International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Y.4467

(01/2020)

SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS, NEXT-GENERATION NETWORKS, INTERNET OF THINGS AND SMART CITIES

Internet of things and smart cities and communities – Frameworks, architectures and protocols

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Minimum set of data structure for automotive emergency response system

Recommendation ITU-T Y.4467

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Recommendation ITU-T Y.4467

Minimum set of data structure for automotive emergency response system

Summary

An automotive emergency response system (AERS) for aftermarket devices defined in Recommendation ITU-T Y.4119 is designed to bring rapid assistance to driver and/or passengers involved in accidents.

For the normal operation purpose of the AERS, an accident related data (so-called minimum set of data (MSD)) needs to be sent from an automotive emergency detection device (AEDD) to an automotive emergency response centre (AERC).

An MSD includes mandatory and optional information. The mandatory information of an MSD is a set of information that shall be included in an MSD when an AEDD performs normal operation. The optional information of an MSD is a set of information on an accident that can be additionally included to give more information to AERC.

Recommendation ITU-T Y.4467 specifies an MSD structure and encoding rule for an AERS.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T Y.4467	2020-01-13	20	11.1002/1000/14170

Keywords

Automotive, AERS, emergency, MSD.

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* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

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Recommendation ITU-T Y.4467

Minimum set of data structure for automotive emergency response system

1 Scope

The objective of this Recommendation is to specify the minimum set of data (MSD) structure for an automotive emergency response system (AERS).

In particular, the scope of this Recommendation includes:

– Overview of MSD for AERS
– Mandatory information of MSD
– Optional information of MSD
– Encoding rule for MSD

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T E.164] Recommendation ITU-T E.164 (2010), *The international public telecommunication numbering plan*.

[ITU-T X.680] Recommendation ITU-T X.680 (2015) | ISO/IEC 8824-1:2015, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation*.

[ITU-T Y.4119] Recommendation ITU-T Y.4119 (2018*), Requirements and capability framework for IoT-based automotive emergency response system*.

[IETF RFC 7049] IETF RFC 7049 (2013), *Concise binary object representation (CBOR).*

[ISO 3779] ISO 3779:2009, *Road vehicles – Vehicle identification number (VIN) - Content and structure*.

[ISO 6709] ISO 6709:2008, *Standard representation of geographic point location by coordinates*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 automotive emergency detection device (AEDD) [ITU-T Y.4119]: a unit (or a set of units) expected to perform at least the following functions:

– receiving sensing data, from internal sensors and/or vehicle sensors, for determining whether or not the accident occurred needs emergency recovery or receiving manual triggering signals,
– determining whether or not the accident occurred needs emergency recovery,

– receiving information about, or determining, the vehicle location,

– sending minimum set of data (MSD) which is related to the accident, and

– providing bidirectional voice communication.

3.1.2 automotive emergency response centre (AERC) [ITU-T Y.4119]: a centre managed by a public authority or a private organization, responsible for:

– answering each automotive emergency response request,

– confirming whether or not the accident occurred, and

– notifying the emergency authority (EA) if EA dispatch is necessary.

NOTE – Considering the features of aftermarket devices, AERC is equipped with false alarms filtering functions.

3.1.3 minimum set of data (MSD) [ITU-T Y.4119]: data related to the accident sent from automotive emergency detection device (AEDD) to automotive emergency response centre (AERC).

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AEDD	Automotive Emergency Detection Device
AERC	Automotive Emergency Response Centre
AERS	Automotive Emergency Response System
CBOR	Concise Binary Object Representation
EA	Emergency Authority
GMT	Greenwich Mean Time
GNSS	Global Navigation Satellite System
MSD	Minimum Set of Data
OID	Object Identifier
UTC	Coordinated Universal Time
VIN	Vehicle Identification Number

5 Conventions

None.

6 Overview of MSD for AERS

An automotive emergency response system (AERS) for aftermarket devices defined in [ITU-T Y.4119] is designed to bring rapid assistance to driver and/or passengers involved in accidents.

For the normal operation purpose of the AERS, an accident related data (so-called minimum set of data, (MSD)) needs to be sent from an automotive emergency detection device (AEDD) to an automotive emergency response centre (AERC) as shown in Figure 1.

An MSD includes mandatory and optional information. The mandatory information of an MSD is a set of information that shall be included in an MSD when an AEDD performs normal operation. The optional information of an MSD is a set of information on an accident that can be additionally included to give more information to AERC.

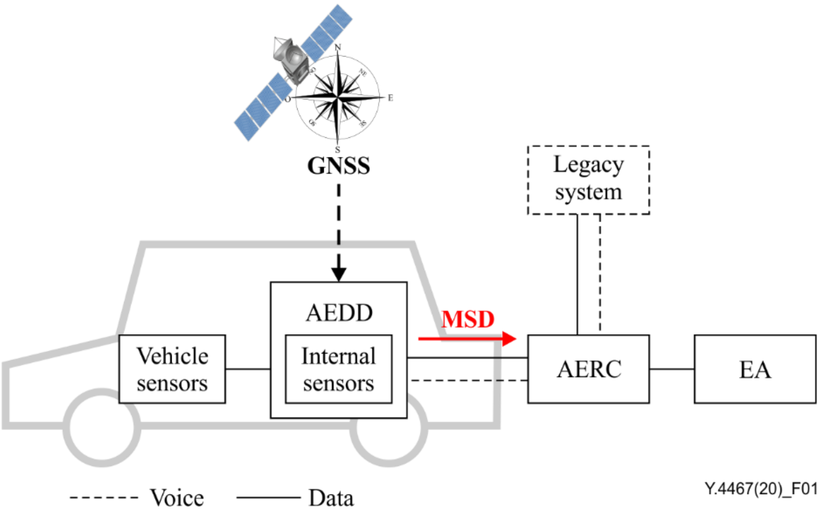

Figure 1 – MSD transmission [ITU-T Y.4119]

7 Minimum set of data

Figure 2 shows the MSD structure.

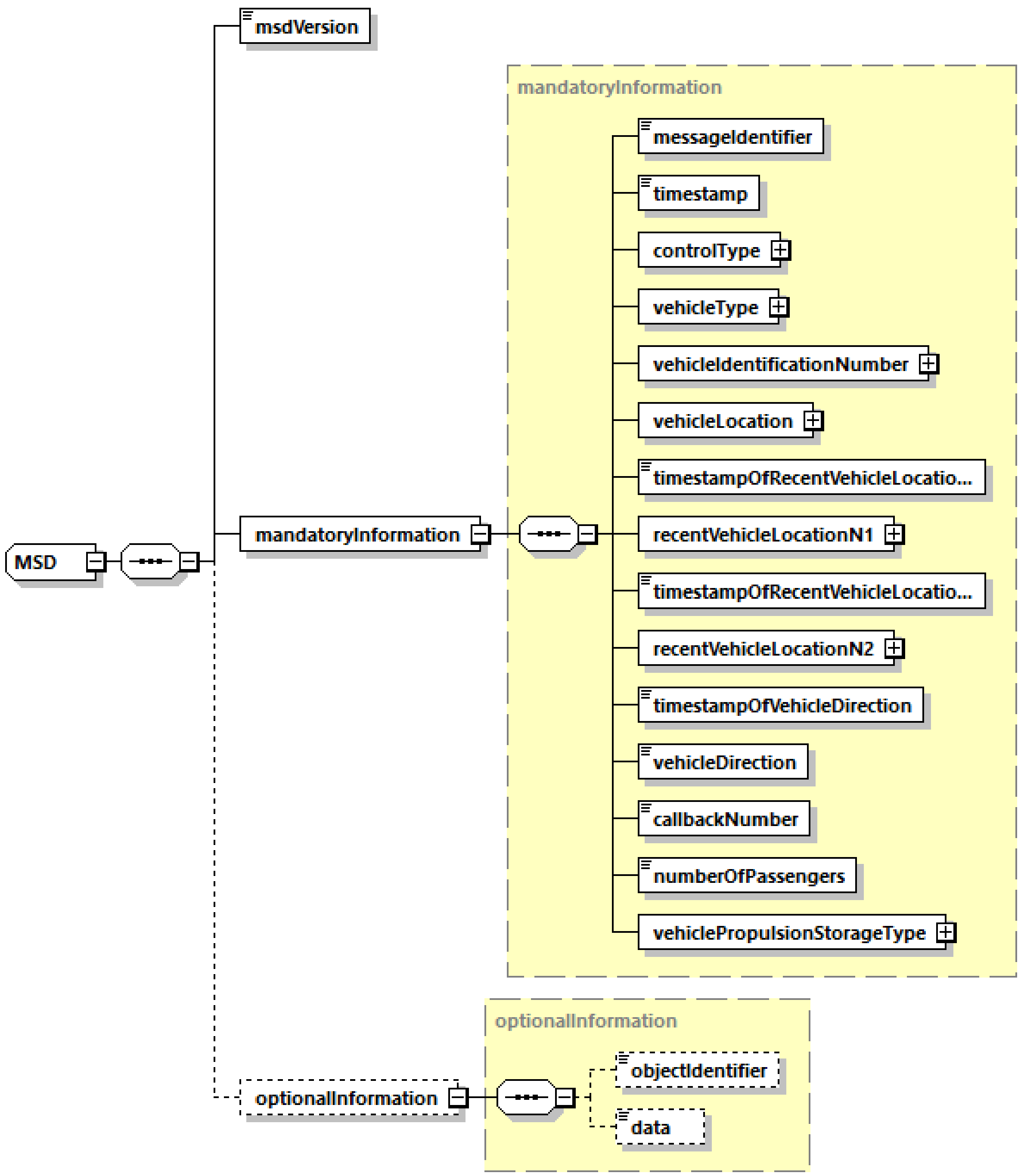

Figure 2 – Structure of MSD

7.1 MSD version

All MSD defines the version according to the data structure so that the AERC can interpret the MSD. The MSD version is mandatory.

msdVersion represents the version value of the MSD and has a value increasing sequentially from 1 to 255 (see Table 1) according to the data structure type.

Table 1 – msdVersion

Type	INTEGER
Constraints	(1 .. 255)
Length	1 byte

7.2 Mandatory information

The mandatory information listed in Table 2 is a set of information that shall be included in an MSD when the AEDD performs normal operations.

Table 2 – Mandatory information

Name	Description	Data size
messageIdentifier	Message sequence of MSD	1 byte
timestamp	The time stamp of accident detection	4 bytes
controlType	Type of control	4 bits
vehicleType	Type of vehicle	5 bits
vehicleIdentificationNumber	Vehicle identification number (VIN)	17 bytes
vehicleLocation	Location of vehicle	8 bytes
timestampOfRecentVehicleLocationN1	The time stamp of recent vehicle location N1	4 bytes
recentVehiclelocation N1	Recent vehicle location N1	8 bytes
timestampOfRecentVehicleLocationN2	The time stamp of recent vehicle location N2	4 bytes
recentVehicleLocationN2	Recent vehicle location N2	8 bytes
timestampOfVehicleDirection	The time stamp of vehicle direction	4 bytes
vehicleDirection	Direction of vehicle	4 bits
callbackNumber	Callback number	15 bytes
numberOfPassengers	The number of passengers	1 byte
vehiclePropulsionStorageType	Fuel type of vehicle	7 bits

7.2.1 messageIdentifier

messageIdentifier indicates the sequence number of transmitted MSD when an accident is detected.

Table 3 – messageIdentifier

Type	INTEGER
Constraints	(1 .. 255)
Length	1 byte

The initial value of *messageIdentifier* is "1" (see Table 3) and it is monotonically increased whenever a new MSD is sent. The value resets to "1" whenever it reaches "255".

7.2.2 timestamp

timestamp records the time of a detected accident.

Table 4 – timestamp

Type	INTEGER
Constraints	(0 .. 4294967295)
Length	4 bytes

timestamp is recorded as a number in seconds that has elapsed since January 1, 1970 (midnight UTC/GMT). Local time can be converted by calculation based on UTC/GMT.

The default value is "0" (see Table 4) if time information is not obtained.

NOTE – *timestamp* will overflow on 07-Feb-2106 06:28:15 UTC.

7.2.3 controlType

controlType is a set of control types for MSD which consists of *automaticActivation*, *testCall*, *positionTrusted*, and *cancelRequest* information (see Table 5).

Table 5 – controlType

Type	SEQUENCE [ITU-T X.680]
Length	4 bits

Children	*controlType*::= SEQUENCE{
	automaticActivation BOOLEAN DEFAULT FALSE,
	testCall BOOLEAN DEFAULT FALSE,
	positionTrusted BOOLEAN DEFAULT FALSE,
	cancelRequest BOOLEAN DEFAULT FALSE
	}

automaticActivation is "true" if an MSD is created automatically generated or "false" if it is manually generated via the SOS button.

testCall is set to "true" if an MSD sent is for service testing purposes.

positionTrusted is "true" if GNSS is used to obtain location information.

cancelRequest is "true" if the MSD is used to cancel previously sent accident report MSD.

7.2.4 vehicleType

vehicleType (see Table 6) indicates the type of vehicle.

Table 6 – vehicleType

Type	ENUMERATED [ITU-T X.680]
Length	5 bits

vehicleType should be determined according to the vehicle class defined in the national or regional regulations. The default value is "0000" if a vehicle type is not identified.

7.2.5 vehicleIdentificationNumber

vehicleIdentificationNumber represents the unique identification string of the vehicle (see Table 7) as defined in [ISO 3779].

Table 7 – vehicleIdentificationNumber

Type	SEQUENCE [ITU-T X.680]
Length	17 bytes

Children	VIN::= SEQUENCE {
	isowmi PrintableString (SIZE(3)) (FROM("0".."9","A".."Z")),
	isovds PrintableString (SIZE(6)) (FROM("0".."9","A".."Z")),
	isovisModelYear PrintableString (SIZE(1)) (FROM("0".."9","A".."Z")),
	isovisSeqPlant PrintableString (SIZE(7)) (FROM("0".."9","A".."Z"))
	}

If the *vehicleIdentificationNumber* value is not obtained or is invalid, the default value is "00000000000000000."

7.2.6 vehicleLocation

vehicleLocation represents the vehicle location information (see Table 8) at the time of the accident detection as defined in [ISO 6709]. The *vehicleLocation* value consists of *positionLatitude* and *positionLongitude*, with the latitude and longitude values of the vehicle respectively.

Table 8 – vehicleLocation

Type	SEQUENCE [ITU-T X.680]
Constraints	Latitude: −90(−324000000) ~ +90(+324000000) Longitude: −180(−648000000) ~ +180(+648000000)
Length	8 bytes

Children	*vehicleLocation*::= SEQUENCE {
	positionLatitude INTEGER(−2147483648..2147483647),
	positionLongitude INTEGER(−2147483648..2147483647)
	}

vehicleLocation shall be written in degrees, minutes, and seconds to the second decimal place of the last second.

The default values of *positionLatitude* and *positionLongitude* are "2147483647" if vehicle position information is not obtained at the time of an accident.

7.2.7 timestampOfRecentVehicleLocationN1, timestampOfRecentVehicleLocationN2, recentVehicleLocationN1, recentVehicleLocationN2

Two past location values (*recentVehicleLocationN1*, *recentVehicleLocationN2*) and the corresponding timestamp values (*timestampOfRecentVehicleLocationN1*, *timestampOfRecentVehicl eLocationN2)* (see Tables 9-12) should be sent. Each valid location value should maintain a time interval of at least 5 seconds. The default values of locations and timestamps are the same as that of *timestamp* and *vehicleLocation* if an AEDD fails to provide valid ones.

Table 9 – timestampOfRecentVehicleLocationN1

Type	INTEGER
Constraints	(0 .. 4294967295)
Length	4 bytes

Table 10 – timestampOfRecentVehicleLocationN2

Type	INTEGER
Constraints	(0 .. 4294967295)
Length	4 bytes

Table 11 – recentVehicleLocationN1

Type	SEQUENCE [ITU-T X.680]
Constraints	Latitude: −90(−324000000) ~ +90(+324000000) Longitude: −180(−648000000) ~ +180(+648000000)
Length	8 bytes

Children	*recentVehicleLocationN1*::= SEQUENCE {
	positionLatitude INTEGER(−2147483648..2147483647),
	positionLongitude INTEGER(−2147483648..2147483647)
	}

Table 12 – recentVehicleLocationN2

Type	SEQUENCE [ITU-T X.680]
Constraints	Latitude: −90(−324000000) ~ +90(+324000000) Longitude: −180(−648000000) ~ +180(+648000000)
Length	8 bytes

Children	*recentVehicleLocationN2*::= SEQUENCE {
	positionLatitude INTEGER(−2147483648..2147483647),
	positionLongitude INTEGER(−2147483648..2147483647)
	}

7.2.8 timestampOfVehicleDirection

timestampOfVehicleDirection (see Table 13) is the corresponding timestamp at the time of valid *vehicleDirection* acquisition. The data format follows a timestamp.

Table 13 –timestampOfVehicleDirection

Type	INTEGER
Constraints	(0 .. 4294967295)
Length	4 bytes

7.2.9 vehicleDirection

vehicleDirection is the vehicle's moving direction value obtained (see Table 14) at the time of an accident or the last value obtained before an accident detection.

Table 14 – vehicleDirection

Type	INTEGER
Constraints	(0 .. 15)
Length	4 bits

Values of *vehicleDirection* are azimuth range based integers as defined in Table 15 based on the true north.

Table 15 – Vehicle azimuth range and vehicleDirection value

Central angle	Azimuth range	*vehicleDirection* value
0	338 ~ 22	1
45	23 ~ 67	2
90	68 ~ 112	3
135	113 ~ 157	4
180	158 ~ 202	5
225	203 ~ 247	6
270	248 ~ 292	7
315	293 ~ 337	8

7.2.10 callbackNumber

callbackNumber (see Table 16) is expressed as a 15-digit number that is comprised of a country code, national destination code, and subscriber number as defined in [ITU-T E.164]. Fewer than 15 digits are recorded starting from the first digit, and the last digit is filled with NULL.

Table 16 – callbackNumber

Type	SEQUENCE [ITU-T X.680]
Length	15 bytes
Children	*passengerPhoneNumber* *PrintableString* (SIZE(15)) (FROM("0".."9")),

If the call back number is not available, it should be written as 15 NULLs.

7.2.11 numberOfPassengers

numberOfPassengers indicates the number of passengers including both driver and passengers (see Table 17).

Table 17 – numberOfPassengers

Type	INTEGER
Constraints	(1 .. 255)
Length	1 byte

The default value is "00000000" If the information is not acquired.

7.2.12 vehiclePropulsionStorageType

vehiclePropulsionStorageType is the fuel type of the vehicle and the hybrid fuel vehicle may contain a plurality of fuel information (see Table 18).

Table 18 – vehiclePropulsionStorageType

Type	SEQUENCE [ITU-T X.680]
Length	7 bits

Children	vehiclePropulsionStorageType::= SEQUENCE{
	gasoline BOOLEAN DEFAULT FALSE
	diesel BOOLEAN DEFAULT FALSE
	compressedNaturalGas BOOLEAN DEFAULT FALSE
	liquidPropaneGas BOOLEAN DEFAULT FALSE
	electricBattery BOOLEAN DEFAULT FALSE
	hydrogen BOOLEAN DEFAULT FALSE
	other BOOLEAN DEFAULT FALSE
	}

The default value is "0000000" if the information is not acquired.

7.3 Optional information of MSD

Optional information (see Table 19) is additional data that an AEDD can send to an AERC for additional functions such as information to determine the severity of an accident. The optional information is expressed as a pair of object identifier and data.

Table 19 – Optional information

Type	SEQUENCE [ITU-T X.680]
Constraints	–
Length	–

7.3.1 objectIdentifier

objectIdentifier is an object identifier (OID) assigned to identify data and records a relative object identifier. The assignment of object identifiers, in this regard, is outside the scope of this Recommendation.

7.3.2 data

data is the additional data that an AEDD sends to an AERC, and its type and format are outside the scope of this Recommendation.

8 Encoding rule for MSD

The encoding rule of MSD shall comply with concise binary object representation (CBOR) defined in [IETF RFC 7049].

9 Security considerations

There is no security consideration other than that described in clause 8 of [IETF RFC 7049].

Appendix I

MSD encoding example using IETF RFC 7049

(This appendix does not form an integral part of this Recommendation.)

Table I.1 is an example value of the MSD to show the encoding example.

Table I.1 – Mandatory information for example

Mandatory information	Type	Example value
msdVersion	INTEGER	1
messageIdentifier	INTEGER	1
timestamp	INTEGER	09-Apr-2019 09:25:33 UTC
controlType	SEQUENCE	Automatic activation Position trusted
vehicleType	ENUMERATED	Midsize vehicle
vehicleIdentificationNumber	SEQUENCE	WM9VDSDSPYA123456
vehicleLocation	SEQUENCE	Latitude: 36°23'02.1"N Longitude: 127°22'02.3"E
timestampOfRecentVehicleLocationN1	INTEGER	09-Apr-2019 09:25:28 UTC
recentVehiclelocation N1	SEQUENCE	Latitude: 36°23'02.5"N Longitude: 127°21'56.1"E
timestampOfRecentVehicleLocationN2	INTEGER	09-Apr-2019 09:25:23 UTC
recentVehicleLocationN2	SEQUENCE	Latitude: 36°23'03.7"N Longitude: 127°21'49.1"E
timestampOfVehicleDirection	INTEGER	09-Apr-2019 09:25:32 UTC
vehicleDirection	INTEGER	175°
callbackNumber	SEQUENCE	+82 10 1234 1234
numberOfPassengers	INTEGER	2
vehiclePropulsionStorageType	SEQUENCE	Gasoline

The example values in Table I.1 can be expressed in human readable diagnostic notation as follows:

[1, //*msdVersion*

[1, //*messageIdentifier*

1554801933, //*timestamp*

true, //*controlType.automaticActivation*

false, //*controlType.testCall*

true, //*controlType.positionTrusted*

false, //*controlType.cancelRequest*

2, //*vehicleType*

"WM9VDSDSPYA123456", //*vehicleIdentificationNumber*

[130982100, 458522300], //*vehicleLocation*

```
        1554801928, //timestampOfRecentVehicleLocationN1
        [130982500, 458516100], //recentVehicleLocationN1
        1554801923, //timestampOfRecentVehicleLocationN2
        [130983700, 458509100], //recentVehicleLocationN2
        1554801932, //timestampOfvehicleDirection
        5, //vehicleDirection
        "821012341234   ", //callbackNumber
        2, //numberOfPassengers
        true, //vehiclePropulsionStorageType.gasoline
        false, //vehiclePropulsionStorageType.diesel
        false, //vehiclePropulsionStorageType.compressedNaturalGas
        false, //vehiclePropulsionStorageType.liquidPropaneGas
        false, //vehiclePropulsionStorageType.electricBattery
        false, //vehiclePropulsionStorageType.hydrogen
        false //vehiclePropulsionStorageType.other
       ]
]
```

The result of encoding the above diagnostic notation using [IETF RFC 7049] is as follows and the total data size is 106 Bytes:

```
82                          # array(2)
  01                        # unsigned(1)
  98 18                     # array(24)
    01                      # unsigned(1)
    1A 5CAC650D             # unsigned(1554801933)
    F5                      # primitive(21)
    F4                      # primitive(20)
    F5                      # primitive(21)
    F4                      # primitive(20)
    02                      # unsigned(2)
    71                      # text(17)
      574D39564453445350594131323334353 6 # "WM9VDSDSPYA123456"
    82                      # array(2)
      1A 07CEA0D4           # unsigned(130982100)
      1A 1B547EBC           # unsigned(458522300)
    1A 5CAC6508             # unsigned(1554801928)
    82                      # array(2)
      1A 07CEA264           # unsigned(130982500)
```

```
  1A 1B546684          # unsigned(458516100)
1A 5CAC6503            # unsigned(1554801923)
82                     # array(2)
  1A 07CEA714          # unsigned(130983700)
  1A 1B544B2C          # unsigned(458509100)
1A 5CAC650C            # unsigned(1554801932)
05                     # unsigned(5)
6F                     # text(15)
  383231303132333431323334202020 # "821012341234   "
02                     # unsigned(2)
F5                     # primitive(21)
F4                     # primitive(20)
F4                     # primitive(20)
F4                     # primitive(20)
F4                     # primitive(20)
F4                     # primitive(20)
F4                     # primitive(20)
```

Appendix II

Vehicle type example

(This appendix does not form an integral part of this Recommendation.)

Table II.1 shows examples of vehicle types.

Table II.1 – Vehicle type value example

Division	Sub-division	vehicleType value	
		Binary	Decimal
Passenger vehicle	Compact	00001	1
	Midsize	00010	2
	Full-size	00011	3
Bus	Compact	00100	4
	Midsize	00101	5
	Full-size	00110	6
Truck	Compact	00111	7
	Midsize	01000	8
	Full-size	01001	9
Motorcycle	Compact	01010	10
	Midsize	01011	11
	Full-size	01100	12

Appendix III

Vehicle location calculation example

(This appendix does not form an integral part of this Recommendation.)

Vehicle location is classified by latitude and longitude. Latitude is calculated as -324000000 when the south latitude (S) is −90 degrees and +324000000 when north latitude (N) is +90 degrees. The longitude is calculated as −64800000 when the west longitude (W) is −180 degrees and +64800000 when the east longitude (E) is +180 degrees.

For example, if the latitude is measured as 36 degrees 23 minutes 2.1 seconds and the longitude 127 degrees 22 minutes 2.3 seconds, then:

Latitude: $36\,°\,23'2.1'' = (36 \times 60 \times 60 + 23 \times 60 + 2.1) \times 1{,}000 = 130982100$

Longitude: $127\,°\,22'2.3'' = (127 \times 60 \times 60 + 22 \times 60 + 2.3) \times 1{,}000 = 458522300$

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Printed in Switzerland
Geneva, 2020