autumn of 1997 with a brief to develop, as soon as possible, a new protocol for broadcasting traffic and travel-related information in the multimedia environment. TPEG technology, its applications and service features were designed to enable travel-related messages to be coded, decoded, filtered and understood by humans (visually and/or audibly in the user's language) and by agent systems. Originally, a byte-oriented data stream format, which may be carried on almost any digital bearer with an appropriate adaptation layer, was developed. Hierarchically structured TPEG messages from service providers to end-users were designed to transfer information from the service provider database to an end-user's equipment.

One year later, in December 1998, the B/TPEG group produced its first EBU specifications. Two documents were released. Part 2 (TPEG-SSF, which became ISO/TS 18234-2) described the syntax, semantics and framing structure, which was used for all TPEG applications. Meanwhile, Part 4 (TPEG-RTM, which became ISO/TS 18234-4) described the first application for road traffic messages.

Subsequently, in March 1999, CEN/TC 278, in conjunction with ISO/TC 204, established a group comprising members of the former EBU B/TPEG and this working group continued development work. Further parts were developed to make the initial set of four parts, enabling the implementation of a consistent service. Part 3 (TPEG-SNI, ISO/TS 18234-3) described the service and network information application used by all service implementations to ensure appropriate referencing from one service source to another.

Part 1 (TPEG-INV, ISO/TS 18234-1) completed the series by describing the other parts and their relationship; it also contained the application IDs used within the other parts. Additionally, Part 5, the public transport information application (TPEG-PTI, ISO/TS 18234-5), was developed. The so-called TPEG-LOC location referencing method, which enabled both map-based TPEG-decoders and non-map-based ones to deliver either map-based location referencing or human readable text information, was issued as ISO/TS 18234-6 to be used in association with the other applications parts of the ISO/TS 18234 series to provide location referencing.

The ISO/TS 18234 series has become known as TPEG Generation 1.

TPEG Generation 2

When the Traveller Information Services Association (TISA), derived from former forums, was inaugurated in December 2007, TPEG development was taken over by TISA and continued in the TPEG applications working group.

It was about this time that the (then) new Unified Modelling Language (UML) was seen as having major advantages for the development of new TPEG applications in communities who would not necessarily have binary physical format skills required to extend the original TPEG TS work. It was also realized that the XML format for TPEG described within the ISO/TS 24530 series (now superseded) had a greater significance than previously foreseen, especially in the content-generation segment, and that keeping two physical formats in synchronism, in different standards series, would be rather difficult.

As a result, TISA set about the development of a new TPEG structure that would be UML based. This has subsequently become known as TPEG Generation 2.

TPEG2 is embodied in the ISO/TS 21219 series and it comprises many parts that cover introduction, rules, toolkit and application components. TPEG2 is built around UML modelling and has a core of rules that contain the modelling strategy covered in ISO/TS 21219-2, ISO/TS 21219-3 and ISO/TS 21219-4 and the conversion to two current physical formats: binary and XML; others could be added in the future. TISA uses an automated tool to convert from the agreed UML model XMI file directly into an MS Word document file, to minimize drafting errors, that forms the annex for each physical format.

TPEG2 has a three container conceptual structure: message management (ISO/TS 21219-6), application (several parts) and location referencing (ISO/TS 21219-7). This structure has flexible capability and can accommodate many differing use cases that have been proposed within the TTI sector and wider for hierarchical message content.

TPEG2 also has many location referencing options as required by the service provider community, any of which may be delivered by vectoring data included in the location referencing container.

The following classification provides a helpful grouping of the different TPEG2 parts according to their intended purpose.

— Toolkit parts: TPEG2-INV (ISO/TS 21219-1), TPEG2-UML (ISO/TS 21219-2), TPEG2-UBCR (ISO/TS 21219-3), TPEG2-UXCR (ISO/TS 21219-4), TPEG2-SFW (ISO/TS 21219-5), TPEG2-MMC (ISO/TS 21219-6), TPEG2-LRC (ISO/TS 21219-7) and TPEG2-LTE (ISO/TS 21219-24).

— Special applications: TPEG2-SNI (ISO/TS 21219-9) and TPEG2-CAI (ISO/TS 21219-10).

— Location referencing: TPEG2-ULR (ISO/TS 21219-11[1)]), TPEG2-GLR (ISO/TS 21219-21[1)]) and TPEG2-OLR (ISO/TS 21219-22).

— Applications: TPEG2-PKI (ISO/TS 21219-14), TPEG2-TEC (ISO/TS 21219-15), TPEG2-FPI (ISO/TS 21219-16), TPEG2-TFP (ISO/TS 21219-18), TPEG2-WEA (ISO/TS 21219-19), TPEG2-RMR (ISO/TS 21219-23) and TPEG2-EMI (ISO/TS 21219-25).

TPEG2 has been developed to be broadly (but not totally) backward compatible with TPEG1 to assist in transitions from earlier implementations, while not hindering the TPEG2 innovative approach and being able to support many new features, such as dealing with applications having both long-term, unchanging content and highly dynamic content, such as parking information.

This document is based on the TISA specification technical/editorial version reference: SP13005/2.1/001.

1) Under development.

Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) —

Part 7: Location referencing container (TPEG2-LRC)

1 Scope

This document establishes the method of signalling the specific location referencing used by all TPEG2 applications that require detailed location information to be delivered to client devices such as TPEG2-TEC. The TPEG2-location referencing container (TPEG2-LRC) is described and shows how it is used to signal which specific location referencing method is in use for a particular TPEG message. It is able to handle location referencing methods that are external to the present ISO series and the internal location referencing methods defined as parts of this series.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 17572-2:2015, *Intelligent transport systems (ITS) — Location referencing for geographic databases — Part 2: Pre-coded location references (pre-coded profile)*

ISO 17572-3, *Intelligent transport systems (ITS) — Location referencing for geographic databases — Part 3: Dynamic location references (dynamic profile)*

ISO/TS 21219-3, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 3: UML to binary conversion rules*

ISO/TS 21219-4, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 4: UML to XML conversion rules*

ISO/TS 21219-21[2], *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 21: Geographic location referencing (TPEG2-GLR)*

ISO/TS 21219-22, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 22: OpenLR™ location referencing (TPEG2-OLR)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

2) Under development.

Digital map based systems, either on the message generation (server) side or on the client (end-user) side, tend to be based upon road mapping rather than, for example, rail track mapping. Therefore, throughout this specification series, there is a tendency to use roads as examples. However, roads are not necessarily implied, so the use and context of an element shall be clarified.

3.1
TPEG client
end user's device, usually consisting of a bearer level tuner/receiver, a TPEG decoder and a human machine interface

3.2
dynamic location reference
location reference generated on the fly based on geographic properties in a digital map database

3.3
location referencing
means to provide information that allows a system to identify accurately a location

Note 1 to entry: The content of a location reference allows the location to be presented in a plain-language manner directly to the end-user (i.e. text, speech or icons) or to be used for navigational purposes, for example, for map-based systems.

3.4
location referencing container
concept applied to the grouping of all the location referencing elements, of a TPEG message, together in one place

Note 1 to entry: Many TPEG applications are designed to deliver TPEG messages, which consist of three high-level containers, each with one or more elements. These containers are for: message management, event information and location referencing information. Note that some special application messages do NOT include a location referencing container, such as a cancellation message. It should also be noted that each container does not necessarily have all possible lower level elements included. Figure 1 shows the "container view" structure used, for example, when a TPEG2-TEC (ISO/TS 21219-15) application message is generated to describe a road event and location references need to be given to the end-user.

The main purpose of the location referencing container is to provide both human understandable and machine-readable elements to appropriate client decoders. It may be delivered to a "thin client", which, for example, is only able to convey limited location referencing information to the end-user or it may be delivered to a "thick client" using a considerable number of elements and using considerable processing power to filter the information for a comprehensive display to an end-user.

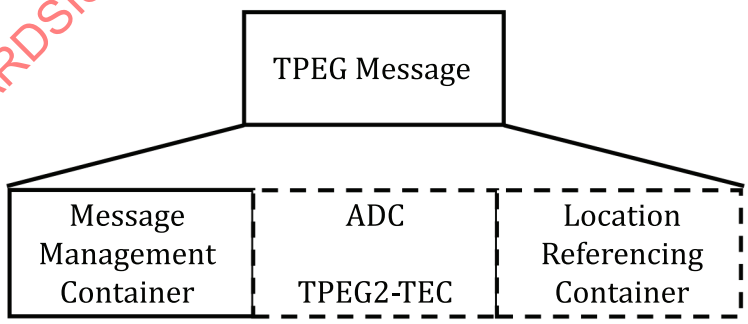

Figure 1 — "Container view" of a TPEG message

3.5
message
collection of coherent information sent through the information channel describing an event, a collection of related events, or status information and including message management information

3.6
pre-coded location reference
location reference using a unique identifier that is agreed upon in both sender and receiver system to select a location from a set of agreed locations

3.7
TPEG server
functionality used by the service provider to distribute or deliver the TPEG data to TPEG client devices

3.8
TPEG2-ULR (universal location reference)
dynamic location referencing method which is designed for delivering messages to human end-users with some definitions having a meaning different from those found in other location referencing systems

Note 1 to entry: An important aspect of the TPEG2-ULR referencing method is that a location description may be created on-the-fly by the service provider (TPEG server) when needed. It may then be interpreted and used by the TPEG-decoder (TPEG client) and then discarded. The pre-creation of codes and the use of a database and code maintenance are entirely avoided.

Note 2 to entry: TPEG-LOC has been deprecated in TPEG2 and is now replaced in TPEG2 with TPEG2-ULR (TISA specification SP13008) as one of the TPEG2 location referencing methods.

4 Abbreviated terms

ACID	application and content identifier
ADC	application data container
CEN	Comité Européen de Normalisation
DLR	dynamic location referencing
DLR1	DLR method as defined in ISO 17572-3
EBU	European Broadcasting Union
ETL	Extended TMC Location Reference
GLR	Geographic Location Reference
ISO	International Organization for Standardization
ITS	intelligent transport systems
LRC	location reference container
MMC	message management container
OLR	OpenLR™
OSI	Open Systems Interconnection
SFW	TPEG service framework: modelling and conversion rules
TEC	traffic event compact application
TISA	Traveller Information Services Association
TMC	traffic message channel

TPEG	Transport Protocol Expert Group
TTI	traffic and travel information
ULR	universal location referencing
UML	Unified Modelling Language
VICS	Vehicle Information and Communication System – Japanese developed real-time road traffic information system providing congestion and regulation information
XML	eXtensible Markup Language

5 Toolkit specific constraints

5.1 Relation to TPEG1-LRC

This document contains all relevant methods of TPEG1-LRC (ISO/TS 18234-11), but one location referencing method has been deprecated and new ones have been added.

5.2 Application identification

TPEG applications are described by the TPEG specifications in the ISO/TS 21219 series and are placed at the highest layers of the OSI protocol stack, ISO/IEC 7498-1. Each TPEG application (e.g. TPEG2-TEC) is assigned a unique Application IDentification (AID) number. In this respect, the TPEG2-LRC is not an application, but it is an essential constituent part of all TPEG messages requiring location referencing.

6 LRC structure

To satisfy the principles of the TPEG technology, location referencing requires the transmission of data that will allow a TPEG client to present such detail to a human, directly as text, speech, graphics or a combination of these, to recreate a comprehensible representation of a real-world location.

Location referencing may come in three distinct types:

— pre-coded, where a number of locations are fixed in a list and the same list shall be used by the service provider (TPEG server) as well as by the client device decoder;

— dynamic, where locations are encoded on-the-fly and decoded by the client device with no specific prior knowledge;

— hybrid, a mixture of the two.

The TPEG2-LRC allows embedding any location referencing method, which is defined in this document.

The TPEG2-LRC is defined so that it can be extended to incorporate other location referencing methods in subsequent versions of TPEG2-LRC (see ISO/TS 21219-2).

A service provider (TPEG server) may use of any one or more location references per TPEG message. The choice will depend upon market driven factors and thus, there is full service provision choice for both transitional and long-term location referencing requirements.

Eight location referencing methods have been identified as suitable for use within TPEG2-LRC. In alphabetical order, they are: DLR1, Extended TMC Location Reference, Geographic Location Reference, Korean Node Link Location, OpenLR™, TMC Location, Universal Location and VICS Link Location. These location referencing methods are detailed in other standards (see Clause 2) and they may be used by inserting the location data, encoded according to their specification, into the TPEG2-LRC. The LRC ensures a stable way to identify the method in use and thus allows TPEG client decoder(s) to identify which location referencing method(s) are present in the message.

The structure of the LRC toolkit is shown in Figure 2.

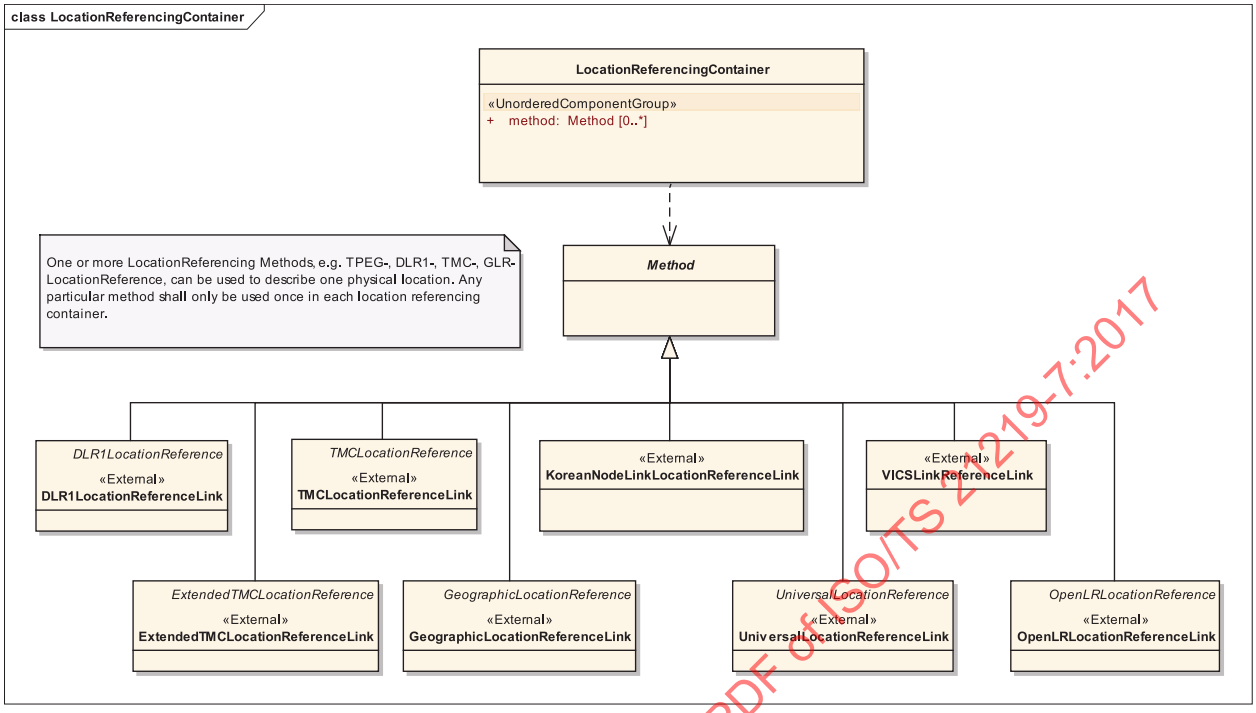

Figure 2 — LRC message structure

In Annex A, the TPEG binary representation for the LocationReferencingContainer is defined. In Annex B, the TPEG-ML representation for the LocationReferencingContainer is specified.

7 LRC message components

7.1 LocationReferencingContainer

The generic LocationReferencingContainer (see Table 1) can contain a pre-coded or a dynamic location reference.

One or more location referencing methods, e.g. ULR Location, DLR1 Location, TMC Location, VICS Link Location, Korean Node Link Location, ETL Location, OLR Location or GLR Location, can be used to describe one physical location. Any particular method shall be used only once in any LocationReferencingContainer.

Table 1 — LRC message structure

Name	Type	Multiplicity	Description
Unordered components			
method	Method	0..*	n.a.

To allow future backward compatible extensions of the location referencing container that do not require one of the current methods, the multiplicity has been modelled as 0, although it is recommended to omit the whole LocationReferencingContainer, if no method is included.

7.2 Method

This component is a placeholder for the actual location reference containers.

Any particular method shall be used once in any LocationReferencingContainer.

7.3 DLR1LocationReferenceLink

The DLR1 location referencing method is a dynamic location referencing method developed by ISO/TC 204.

The method is designed to provide compact location references that allow accurate location referencing for 100 % of the road network. DLR1 location references are machine readable and are primarily aimed at dynamic route guidance navigation systems. The DLR1 method and the TPEG2 conformant structure of TPEG2-DLR are specified in ISO 17572-3.

7.4 TMCLocationReferenceLink

The RDS-TMC protocol (i.e. ALERT-C protocol) is specified in ISO 14819-1. This protocol is designed to provide pre-coded information messages using pre-coded location references to end-users on inter-urban road networks. Both messages and locations are required to be stored in all client devices. The TMC system, developed for FM transmission in the RDS sub-channel, is limited to a code-base of <64 000 locations per location table. The TMC location reference method for embedding ALERT-C location references in the TPEG2 conformal structure of TPEG2-TMC is specified in ISO 17572-2:2015, Annexes B, C, and D.

7.5 KoreanNodeLinkLocationReferenceLink

This element is defined by ISO 17572-2.

The content of this component is defined in another specification. The purpose of this class definition is to assign a unique identifier to the component.

7.6 VICSLinkReferenceLink

VICS Link Location is a pre-coded location referencing method designed for the Japan road network. The VICS Link Location reference method is defined in ISO 17572-2.

The content of this component is defined in another standard. The purpose of this class definition is to assign a unique identifier to the component.

7.7 ExtendedTMCLocationReferenceLink

The RDS-TMC protocol (i.e. ALERT-C protocol) is specified in ISO 14819-1. This protocol is designed to provide pre-coded information messages using pre-coded location references to end-users on inter-urban road networks. Both messages and locations are required to be stored in all client devices. The TMC system, developed for FM transmission in the RDS sub-channel, is limited to a code-base of <64 000 locations per location table. Some events in the RDS-TMC protocol address only the exit and entries of the point location defined by the location code. To allow addressing these exit and entries in the location reference (and not the event), additional information next to the location code has to be supplied in the location container. The Extended TMC Location Reference extends the ALERT-C location referencing defined in ISO 17572-2 to allow, additionally, specification of exits and entry roads of a defined TMC point location. The ETL location reference method for embedding Extended TMC location References in the TPEG-LRC is specified in ISO 17572-2:2015, Annexes E, F, and G.

7.8 GeographicLocationReferenceLink

The GLR location referencing method is a simple geographic location referencing method developed by TISA.

The method is designed to provide compact, dynamic location references for geographic features, e.g. geographic point, line, and area locations. The GLR method is primarily aimed at geo-oriented (i.e. not road network related) applications such as weather reports, safety alerts and emergency warnings. The GLR method is specified in ISO/TS 21219-21.

7.9 UniversalLocationReferenceLink

The ULR location referencing method is a dynamic location referencing method (universal location referencing) which aims to overcome the limits of TPEG-LOC (in terms of efficiency and accuracy) based on an open, royalty-free method. ULR offers a flexible method to fulfil needs of content providers and users in relevant domains. It aims to be really "universal", designed for human-centred assistance devices as well as map-related devices like navigation systems. Therefore, it supports human-understandable representations such as text as well as machine-processable coding for the map-matching process on on-board digital maps. TPEG-ULR is open for applications "beyond the car" and is intended to support even applications which are not defined yet. The ULR method is specified in TISA specification SP13008.

7.10 OpenLRLocationReferenceLink

OpenLR™ has been designed for the use case of transferring traffic information from a centre to in-vehicle systems, built-in or used as an add-on (PND, smart phone). The corresponding locations are roads, a list of connected roads, points of interest, or areas.

In order to transmit location information from a sending to a receiving side, the OpenLR™ method defines rules for generating map-independent location references, that is, the actual location references are generated dynamically not incorporating any pre-coding steps. The OLR method is specified in ISO/TS 21219-22.

Annex A
(normative)

TPEG application, TPEG-Binary Representation

A.1 General

This annex provides the TPEG binary representation derived via application of the UML to binary conversion rules specified in ISO/TS 21219-3.

A.2 Message components

A.2.1 List of generic component Ids

Name	Id
LocationReferencingContainer	x
DLR1LocationReferenceLink	1
TMCLocationReferenceLink	2
KoreanNodeLinkLocationReferenceLink	3
VICSLinkReferenceLink	4
ExtendedTMCLocationReferenceLink	5
GeographicLocationReferenceLink	6
UniversalLocationReferenceLink	7
OpenLRLocationReferenceLink	8

A.2.2 LocationReferencingContainer

<LocationReferencingContainer(x)>:=	
<IntUnTi>(x),	: id of this component
<IntUnLoMB>(lengthComp),	: number of bytes in component
<IntUnLoMB>(lengthAttr),	: number of bytes in attributes
unordered {	
n * <Method>(method)	
};	

A.2.3 Method

<Method(x)>:=	
<IntUnTi>(x),	: id of this component
<IntUnLoMB>(lengthComp),	: number of bytes in component
<IntUnLoMB>(lengthAttr);	: number of bytes in attributes

A.2.4 DLR1LocationReferenceLink

<DLR1LocationReferenceLink(1)<Method()>>:=	
External <DLR1LocationReference(1)>;	: see DLR1LocationReference specification

A.2.5 TMCLocationReferenceLink

<TMCLocationReferenceLink(2)<Method()>>:=	
External <TMCLocationReference(2)>;	: see TMCLocationReference specification

A.2.6 KoreanNodeLinkLocationReferenceLink

<KoreanNodeLinkLocationReferenceLink(3)<Method()>>:=	
External <UndefinedPackage(3)>;	: External package is not defined

A.2.7 VICSLinkReferenceLink

<VICSLinkReferenceLink(4)<Method()>>:=	
External <UndefinedPackage(4)>;	: External package is not defined

A.2.8 ExtendedTMCLocationReferenceLink

<ExtendedTMCLocationReferenceLink(5)<Method()>>:=	
External <ExtendedTMCLocationReference(5)>;	: see ExtendedTMCLocationReference specification

A.2.9 GeographicLocationReferenceLink

<GeographicLocationReferenceLink(6)<Method()>>:=	
External <GeographicLocationReference(6)>;	: see GeographicLocationReference specification

A.2.10 UniversalLocationReferenceLink

<UniversalLocationReferenceLink(7)<Method()>>:=	
External <UniversalLocationReference(7)>;	: see UniversalLocationReference specification

A.2.11 OpenLRLocationReferenceLink

<OpenLRLocationReferenceLink(8)<Method()>>:=	
External <OpenLRLocationReference(8)>;	: see OpenLRLocationReference specification

Annex B
(normative)

TPEG application, TPEG-ML Representation

B.1 General

This annex provides the XML representation derived via application of the UML to XML conversion rules specified in ISO/TS 21219-4.

B.2 Message components

B.2.1 LocationReferencingContainer

```
<xs:element name="LocationReferencingContainer" type="LocationReferencingContainer"/>
<xs:complexType name="LocationReferencingContainer">
<xs:sequence>
<xs:choice maxOccurs="unbounded">
<xs:element name="method" type="Method" minOccurs="0" maxOccurs="unbounded"/>
</xs:choice>
</xs:sequence>
</xs:complexType>
```

B.2.2 Method

```
<xs:complexType name="Method">
<xs:sequence>
<xs:choice minOccurs="1" maxOccurs="1">
<xs:element name="optionDLR1LocationReferenceLink" type="dlr:DLR1LocationReference"
minOccurs="1" maxOccurs="1"/>
<xs:element name="optionTMCLocationReferenceLink" type="tmc:TMCLocationReference"
minOccurs="1" maxOccurs="1"/>
<xs:element name="optionKoreanNodeLinkLocationReferenceLink" type="xs:base64Binary"
minOccurs="1" maxOccurs="1"/>
<xs:element name="optionVICSLinkReferenceLink" type="xs:base64Binary" minOccurs="1"
maxOccurs="1"/>
<xs:element name="optionExtendedTMCLocationReferenceLink" type="etl:
ExtendedTMCLocationReference" minOccurs="1" maxOccurs="1"/>
<xs:element name="optionGeographicLocationReferenceLink" type="glr:
GeographicLocationReference" minOccurs="1" maxOccurs="1"/>
<xs:element name="optionUniversalLocationReferenceLink" type="ulr:
UniversalLocationReference" minOccurs="1" maxOccurs="1"/>
<xs:element name="optionOpenLRLocationReferenceLink" type="olr:OpenLRLocationReference"
minOccurs="1" maxOccurs="1"/>
</xs:choice>
</xs:sequence>
</xs:complexType>
```

B.3 Datatypes

No specific data types are defined in this document.

B.4 Full LRC schema definition

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- This XML schema is generated with tpegUMLconverter V2.1 -->
<xs:schema xmlns="http://www.tisa.org/TPEG/LRC_2_1"
 targetNamespace="http://www.tisa.org/TPEG/LRC_2_1"
 xmlns:xs="http://www.w3.org/2001/XMLSchema"
```