ENGLISH TRANSLATION

700 MHz BAND
INTELLIGENT TRANSPORT SYSTEMS

Experimental Guideline for
Roadside-to-Roadside Communications

ITS FORUM RC-012 Ver. 1.0

Established on March 31, 2014

ITS Info-communications Forum

of Japan

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Revision History

Ver.	Date	Chapter/Section	Reason	Revised Content
1.0	March 31, 2014	Establishment	Newly established	

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Introduction

This document is a guideline which specifies specifications and interfaces for functions required for experimental testing of communications between a base station and another base station (roadside-to-roadside communication) that is carried out in an environment where inter-vehicle communications and roadside-to-vehicle communications are implemented in accordance with the "700 MHz BAND INTELLIGENT TRANSPORT SYSTEMS" (ARIB STD-T109) along with the "700 MHz BAND INTELLIGENT TRANSPORT SYSTEMS - Extended Functions Guideline" (ITS FORUM RC-010) and is aimed for diversification of applications utilizing 700 MHz band intelligent transport systems.

It is hoped that this Guideline will fully be verified by organizations and other parties which utilize the respective standards for thorough practical verification and validation testing.

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700 MHz Band Intelligent Transport Systems

Experimental Guideline for Roadside-to-Roadside Communications

Contents

Chapter 1 General Descriptions

1.1 Overview

The “700 MHz BAND INTELLIGENT TRANSPORT SYSTEMS Experimental Guideline for Roadside-to-Roadside Communications” (hereinafter referred to as "this Guideline" or "the Guideline") stipulates the specifications and interface standards applying to communication functions required for sending/receiving application data intended for testing of roadside-to-roadside communications, in addition to application data for roadside-to-vehicle communications, by base stations. The context is a system implementing the ARIB standard for the “700 MHz BAND INTELLIGENT TRANSPORT SYSTEMS” (ARIB STD-T109) (hereinafter referred to as "the Standard") and the “700 MHz BAND INTELLIGENT TRANSPORT SYSTEMS - Extended Functions Guideline” (ITS FORUM RC-010) (hereinafter referred to as "the Extended Functions Guideline") which specifies an Extended Layer for standard communication protocol functions.

1.2 Scope of application

A system applying the stipulations of this Guideline to a 700 MHz band intelligent transport system (hereinafter referred to as "the system") consists of a number of base stations and land mobile stations (hereinafter referred to as "mobile stations").

This system is to be operated in the 700 MHz radio frequency band where a number of base stations deployed along the roads and mobile stations installed in vehicles perform roadside-to-vehicle communications and inter-vehicle communications. In this system, the experimental implementation of roadside-to-roadside communications is assumed.

As shown in Figure 1.1, this Guideline specifies functions that are not covered by the Standard and the Extended Functions Guideline, when base stations perform roadside-to-vehicle communications and roadside-to-roadside communications. This Guideline does not contain any stipulations for mobile stations.

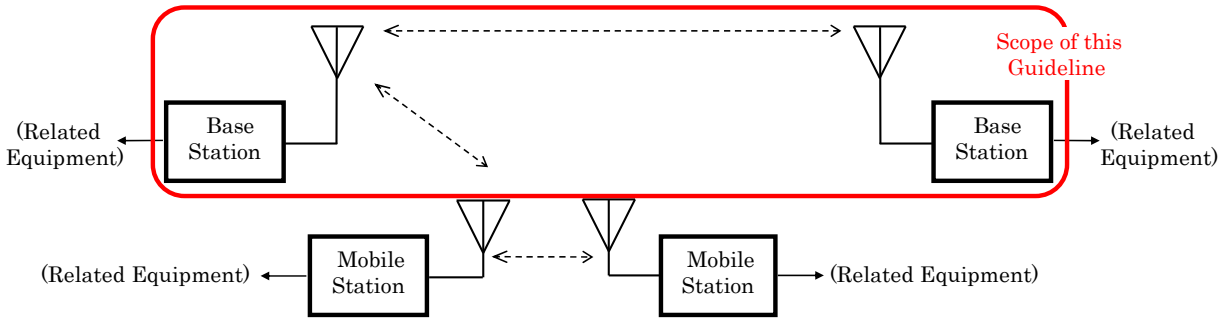

Figure 1.1　System configuration and scope of this Guideline

1.3　Normative references

Items not specifically described in this Guideline shall be dealt with in accordance with the following standards.

[1] ARIB STD-T109　700 MHz BAND INTELLIGENT TRANSPORT SYSTEMS, Ver. 1.2

[2] ITS FORUM RC-010　700MHz BAND INTELLIGENT TRANSPORT SYSTEMS - Extended Functions Guideline Ver. 1.0

Chapter 2 General System Overview

2.1 System configuration

The system consists of a number of base stations and mobile stations as specified in the Standard (Reference Document [1]) and the Extended Functions Guideline (Reference Document [2]). The requirements for a base station covered by this Guideline are as follows.

2.1.1 Base station

The base station is capable of wireless communication with mobile station and other base stations. Other requirements are as specified in 2.1.1 of the Standard (Reference Document [1]).

2.2 Radio communication method

The wireless communication method for the system is as specified in 2.4 of the Standard (Reference Document [1]). However, the following applies with regard to the access method used in this Guideline.

2.2.1 Access method

As this system accommodates both roadside-to-vehicle and inter-vehicle communications (including roadside-to-roadside communications) while it is operated with a single channel, it assigns different time periods for transmissions by base stations and mobile stations respectively.

2.3 Functions specified by this Guideline

This Guideline implements the following basic functions for base stations. The "transmission category" mentioned below is an identifier for specifying the transmission period when an application sends application data.

(1) Specified-Period-Transmitting-Function for each transmission category (SPTF):
A function for transmitting multiple application data for roadside-to-vehicle and roadside-to-roadside communications in a transmission period specified for each transmission category assigned to each application data.

(2) Transmission-Interval-Setting-Function for each transmission category (TISF):
A function for transmitting application data for roadside-to-roadside communication in a longer transmission interval (multiples of a control period) than that in which

application data for roadside-to-vehicle communication is transmitted.

2.4 Preconditions

2.4.1 Preconditions related to base station functions

The following preconditions shall be met in order to realize the functions described in 2.3.

- When a base station sends multiple application data in a control period, roadside-to-vehicle communication data shall be sent before roadside-to-roadside communication data.
- A base station application shall be able to transmit in a transmission interval that is longer than a control period (integer multiples of a control period), and the transmitting timing shall be synchronized to other base station applications.

2.4.2 Preconditions for protocol model

Figure 2.1 shows the protocol stack using the Standard Layers and the Extended Layer (hereinafter referred to as "EL") of the Extended Functions Guideline. This Guideline assumes the use of the protocol stack shown in Figure 2.1 for base stations. A platform for realizing roadside-to-vehicle communications and roadside-to-roadside communications is provided by adding or modifying functions such as EL and MAC sublayer, primitives for layers from the application to the MAC sublayer, and Inter-Vehicle Communication and Roadside-to-Vehicle Communication Control Layer management (hereinafter referred to as "IVC-RVC Layer management"). This Guideline does not cover mobile stations.

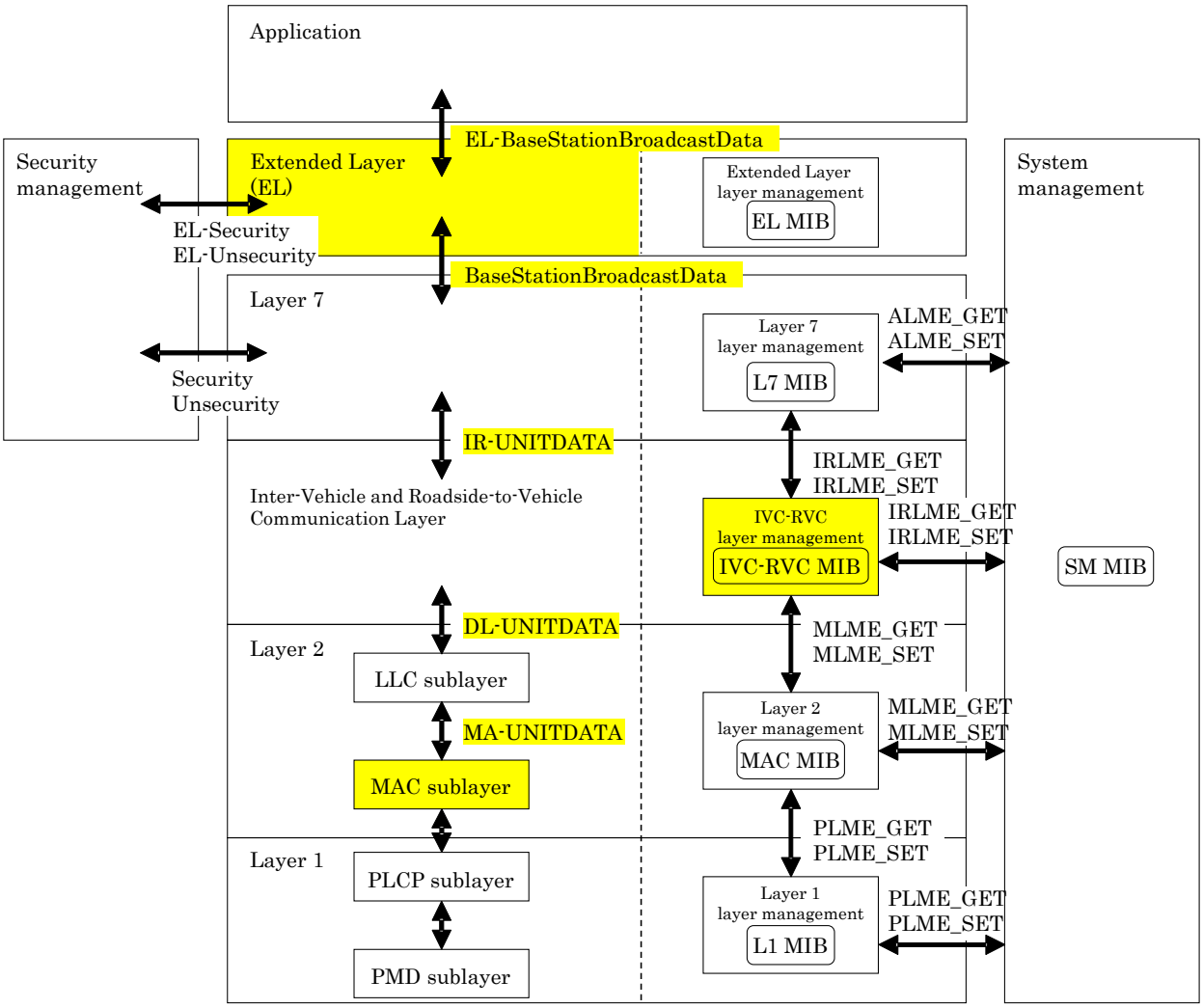

Figure 2.1　Protocol stack (base station)

2.4.3　Preconditions related to security method

This Guideline does not specify a security method.

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Chapter 3 Communication Control Method

3.1 Overview

This chapter specifies items related to processing in each layer, additional interlayer primitives, and layer management required for a base station to realize the functions described in 2.3 which cannot be covered by complying with the specifications of the Standard and the Extended Functions Guideline alone.

3.2 Description principles

This chapter describes the necessary content by indicating the difference to the content of the Standard and the Extended Functions Guideline. Regarding items that have no difference to the content of the Standard and the Extended Functions Guideline, it is noted that the items conform to these documents.

3.2.1 Basic representation

With regard to chapters and sections where differences to the Standard and Extended Functions Guideline exist, the type of the difference is first indicated, and the differences are then listed by type.

The following four types of differences are indicated: "Change", "Deletion", "Addition/Insertion" and "Replacement".

A "Change" is an alteration of relatively minor scope, such as a change in an expression or term in the main text or a figure, table or similar of the existing reference document. In such a case, the existing content is reproduced with strikeout added, followed by the changed content with underlining added. A "Deletion" is a partial cut in the main text or a figure, table or similar of the existing reference document. An "Addition/Insertion" is text or a figure, table or similar that is newly added to or inserted into the existing reference document, without affecting the existing main text or figures, tables and similar. If material is newly added or inserted as a whole chapter or section of the reference document, the added chapter number or section number is also given. Numbers for figures or tables are generated by adding a letter suffix to the number of the immediately preceding figure or table. A "Replacement" is an alteration of major scope, such as the deletion of an entire chapter or section, or an entire figure or table of the existing reference document and the insertion of other content in its place. In such a case, only the new content reflecting the replacement is reproduced.

3.2.2 Description exceptions

Regarding a change made to multiple chapters or sections of the reference documents, the indication of Table 3.1 applies.

Table 3.1 Changes in Multiple Chapters or Sections of Reference Documents

Reference document	Before	After	Type
Standard (Reference Document [1])	Roadside-to-Vehicle communication period	~~Roadside-to-Vehicle communication period~~ Base station transmission period	Change
Extended Functions Guideline (Reference Document [2])			

3.3 Content difference to Standard and Extended Functions Guideline

The differences to the respective reference documents are listed separately by layer.

3.3.1 Layer 1 (Physical Layer) standards

Layer 1 is as specified in Reference Document [1].

3.3.2 Layer 2 (Data Link Layer) standards

Layer 2 is as specified in Reference Document [1], except for the differences given below.

3.3.2.1 Addition/Insertion: Reference Document [1] 4.3.4.1.2 Definition of the services

Add the following text to the end of the 2nd paragraph:

— N second cycle timer management (base station) for transmission interval setting by transmission category

3.3.2.2 Change: Reference Document [1] 4.3.4.2.2 (1) b) Semantics of service primitive

Change the 2nd paragraph as shown:

This primitive shall provide parameters as follows: MA-UNITDATA.request (SequenceNumber, LinkAddress, data, ControlInformation, TransmissionCategoryInformation)

3.3.2.3 Addition/Insertion: Reference Document [1] 4.3.4.2.2 (1) b) Semantics of service primitive

Add the following text to the end of the 3rd paragraph:

"TransmissionCategoryInformation" shall be set the radio transmission parameters described in 4.5.2.1.4 (10).

3.3.2.4 Addition/Insertion: Reference Document [1] 4.3.4.3.6 N second cycle timer management for transmission interval setting by transmission category

Add the following text to the end of 4.3.4.3.5:

4.3.4.3.6 Management of N second cycle timer for transmission interval setting by transmission category

The base station performs timer management for the transmission interval setting by transmission category. The timer specifications are as follows. Cycle is N seconds, units are microseconds, value range is from "0" to "(Value of N x 1000000 - 1)". The value of "N" shall be an integer multiple of the control period (100 ms), and shall be within the range from 1.0 to 10.0. However, the value of "N" is not specified in this Guideline. Time correction shall be performed at the same point as time correction for the one second cycle timer based on instructions from the IVC-RVC Layer. When the time correction value TC which is a MIB attribute was updated, the timer shall be corrected using TC as reference. Because the time correction value TC is given as differential information, a negative value requires the timer to be delayed and a positive value requires the timer to be advanced. If N is larger than 1.0 (N > 1.0), the start (reset) time for the N second cycle timer shall be synchronized among multiple base stations, but this is not specified in this Guideline.

3.3.2.5 Change: Reference Document [1] 4.3.4.5.1 (1) a) Maintenance and discard of MSDU

Change the 1st paragraph as shown:

The MAC sublayer of a base station shall maintain MSDU <u>for each transmission category, referencing "TransmissionCategoryInformation" of the MSDU</u>, which is received from LLC until the <u>start of the</u> ~~Roadside-to-Vehicle communication~~ <u>base station transmission</u> period. The base station shall check <u>for each transmission category</u> whether the number of maintained MSDU reaches the total number of "SequenceNumber". If all the "SequenceNumber" are

assembled, the base station shall check the IVC-RVC Layer MIB registered "RTC" and determine whether the next control period is appropriate for a transmission opportunity of the multiple MSDU for the current transmission category. If yes, the base station shall make a request of transmission to Layer 1 when the ~~Roadside-to-Vehicle communication period~~base station transmission period in ~~each~~ the respective control period (100 ms) starts. Before this operation, the base station shall request PLME-TXTIME to Layer 1 and get the transmission time. If the total transmission time including the short interframe space between packets in the respective control period exceeds 10.5 ms, the base station shall discard some MSDU so that the total transmission time is 10.5 ms or shorter. The base station shall also check whether all the packets can be transmitted within the ~~Roadside-to-Vehicle communication~~ base station transmission period for the respective transmission category, and if the total transmission time including the short interframe space between packets exceeds the ~~Roadside-to-Vehicle communication~~ base station transmission period, and the base station shall discard some MSDU so that the total transmission time is equal to the Roadside-to-Vehicle communication period or shorter. When plural ~~Roadside-to-Vehicle communication~~ base station transmission periods are set for the respective transmission category, the base station shall check whether packets can be transmitted in each ~~Roadside-to-Vehicle transmission time~~base station transmission period for the respective transmission category, and discard some packets so that all packets can be transmitted in all Roadside-to-Vehicle transmission periods if necessary. (Description 1 indicates an example of the calculation of time for transmitting plural packets consecutively.) If the number of maintained MSDU does not reach the total number of "SequenceNumber", the base station shall not make a request of transmission to Layer 1 and maintain the MSDU until the next control period. If the transmission category value indicated by " TransmissionCategoryInformation" is "0" (roadside-to-vehicle communication), and if the MAC sublayer receives two or more full sets of MSDU, each of which completes all the packets indicated by "SequenceNumber", the base station shall maintain only the newest MSDU set and discard the others. This Guideline does not contain any stipulations for other transmission category values (including roadside-to-roadside communications).

3.3.2.6 Change: Reference Document [1] 4.3.4.5.1 (3) Procedures for setting of transmission inhibition period

Change the 1st paragraph as shown:

The base station shall set the transmission inhibition period referring to "RTC" in the MIB of

the IVC-RVC Layer. The transmission inhibition period shall be set to "all the time" except for each transmission period duration from transmission timing. Concretely, as shown in Figure 4-12, in each control period (100 ms), the transmission inhibition period shall be set except for the time when the value of less than 100 ms of the one second cycle timer is within the transmission period duration indicated by "RTC.TRP" from the transmission start timing indicated by "RTC.TST". If the total transmission inhibition period in each control period is shorter than 89.5 ms, the base station shall add the transmission inhibition period to the time so that the transmission period duration is 10.5 ms or longer. The "RTC.TCL", "RTC.TRI", "RTC.TRO" and the N second cycle timer for transmission interval setting by transmission category are used to determine the control period to enable transmission of MSDU sets. For all other control periods except for those that enable transmission of MSDU sets for each transmission category, the transmission inhibition period shall be added. This procedure shall be performed every time the "RTC" parameter is updated.

3.3.2.7 Change: Reference Document [1] 4.3.5.2.2 (1) b) Semantics of the service primitive

Change the 2nd paragraph as shown:

This primitive shall provide parameters as follows:

DL-UNITDATA.request (LinkAddress, data, SequenceNumber, ControlInformation, TransmissionCategoryInformation)

3.3.2.8 Change: Reference Document [1] 4.3.5.2.2 (1) b) Semantics of the service primitive

Change the 3rd paragraph as shown:

The SequenceNumber parameter specifies the parameter as described in 4.5.2.1.4(1). The ControlInformation parameter specifies the parameter as described in 4.5.2.1.4(2). The TransmissionCategoryInformation parameter specifies the parameter as described in 4.5.2.1.4(10).

3.3.3 Inter-vehicle Communication and Roadside-to-vehicle Communication Control layer (IVC-RVC Layer) standards

Layer 3 is as specified in Reference Document [1], except for the differences given below.

3.3.3.1 Change: Reference Document [1] 4.4.2.1.2(1)b) Semantics of the primitive

Change the 2nd paragraph as shown:

IR-UNITDATA.request (LinkAddress, data, SequenceNumber, ControlInformation, TransmissionCategoryInformation)

3.3.3.2 Change: Reference Document [1] 4.4.2.1.2 (1) b) Semantics of the primitive

Change the 3rd paragraph as shown:

The SequenceNumber parameter specifies the parameter as described in 4.5.2.1.4(1). The ControlInformation parameter specifies the parameter as described in 4.5.2.1.4(2). The TransmissionCategoryInformation parameter specifies the parameter as described in 4.5.2.1.4(10).

3.3.3.3 Change: Reference Document [1] 4.4.3.2.1 (2) Transmission Control variable (RTC)

Change the 1st paragraph as shown:

The transmission control variable (RTC) is an array of structures and is used for the transmission control. The number of elements is m, where m is implementation dependent and is not specified in this standard. Each element consists of the transmission start timing variable "RTC.TST", the transmission period duration variable "RTC.TRP", the transmission category label variable "RTC.TCL", the transmission interval variable "RCT.TRI" and the transmission offset variable "RTC.TRO". The RTC.TST represents the timing when the transmission begins and is an integer value that is represented in a manner that treats 16 μs (the control time unit) as 1. The range of the value shall be from 0 to 6249. The RTC.TRP represents the duration of the transmission period and is an integer value that is represented in the same manner as the RTC.TST. The range of the value shall be from 0 to 6250 and the value = 0 indicates that there is no transmission period. RTC.TCL is an integer value that provides transmission category information for the transmission packets belonging to the transmission period specified by RTC.TST and RTC.TRP. The range of the value shall be from 0 to 2. RTC.TRI is an integer value that indicates the frequency in which the control period for the transmission period specified by RTC.TST and RTC.TRP appears. 100 ms (control period) is treated as 1. The range of the value shall be from 1 to 10. RTC.TRO is an integer value that

indicates the transmission time until the first transmission opportunity of the control period for the transmission period specified by RTC.TST and RTC.TRP appears, taking the control period immediately after reset of the N second cycle timer for transmission interval setting in each transmission category as a start point. 100 ms (control period) is treated as 1. The range of the value shall be from 0 to 9.

3.3.3.4 Change: Reference Document [1] 4.4.3.3.1 (1) b) Requesting a transfer of IPDU to LLC sublayer

Change the 1st paragraph as shown:

After generating an IPDU, the IVC-RVC Layer entity calls the DL-UNITDATA.request primitive in the LLC sublayer to request a transfer of the IPDU. At this time, the IVC-RVC Layer shall transfer the "LinkAddress", "SequenceNumber", ~~and~~ "ControlInformation", and "TransmissionCategoryInformation" parameters received from Layer 7 to the LLC sublayer with the IPDU.

3.3.4 Layer 7 (Application layer) standards

Layer 7 is as specified in Reference Document [1], except for the differences given below.

3.3.4.1 Change: Reference Document [1] 4.5.2.1.3 (2) b) Format

Change the 2nd paragraph as shown:

BaseStationBroadcastData.request (SequenceNumber, ControlInformation, SecurityClassification, SecurityInformation, ApplicationAssociatedInformation, ApplicationDataLength, ApplicationData, LinkAddress, TransmissionCategoryInformation)

3.3.4.2 Change: Reference Document [1] 4.5.2.1.4 (1) SequenceNumber

Change the 1st paragraph as shown:

SequenceNumber shows the total number and the sequence of the packets generated by the application each time for each transmission category.

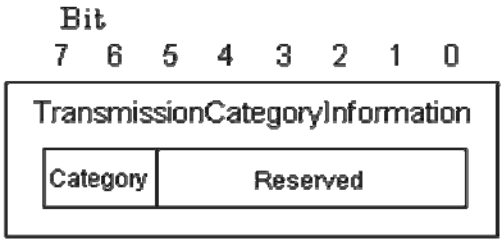
3.3.4.3 Addition/Insertion: Reference Document [1] 4.5.2.1.4 (10) TransmissionCategoryInformation

Add the following subsection to the end of 4.5.2.1.4 (9):

(10) TransmissionCategoryInformation

TransmissionCategoryInformation shows the transmission category of the application data passed from the base station application to Layer 7.

The format of TransmissionCategoryInformation is shown in Figure 4-32A.



Classification	Value	Meaning
Category	0 1 2 3	Category 0 (Roadside–to–vehicle communication) Category 1 Category 2 Reserved
Reserved		

Figure 4-32A Format of TransmissionCategoryInformation

3.3.4.4 Addition/Insertion: Reference Document [1] 4.5.3.2.1 (1) a) Generation of APDU

Add the following text to the end of the 1st paragraph:

9) TransmissionCategoryInformation

3.3.4.5 Change: Reference Document [1] 4.5.3.2.1 (1) b) Generation of transmitting request to the IVC-RVC Layer

Change the 1st paragraph as shown:

After generating the APDU, Layer 7 shall generate the transmitting request to the IVC-RVC by invoking the IR-UNITDATA.request primitive. Layer 7 shall pass the APDU as the “data”

parameter of the IR-UNITDATA.request primitive, together with 1) “SequenceNumber”, 2) “ControlInformation”, ~~and~~ 8) “LinkAddress”, and 9)TransmissionCategoryInformation parameters to the IVC-RVC Layer through the IR-UNITDATA.request primitive.

3.3.5 Extended Layer

The Extended Layer is as specified in Reference Document [2], except for the differences given below.

3.3.5.1 Change: Reference Document [2] 3.2.2.1.3 (2) b) Format

Change the 2nd paragraph as shown:

EL-BaseStationBroadcastData.request (ControlInformation, EL_SecurityClassification, SecurityInformation, ApplicationAssociatedInformation, EL_ApplicationDataLength, ApplicationData, LinkAddress, DataAssociatedInformation, TransmissionCategoryInformation)

3.3.5.2 Change: Reference Document [2] 3.2.2.1.4 (9) DataAssociatedInformation

The text on the 2nd line of the 1st paragraph is to be changed.

DataAssociatedInformation shows application data associated information. The information is passed between the application and the EL. At that time, DataSequence and DataTotalNumber shall be assigned separately for each communication type indicated by ApplicationAssociatedInformation.

The format of DataAssociatedInformation is shown in Figure 3.5.

3.3.5.3 Addition/Insertion: Reference Document [2] 3.2.2.1.4 (10) TransmissionCategoryInformation

Add the following text to the end of 3.2.2.1.4 (9):

(10) TransmissionCategoryInformation

See respective items in Standard 4.5.2.1.4 Parameters.

3.3.5.4 Addition/Insertion: Reference Document [2] 3.2.3.4.1 (1) a) Generation of EL-PDU

Add the following text to the end of the 1st paragraph:

9) TransmissionCategoryInformation

3.3.5.5 Change: Reference Document [2] 3.2.3.4.1 (1) a) Generation of EL-PDU

Change the 8th paragraph as shown:

These procedures shall be repeated for each ApplicationData with the same transmission category information. Taking the overhead for the communication protocol specified by the Standard into consideration, if there is an excess of time in the Roadside-to-Vehicle communication period allocated by the ApplicationData transmission category, a data fragmentation according to DDS and SES as defined in 3.2.3.3 shall be performed.

3.3.5.6 Change: Reference Document [2] 3.2.3.4.1 (1) a) Generation of EL-PDU

Change the 9th paragraph as shown:

Figure 3.15 shows a procedure example for evaluating whether the data fragmentation in the EL has been performed. This example shows the implementation procedure for data fragmentation in the base station transmission period for a single transmission category. For case 1 and case 2 in this instance, any new excess time that occurred after the data fragmentation shall be dealt with by repeating this evaluation procedure for the next data. If data from multiple transmission categories exist, the procedure shall be carried out for each transmission category information.

3.3.5.7 Change: Reference Document [2] 3.2.3.4.1 (1) b) Transmission request to Layer 7

Change the 1st paragraph as shown:

After generating EL-PDU for all transmission data received from the application every 100 ms, a transmission request shall be performed by calling the BaseStationBroadcastData request primitive of Layer 7. If there are multiple EL-PDUs, a transmission request shall be performed for each EL-PDU. In this case, the EL takes the EL-PDU as ApplicationData and sends it to the BaseStationBroadcastData request primitive, along with 1) ControlInformation, 3) SecurityInformation, 4) ApplicationAssociatedInformation, 7) LinkAddress, and 9) TransmissionCategoryInformation received from the application. The EL also sends the

following parameters for the BaseStationBroadcastData request primitive.

3.3.5.8 Change: Reference Document [2] 3.2.3.4.1 (1) b) Transmission request to Layer 7

Change the 2nd paragraph as shown:

Regarding SequenceNumber of the BaseStationBroadcastData request primitive, the sequence number/total number shall be appended every 100 ms <u>for every transmission category shown by TransmissionCategoryInformation</u> for all data received from the application. A value calculated by adding the EL base station header size to the EL_ApplicationDataLength shall be taken as the ApplicationDataLength of the BaseStationBroadcastData request primitive. If the EL_SecurityClassification value is 00 or 10, the SecurityClassification value of the BaseStationBroadcastData request primitive shall be set to 0. If the EL_SecurityClassification value is 01, the SecurityClassification value of the BaseStationBroadcastData request primitive shall be set to 1.

3.3.6 Communication protocol parameters

The communication protocol parameters are as specified in Reference Document [1] and Reference Document [2], except for the differences given below.

3.3.6.1 Addition/Insertion: Reference Document [1] (Annex 1) 3.1 Management information base (MIB)

RTC[m].TCL, RTC[m].TRI and RTC[m].TRO are to be added to Table S1-3 RTC [m].

Table S1-3 Base station variables

Parameter		Meaning	Type	Length	Value	NOTE
RTC[m]		Transmission Control				The size m is implementation-dependent
	TCL	Transmission Category Label	INTEGER	1 oct	0..2	
	TRI	Transmission Interval	INTEGER	1 oct	1..10	
	TRO	Transmission Offset	INTEGER	1 oct	0..9	

3.3.7 Application data structure definitions

The application data structure definitions are as specified in Reference Document [1] and Reference Document [2], except for the differences given below.

3.3.7.1 Addition/Insertion: Reference Document [1] (Annex 2) 2 Application Data of a Base Station

The application data structure definitions given below are to be added to the end of the section.

```
TransmissionCategoryInformation::= INTEGER {
        Category 0 (Roadside-to-vehicle communication)    (0)
        Category 1                (1)
        Category 2                (2)

        -- Values 3 to 15 for TransmissionCategoryInformation are reserved.
}(0…2)
```

3.3.7.2 Addition/Insertion: Reference Document [2] (Annex 2) 2 Application Data of a Base Station

The application data structure definitions given below are to be added to the end of the section.

```
TransmissionCategoryInformation::= INTEGER {
        Category 0 (Roadside-to-vehicle communication)    (0)
        Category 1                (1)
        Category 2                (2)

        -- Values 3 to 15 for TransmissionCategoryInformation are reserved.
}(0…2)
```

3.4 Abbreviations

SPTF: Specified-Period-Transmitting-Function for each transmission category

TISF: Transmission-Interval-Setting-Function for each transmission category

TCL: Transmission Category Label

TRI: Transmission Interval

TRO: Transmission Offset

Annex 1　CommunicationTypeInformation

In a situation where multiple services are provided via a single wireless system, and the service standards are defined by multiple service standard developing organizations, messages conforming to different service standards will be exchanged via the wireless communication (see Figure A1.1). In the case of applications intended to provide driving safety assistance or similar, messages will be broadcast to stations in the vicinity without limiting these to a specific receiver. The application (or the facility layer) therefore requires an identification function that can determine whether a received message is required for the respective station or not. This identification function should be defined by a common specification independent of the CommunicationTypeInformation (inter-vehicle communications, roadside-to-vehicle communications, or roadside-to-roadside communications), and it should be implemented with a minimum of required information. An experimental definition of information for such a message identification function according to a common specification is given in this section.

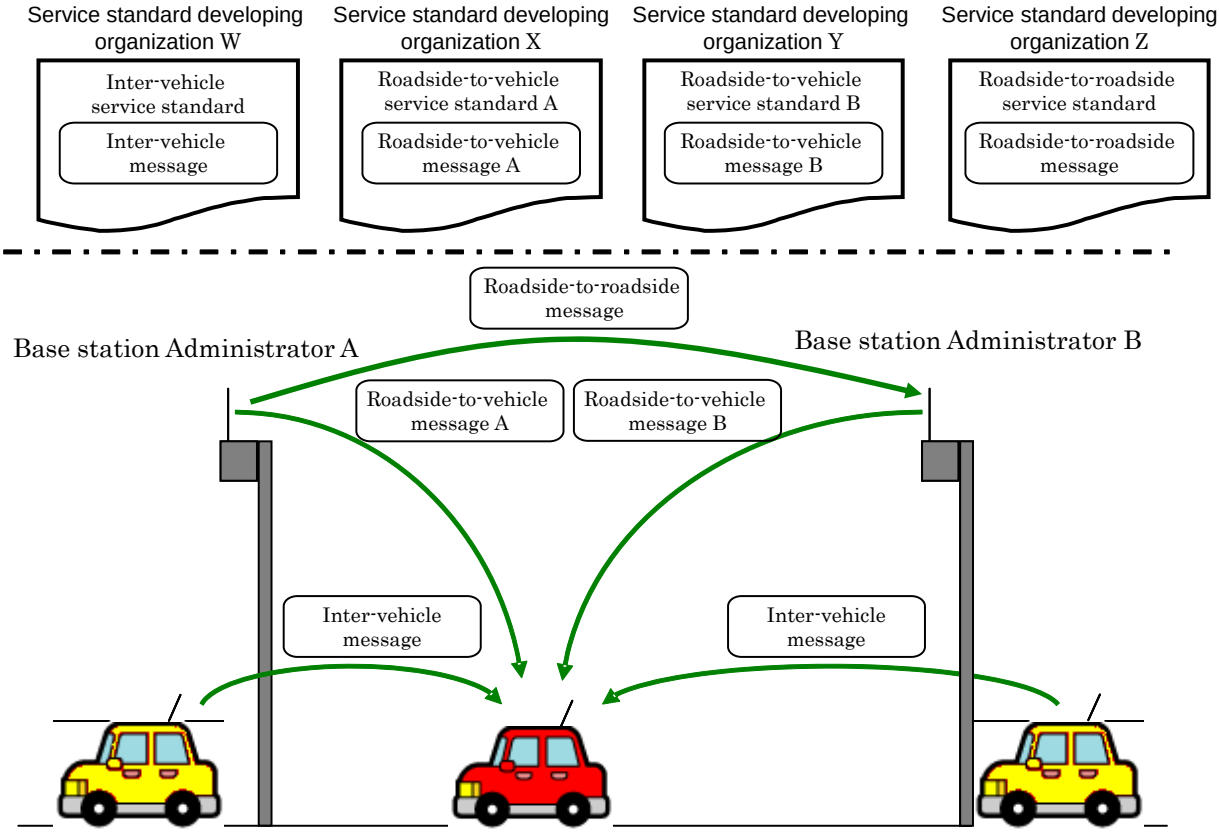


Figure A1.1　Conceptual diagram of single wireless communication system supporting various types of messages

This annex defines CommunicationTypeInformation to be used as message identification information.

1 Definition of CommunicationTypeInformation

CommunicationTypeInformation is defined as information that allows identification of the communication format, such as inter-vehicle communication, roadside-to-vehicle communication, and roadside-to-roadside communication. By performing identification using CommunicationTypeInformation at a point prior to the application (communication layer), more effective processing should be possible. The information therefore is assumed not to be contained within the message but in a communication header. The definition of CommunicationTypeInformation is given in Table A 1.1. The CommunicationTypeInformation data size is 3 bit. 0 is reserved, 7 is reserved for the system, and 1 to 6 are allocated to possible communication format combinations of mobile stations and base stations. The description of communication format allocations uses the expression "xx station to yy station", but this does not indicate that the receiving station is exclusively restricted to the latter type. Rather it indicates the intended receiving station as seen from the transmitting station.

Table A 1.1 Definition of CommunicationTypeInformation

Classification	Value	Meaning
Communication TypeInformation	0	Reserved
	1	Communication from mobile station to mobile station and/or base station
	2	Communication from base station to mobile station and/or base station
	3	Communication from mobile station to mobile station
	4	Communication from base station to mobile station
	5	Communication from mobile station to base station
	6	Communication from base station to base station
	7	Reserved for system

2 Application of CommunicationTypeInformation

This section describes how to apply the CommunicationTypeInformation to the Standard

(Reference Document [1]).

According to the Standard, ApplicationAssociatedInformation exists in the Layer 7 header, with a data size of 8 bit, but no further specification is made (it is considered outside the range of the Standard). The first 3 bits of the ApplicationAssociatedInformation are allocated to the above mentioned CommunicationTypeInformation. The structure of the ApplicationAssociatedInformation and the allocated CommunicationTypeInformation are shown in Figure A1.2.

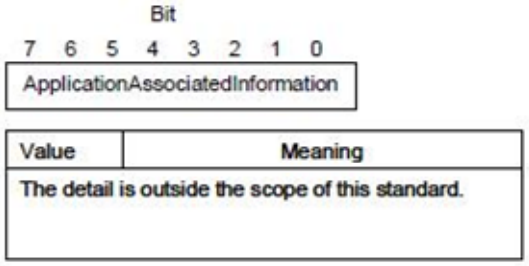
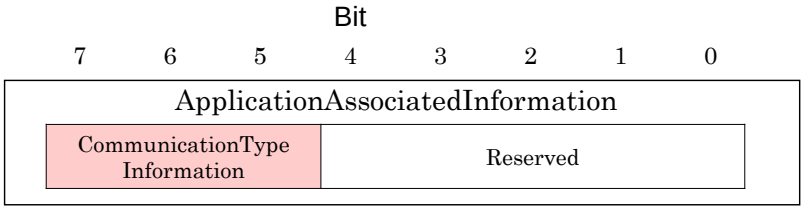


Figure 4-29 The format of ApplicationAssociatedInformation

For experimental purposes, the upper 3 bit of ApplicationAssociatedInformation are allocated as follows.



Classification	Value	Meaning
CommunicationType Information	0	Reserved
	1	Communication from mobile station to mobile station and/or base station
	2	Communication from base station to mobile station and/or base station
	3	Communication from mobile station to mobile station
	4	Communication from base station to mobile station
	5	Communication from mobile station to base station
	6	Communication from base station to base station
	7	Reserved for system

Figure A1.2 Structure of ApplicationAssociatedInformation and CommunicationTypeInformation

In the Standard, the ApplicationAssociatedInformation is passed between the application and Layer 7 as one of the parameters of each primitive. An example for the flow of ApplicationAssociatedInformation is shown in Figure A1.3. ApplicationAssociatedInformation

is first generated by the application on the sending side and passed to Layer 7 via the EL (Extended Layer). In Layer 7, the information is stored in the Layer 7 header and sent out by wireless transmission via the lower layers. On the receiving side, the header is passed from the lower layers to Layer 7, and ApplicationAssociatedInformation can be extracted from it. Finally, it is passed on via the EL along with the application message (ApplicationData). By storing CommunicationTypeInformation in the ApplicationAssociatedInformation, the receiving side can use the CommunicationTypeInformation from Layer 7 to identify the message and discard messages from a communication type that is not needed.

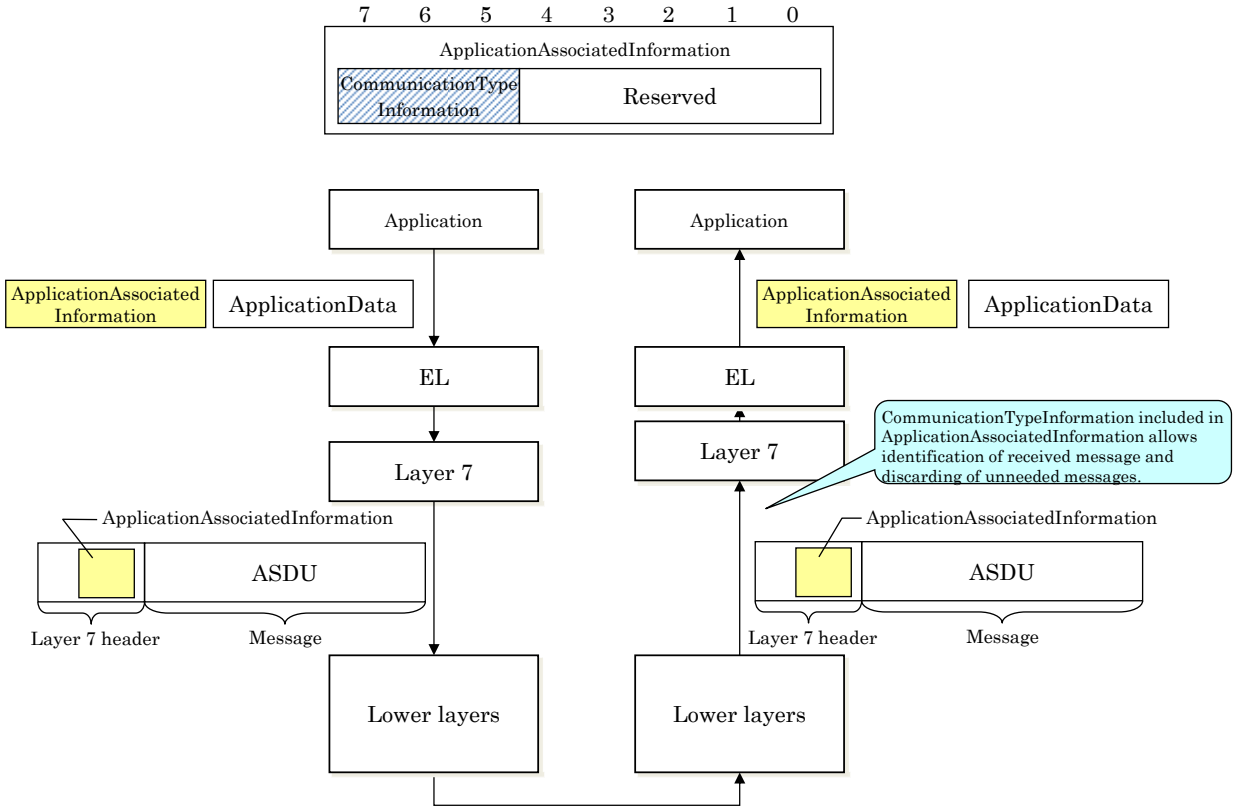


Figure A1.3 Example of the processing flow about ApplicationAssociatedInformation with CommunicationTypeInformation

Reference 1 Communication Control Example for Sharing of Roadside-to-Vehicle Communications and Roadside-to-Roadside Communications

This reference section describes an example of how a base station can perform communication control for roadside-to-vehicle communications and roadside-to-roadside communications in accordance with this Guideline.

1 Concept of roadside-to-vehicle communications and roadside-to-roadside communications by base station

Within the scenario envisioned by the Standard (Reference Document [1]) and Extended Functions Guideline (Reference Document [2]), a compliant base station performs roadside-to-vehicle communications aimed at accident prevention, such as providing traffic signal and traffic restriction information, information for intersections with bad visibility, and other driver assistance information to vehicles in the vicinity of an intersection.

In addition to roadside-to-vehicle communications performed by a base station, applications are under consideration that would use roadside-to-roadside communications with the aim of assisting pleasant or environment-friendly driving. For example, such roadside-to-roadside communications could serve for exchanging traffic signal control information between intersections in the vicinity and/or the traffic management center, thereby allowing more sophisticated traffic signal control. The concept of roadside-to-vehicle communications and roadside-to-roadside communications by a base station is shown in Figure R1.1.

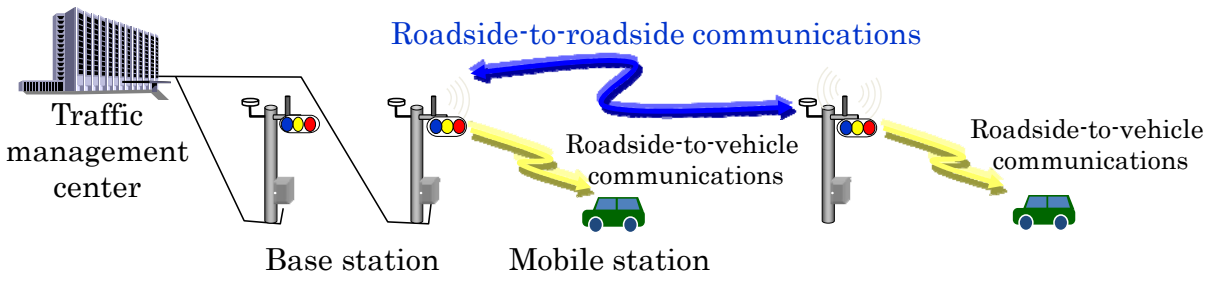


Figure R1.1 Example for roadside-to-vehicle communications and roadside-to-roadside communications

In an application such as shown above, the information transmitted via roadside-to-roadside communications is characterized by the fact that it will be transmitted less frequently than roadside-to-vehicle information by a factor of up to several tens, and the amount of information

per transmission will be small. Taking this into consideration, two communication control methods for making effective use of bandwidth are envisioned, as shown in Figure R1.2.

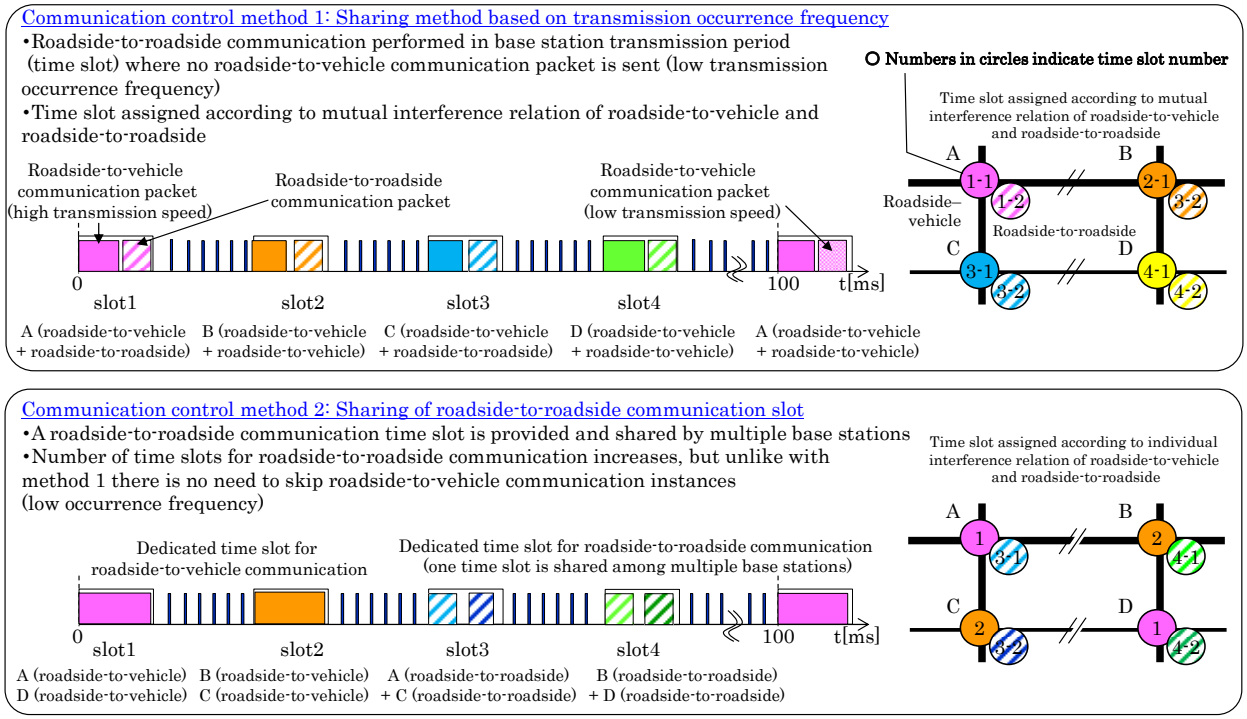


Figure R1.2　Examples for communication control by roadside-to-vehicle communication application and roadside-to-roadside communication application

Communication control method 1 makes use of the fact that in roadside-to-vehicle communications there is information that fluctuates rapidly with time, and there is also information that will not fluctuate greatly. Information for applications designed to support driving safety will be based on rapidly changing vehicle detection data and therefore will change frequently. By contrast, information about traffic restrictions or similar will change relatively infrequently. The latter can therefore be set to a lower transmission occurrence than the former. With this method, Base Station Transmission Period (time slot) in a control period where the latter type of roadside-to-vehicle communication information is not sent is used to send roadside-to-roadside communication information.

Communication method 2 on the other hand makes use of the fact that the data size of roadside-to-roadside communication information is smaller than that of roadside-to-vehicle communication information, and its transmission occurrence frequency is lower. For this reason,

separate time slots for roadside-to-vehicle communication and roadside-to-roadside communication are allocated for base station transmission, and the time slot for roadside-to-roadside communication is shared by multiple base stations. An example for using communication control method 2 where multiple base stations share a roadside-to-roadside communication time slot is shown in Figure R1.3. In the illustration, time slot 16 for roadside-to-roadside communication is made available for sharing by base stations A to D. Within the same control period, time slot 16 is subdivided and used by base stations A and B (or C and D). This is mutually exclusive, meaning that in a control period where base stations A and B share the time slot, it is not available to base stations C and D, and vice versa.

This Guideline assumes that one of the two communication control methods described above is used by the base stations.

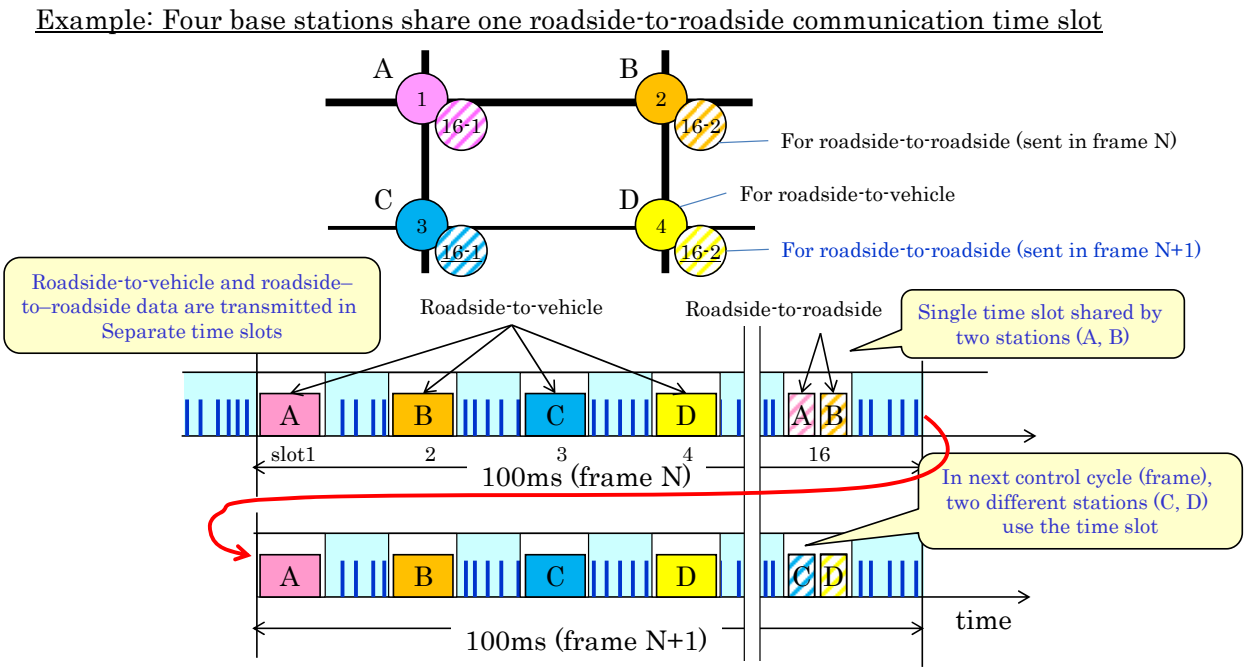


Figure R1.3 Communication control method 2: multiple base stations share a roadside-to-roadside communication time slot

2 Functions required in a base station

This section describes the functions required of Layer 1 to EL in the base station in order to implement the communication control methods of the preceding section.

Table R 1.1 lists the functions required of the base station in order to realize the communication control methods of the preceding section. With regard to communication control method 1, functions No. 1 to No. 3 are not required, because the base station transmits roadside-to-roadside communication information in the control period where no roadside-to-vehicle communication information is transmitted (low transmission occurrence frequency). Only function No. 4 for DataAssociatedInformation-Appending-Function for each CommunicationTypeInformation (DAF) is required. For the communication control method 2 on the other hand, all functions (No. 1 to No. 4) are required. Table R

Table R 1.1 Functions required in a base station

No.	Function	Conditions.
1	Specified-Period-Transmitting-Function for each transmission category (SPTF)	Ability to transmit in a specified base station transmission period for each transmission category as assigned to each data packet for roadside-to-vehicle communication and roadside-to-roadside communication applications
2	Transmission-Interval-Setting-Function for each transmission category (TISF)	Ability to transmit roadside-to-roadside communication application data etc. with timing shifted from other base stations in control period units, using a transmission interval longer than the control period
3	Transmission-Period-Setting-Function in control period (TPSF)	Ability to share a specified transmission period within a control period with other base stations
4	DataAssociatedInformation-Appending-Function for each CommunicationTypeInformation (DAF)	Ability to prevent erroneous mismatch between SDU total number and total number field information in data associated information, when communication was normal, but multiple communication types were sent from the base station, and Layer 7 on the receiving side (base station, mobile station) has processed only information of a specific CommunicationTypeInformation (as explained in Annex 1).

The key points in this Guideline for implementing the functions listed in Table R 1.1 are

shown in Table R 1.2. An explanation of each function is given in the next section.

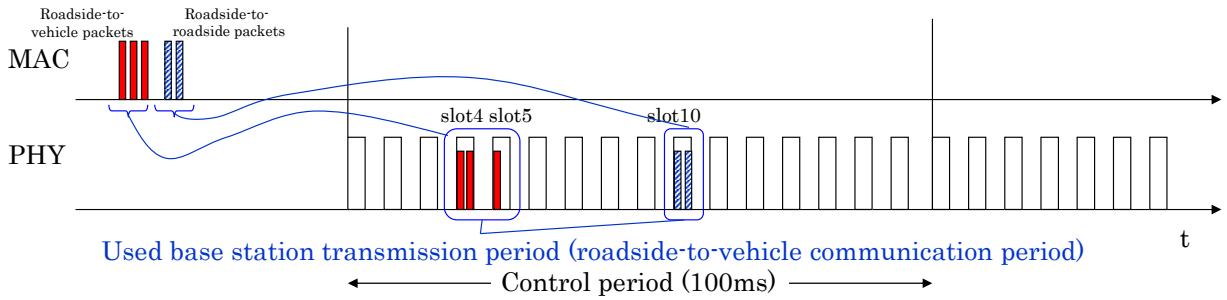
Table R 1.2 Key points in this Guideline regarding functions required of base stations

No.	Function	Corresponding key point in this Guideline
1	Specified-Period-Transmitting-Function for each transmission category (SPTF)	Transmission in the specified period for each transmission category can be implemented as follows. A primitive (TransmissionCategoryInformation) which becomes the identifier for specifying the base station transmission period in application data is defined, along with a MIB variable (RTC[m].TCL) that sets the transmission category for the base station transmission.
		By assigning a SequenceNumber of the Standard to each transmission category, MSDU corresponding to each category can be sent.
2	Transmission-Interval-Setting-Function for each transmission category (TISF)	When an application sends multiple application data with a transmission interval that is longer than the control period, it shall be possible to synchronize the transmission timing with applications on other base stations. (The methods to achieve this are not specified in this Guideline.)
		If MSDU are not lined up in the MAC sublayer, sending in a control period that is allocated as a transmission opportunity to other base stations shall be inhibited. This is achieved by using an N second cycle timer in conjunction with MIB variables (RTC[m].TRI, RTC[m].TRO) for specifying the transmission interval and transmission offset for each transmission category.
3	Transmission-Period-Setting-Function in control period (TPSF)	No particular points. Can be implemented by IVC-RVC Layer MIB variables (RTC[m].TST and RTC[m].TRP) defined in the Standard.
4	DataAssociatedInformation-Appending-Function for each CommunicationTypeInformation (DAF)	Can be implemented for each CommunicationTypeInformation (see Annex 1) by data associated information DataSequence and DataTotalNumber.

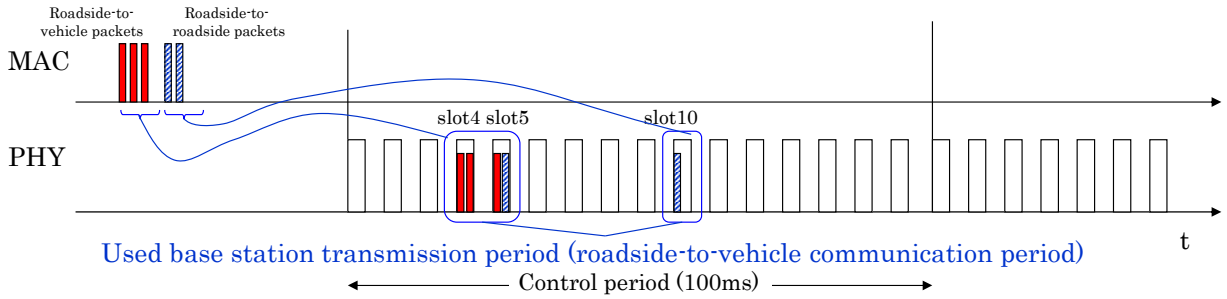
2.1 Specified-Period-Transmitting-Function for each transmission category (SPTF)

This section explains the Specified-Period-Transmitting-Function for each transmission category (SPTF).

If base stations conforming to the Standard and the Extended Functions Guideline are transmitting application data for roadside-to-vehicle communications and roadside-to-roadside communications, it is difficult to include an application data type specific transmission period specification for the base station in the transmission. This is because the application does not have a means (such as a primitive or the like) for specifying the transmission period for an application data packet to be sent in the base station transmission period of the next control period. For example, assume that the situation shown in Figure R1.4 exists. Three base station transmission periods (slot 4, slot 5, slot 10) are assigned to the base station, and a base station application is to send a total of five application data packets (three roadside-to-vehicle communication data packets and two roadside-to-roadside communication data packets) at the next transmission opportunity. In this case, even if the base station tries to send the roadside-to-vehicle communication data packets in the base station transmission periods slot 4 and slot 5, and the roadside-to-roadside communication data packet in the base station transmission period slot 10, as shown in Figure R1.4 a), packets will be sent sequentially from the start of the base station transmission periods allocated to the MAC sublayer. Therefore, as shown in Figure R1.4 b), if after sending the roadside-to-vehicle communication application data packets, there is a time slot for sending subsequent packets, the roadside-to-roadside communication application data packets will be sent.



a) Desired transmission pattern (example)



b) Actual transmission pattern according to Standard and Extended Functions Guideline

Figure R1.4　Transmission from base station

As shown in Figure R1.4 a), in order for the base station to perform transmission in the desired base station transmission period for each transmission category, a parameter called TransmissionCategoryInformation for primitives between the MAC sublayer and other layers, and a management information base (MIB) variable called RTC.TCL (transmission category label) for the Inter-Vehicle Communication and Roadside-to-vehicle Communication Control Layer (IVC-RVC Layer) are provided. The former is a primitive that serves as an identifier for specifying the base station transmission period for the application data packets to be sent by the application, and the latter is a MIB variable that indicates which transmission category data the base station transmission period allocated to the base station is for.

An example of setting values for the above primitive and MIB variable in order to achieve the transmission of Figure R1.4 a) is given in Table R 1.3. The application uses TransmissionCategoryInformation to assign "0" to the roadside-to-vehicle communication application data and "1" to the roadside-to-roadside communication application data. This is sent to the Extended Layer (EL) along with other primitives. After performing split processing and other functions on these data in the EL to create the transmission packets, the data are passed to the MAC sublayer. After receiving the primitives and packets including TransmissionCategoryInformation, the MAC sublayer references RTC to determine for which transmission category information the application data transmission periods including the own station base station transmission period and the other base station transmission periods (slot4, slot5, slot10) are intended. While checking the TransmissionCategoryInformation assigned to each packet (application data), the MAC sublayer sequentially sends the information to lower layers in the base station transmission periods for the respective transmission category, starting with packets designated as transmission category "0". At this time, the MIB variable

RTC.TCL of the IVC-RVC Layer is set, along with the variables RTC.TST and RTC.RTP that specify the start timing and the period for transmission in the control period for the base station. These processing steps enable transmission according to Figure R1.4 a).

Table R 1.3　MIB and primitive settings example for SPTF

a) Primitives

Packets		Roadside-to-vehicle 1		Roadside-to-vehicle 2	Roadside-to-roadside 1	
EL	Sequence Number (Sequence/Total)	1/5	2/5	3/5	4/5	5/5
APL	TransmissionCategory Information	0			1	

b) IVC-RVC Layer MIB

Item		Value					
RRC[n]	n (= 1 to 16)	・・	4	5	・・	10	・・
RTC[m]	m (implementation-dependent)	・・	1	2	・・	3	・・
	TST (Transmission Start Timing)		1170	1560		3510	
	TRP (Transmission Period)		189	189		189	
	TCL (Transmission Category Label)		0	0		1	

2.2　Transmission-Interval-Setting-Function for each transmission category (TISF)

This section explains the Transmission-Interval-Setting-Function for each transmission category (TISF).

When the base station has to share a base station transmission period (time slot) with other base stations for sending roadside-to-roadside communication application data in an interval longer than the control period (100 ms), this function is required. The function assumes that the base station application is able to transmit in an interval that is longer than the control period (in integer multiples of the control period). However, the method to achieve this is not specified in this Guideline.

Both when application transmission timing for each base station is not synchronized (case 1) and even if it is synchronized for the respective transmission, when delays due to security processing and communication processing between the EL and MAC sublayer occur, this can

lead to incomplete MSDU sets for which transmission is planned in the MAC sublayer (case 2), causing the following problem to occur in a base station conforming to the Standard. The explanation using Figure R1.5 below applies to case 2. If MSDU sets from the application are delayed due to security processing in the MAC sublayer of the base station, and transmission in the base station transmission period for the own base station is therefore not possible, these MSDU sets will be held until the next control period. If the base station transmission period of that control period is allocated to another base station, an interference problem occurs. Regarding MSDU sets to be transmitted, if the roadside-to-vehicle communication MSDU set is completed but the roadside-to-roadside communication MSDU set is incomplete, transmission will not occur regardless of the complete roadside-to-vehicle communication MSDU set, and all sets will be held until the next control period.

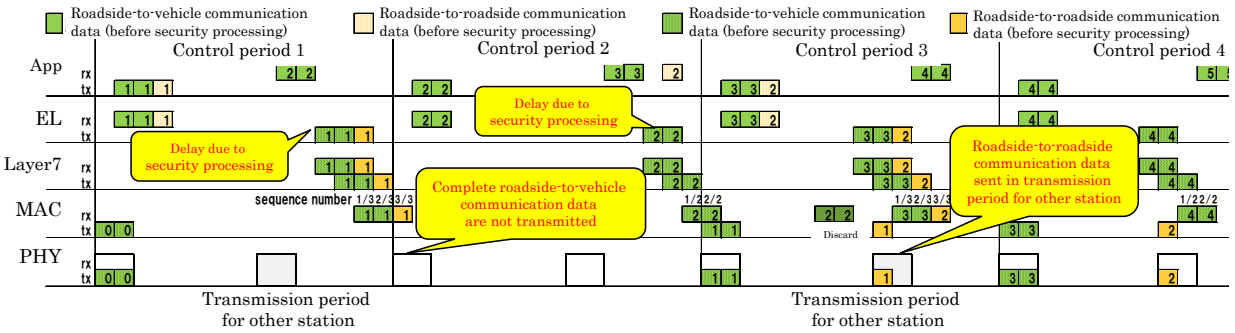


Figure R1.5　Delays due to transmission processing (base station: conforming to the Standard)

In order to prevent such a situation, the following are provided: a parameter called TransmissionCategoryInformation for each primitive from the application to the MAC sublayer, an N second cycle timer and MIB variables called RTC.TRI (Transmission Interval), RTC.TRO (Transmission Offset) and RTC.TCL (Transmission Category Label) of the IVC-RVC Layer. The method for the parameter "SequenceNumber" provided for each primitive from the EL to the MAC sublayer and other layers is also changed.

A concrete explanation of this approach is given using Figure R1.6 and Table R 1.4. The base station manages all application data transmissions using an N second cycle timer with integer multiples of the transmission interval. The N second cycle timer uses only values that are integer multiples of the control period, and the range of values is limited to the range from 1.0 to 10.0. .In Figure R1.6, the N second cycle timer is set to N = 1.0 because application data for roadside-to-vehicle communications and roadside-to-roadside communications are transmitted in the 100 ms and 200 ms transmission interval respectively. Next, the base station

administrator sets the IVC-RVC Layer MIB variables as follows. The RTC.TRI variable is used to specify the appearance interval of the timing (control period) in which data for each transmission category as set by RTC.TCL can be transmitted, and the RTC.TRO variable is used to specify the timing offset from the N second cycle timer "0" (reset) point. .In the situation of Figure R1.6 and Table R 1.4, base station <a> uses the base station transmission periods "slot 4" and "slot 5" for roadside-to-vehicle communications and "slot 10" for roadside-to-roadside communications. Base station <b> uses "slot 6" and "slot 7" for roadside-to-vehicle communications and "slot 10" for roadside-to-roadside communications. In this case, the roadside-to-roadside communications transmission interval for both base station <a> and base station <b> is set to 200 ms (RTC[3].TRI=2). The transmission offset is set to none (RTC[3].TRO=0) for base station <a> and to 100 ms (RTC[3].TRO=1) for base station <b>. This allows "slot 10" to be shared as shown in Figure R1.6. Finally, for the base station application to perform roadside-to-vehicle communications and roadside-to-roadside communications, TransmissionCategoryInformation is assigned to each application data as shown in Table R 1.4. A SequenceNumber is assigned to each value of TransmissionCategoryInformation.

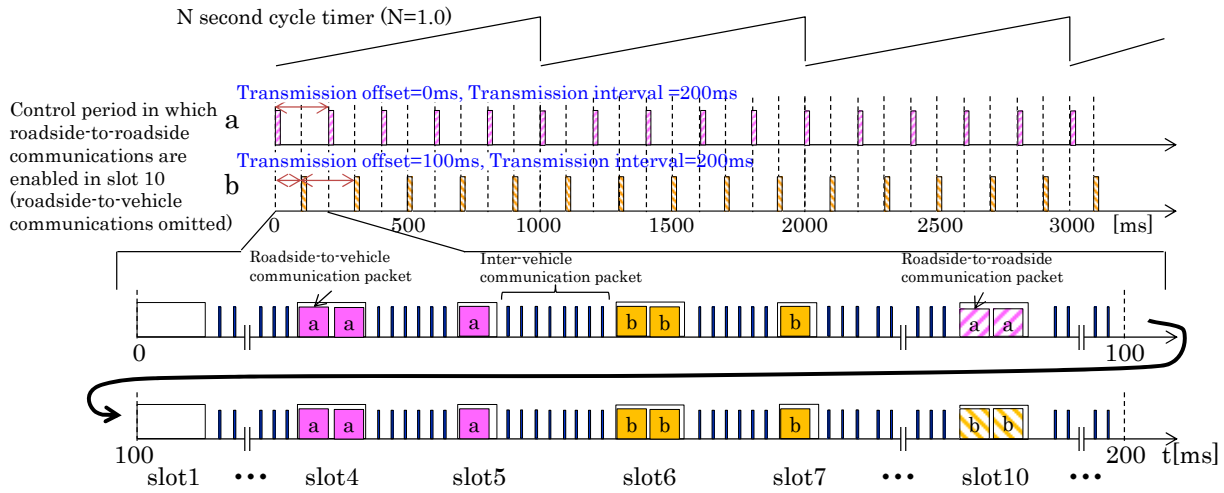


Figure R1.6 Example for TISF (roadside-to-roadside communications transmission interval 200 ms)

Table R 1.4　MIB and primitive settings example for TISF

a) Primitives (base stations <a> and <b>)

Packets		Roadside-to-vehicle 1		Roadside-to-vehicle 2	Roadside-to-roadside 1	
EL	Sequence Number (Sequence/Total)	1/3	2/3	3/3	1/2	2/2
APL	TransmissionCategoryInformation	0			1	

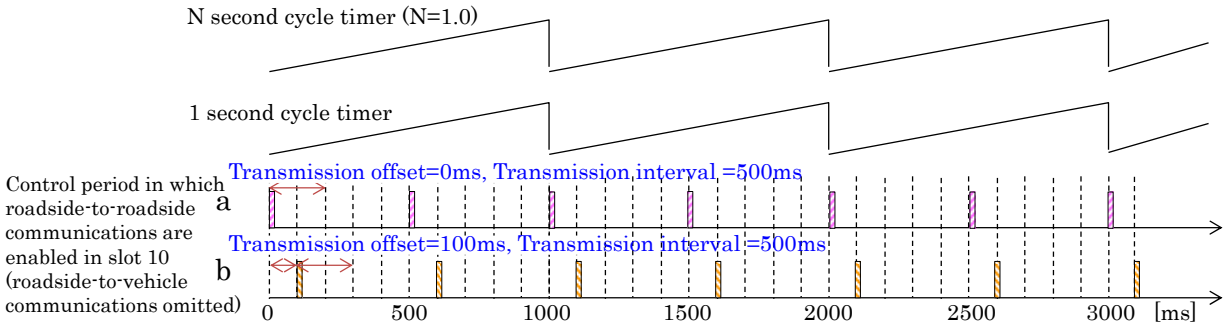
b–1) IVC–RVC Layer MIB (base station <a)

Item		Value					
RRC[n]	n (= 1 to 16)	・・	4	5	・・	10	・・
RTC[m]	m (implementation-dependent)	・・	1	2	・・	3	・・
	TST (Transmission Start Timing)		1170	1560		3510	
	TRP (Transmission Period)		189	94		189	
	TCL (Transmission Category Label)		0	0		1	
	TRI (Transmission Interval)		1	1		2	
	TRO (Transmission Offset)		0	0		0	

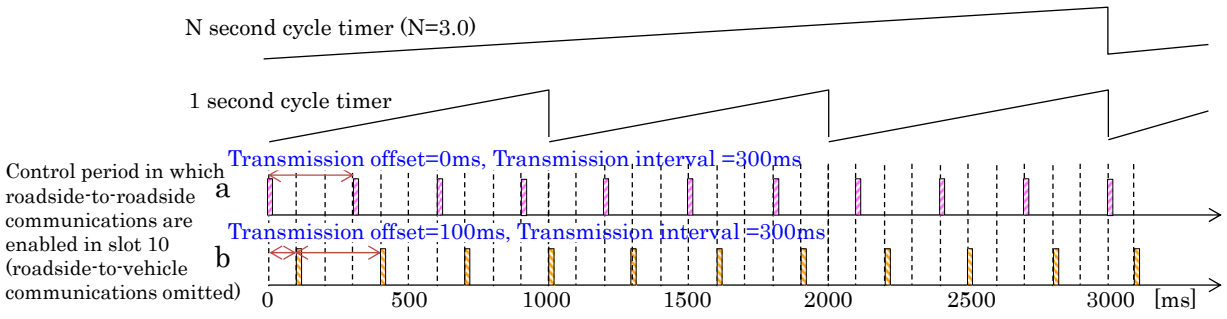
b-2) IVC-RVC Layer MIB (base station <b>)

Item		Value					
RRC[n]	n (= 1 to 16)	・・	6	7	・・	10	・・
RTC[m]	m (implementation-dependent	・・	1	2	・・	3	・・
	TST (Transmission Start Timing)		1950	2340		3510	
	TRP (Transmission Period)		189	94		189	
	TCL (Transmission Category Label)		0	0		1	
	TRI (Transmission Interval)		1	1		2	
	TRO (Transmission Offset)		0	0		1	

As shown in Figure R1.7 a), the duration from the timer reset point to the first transmission opportunity is constant also at transmission intervals other than 200 ms, namely 100 ms, 500 ms, and 1000 ms. Therefore the N second cycle timer with N = 1.0 can be used in these cases also. With N = 1.0 for the N second cycle timer, if the reset timing for the timer is synchronized with that of the one second cycle timer synchronized with other base stations, synchronization of the N second cycle timer can also be achieved easily. However, with transmission intervals other than the above, such as 300 ms etc., the duration from the timer reset point to the first transmission opportunity is not constant when the N second cycle timer with N = 1.0 is used. In such cases, an N second cycle timer with for example N = 3.0 needs to be used. Unlike with the N = 1.0 setting, simply synchronizing the N second cycle timer reset timing with the one second cycle timer is not enough to achieve synchronization between multiple base stations. The N second cycle timer reset timing must therefore be synchronized among stations by other means.



a) Transmission interval for roadside-to-roadside communications set to 500 ms



b) Transmission interval for roadside-to-roadside communications set to 300 ms

Figure R1.7　Examples for TISF

This Guideline does not specify a method for synchronizing the N second cycle timer reset timing among base stations when a value larger than 1.0 is used for N, as shown in Figure R1.7

b). The following method will be considered as one of the solutions if it refers to the one second cycle timer synchronization method described in “Description 2” of the Standard.

(1) GPS based synchronization

Using not only the 1PPS signal from the GPS, but also the absolute time information, the N second cycle timer is monitored and corrected, to synchronize the reset timing among base stations.

(2) Air based synchronization

The base station appends information to the wireless header of the transmission packet (for example to the enhanced field of the IR Control field as defined by the Standard). The information includes the N second cycle timer value, the number of control periods since N second cycle timer reset, etc. The receiving base station uses the timestamp information of the IR Control field to correct its own N second cycle timer and also uses the N second cycle timer information from the transmitting base station to monitor the difference to its own N second cycle timer and make sure that the difference does not exceed a certain threshold (such as 100 ms). If this occurs, a correction is made or problem information is recorded etc.

By performing the above processing steps, transmission in the control period required for each value of TransmissionCategoryInformation becomes possible, and even if security processing and EL to MAC sublayer processing cause delays, unwanted transmission in control period used by other base stations can be avoided. Also, because the MAC sublayer transmits complete MSDU sets for each value of TransmissionCategoryInformation a situation where roadside-to-vehicle communication MSDU sets have to be put in "transmission standby" because of processing delays of MSDU sets not for roadside-to-vehicle communications can also be avoided.

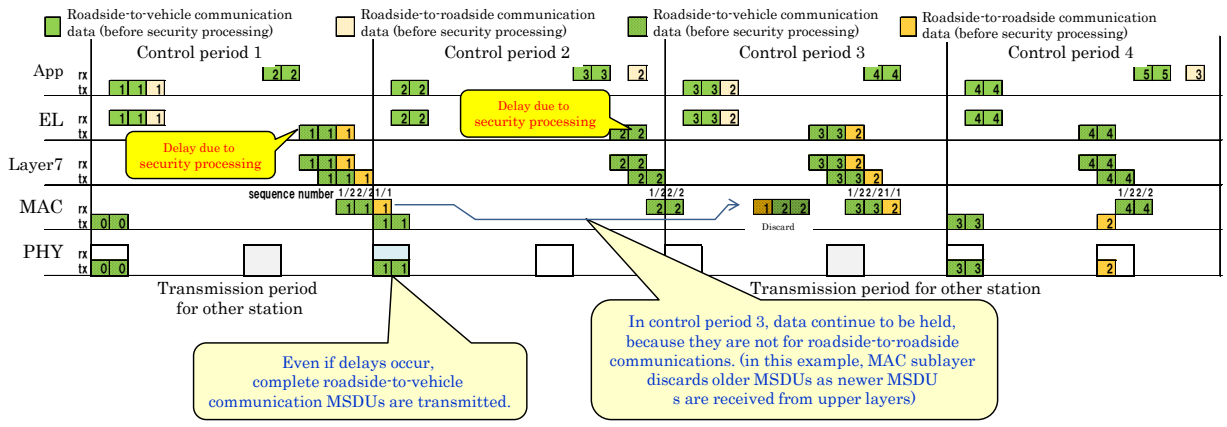


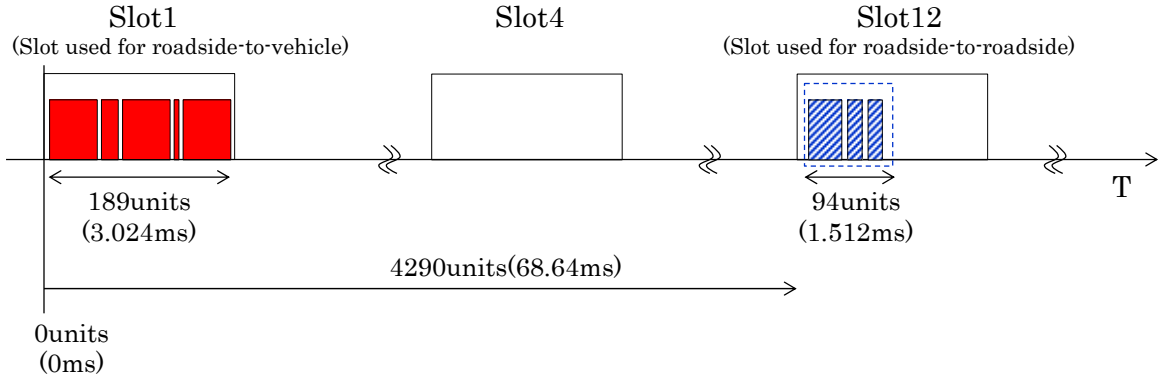
Figure R1.8　Delays due to transmission processing (base station: conforming to this Guideline)

2.3 Transmission-Period-Setting-Function in control period (TPSF)

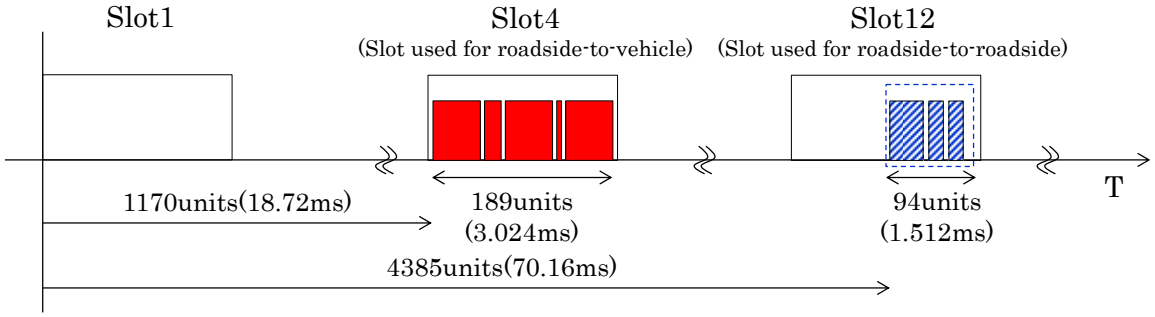
This section describes the Transmission-Period-Setting-Function in control period (TPSF).

In the case of the communication control method 2, where multiple base stations share a base station transmission period (time slot) for sending roadside-to-roadside communication information, the transmission period must be divided by time, in order to prevent mutual interference between the information from different base stations within the time slot. This is achieved by TPSF.

TPSF can be implemented by using the RTC provided by the Standard. The following explanation uses the situation shown in Figure R1.9 as an example. Base station A uses time slot 1 for roadside-to-vehicle communication, and the first half of time slot 12 for roadside-to-roadside communication. Base station B uses time slot 4 for roadside-to-vehicle communication, and the second half of time slot 12 for roadside-to-roadside communication. An example of MIB settings for the IVC-RVC Layer of base stations A and B is shown in Table R 1.5. By establishing the settings shown in Table R 1.5, time slot 12 can be shared by base station A and base station B.



a) Base station A (uses time slot 1 and 12)



b) Base station B (uses time slot 4 and 12)

Figure R1.9 Example for TPSF (sharing time slot 12 by multiple base stations)

Table R 1.5　IVC-RVC Layer MIB settings

a) Base station A (uses base station transmission periods 1 and 12)

Item		Value				
RRC[n]	n (= 1 to 16)	・・・	1	・・・	12	・・・
	TRC (Transmission Count)		1		1	
	RCP (RVC Communication Period)		63		63	
RTC[m]	m (implementation-dependent)	・・・	1	・・・	2	・・・
	TST (Transmission Start Timing)		0		4290	
	TRP (Transmission Period)		189		94	

b) Base station B (uses base station transmission periods 4 and 12)

Item		Value				
RRC[n]	n (= 1 to 16)	・・・	4	・・・	12	・・・
	TRC (Transmission Count)		1		1	
	RCP (RVC Communication Period)		63		63	
RTC[m]	m (implementation-dependent)	・・・	1	・・・	2	・・・
	TST (Transmission Start Timing)		1170		4385	
	TRP (Transmission Period)		189		94	

2.4 DataAssociatedInformation-Appending-Function for each CommunicationTypeInformation (DAF)

This section describes the DataAssociatedInformation-Appending-Function for each CommunicationTypeInformation (DAF).

A base station application uses the data associated information (DataAssociatedInformation) parameter of the primitive between the application and the Extended Layer to specify the base station ID (BaseStationID), data sequence (DataSequence) and total data number (DataTotalNumber). This information is stored in the EL base station header of the transmission packet. If at this time, a situation such as shown in Figure R1.10 occurs, where base station A sends multiple information of several different communication types, and Layer 7 at the receiving side (base station B, vehicle mobile station) has performed reception processing to only receive information of a specific communication type, using the method described in Annex 1, a mismatch of the values in the total data number field (DataTotalNumber) of the data associated information for the MSDU handed to the Extended Layer will occur, even if reception processing was completed normally. As shown in Table R 1.6, this is because base station A assigns the DataSequence and DataTotalNumber values for the application data to be sent in the control period regardless of the communication type.

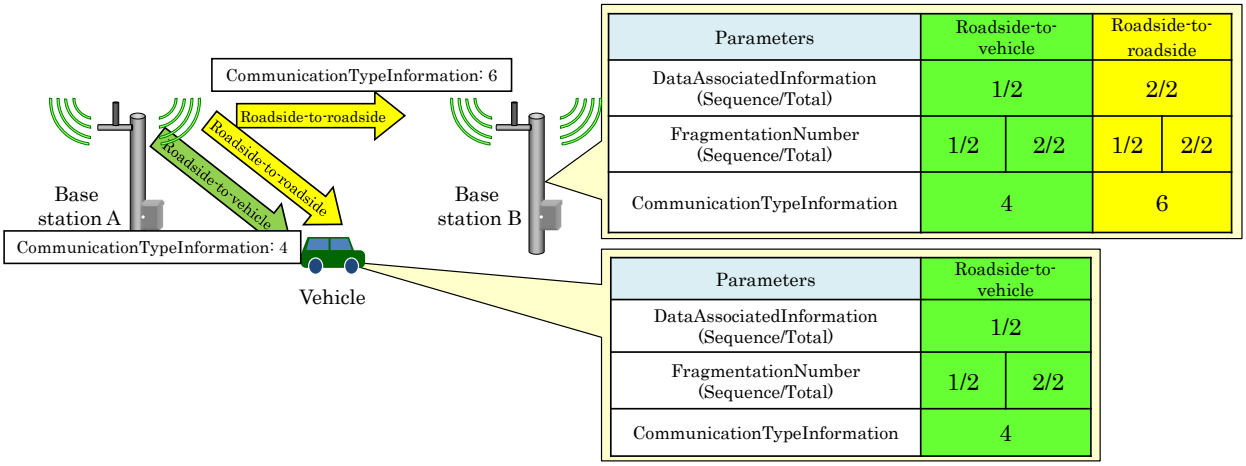


Figure R1.10 Reception processing with CommunicationTypeInformation only (base station conforming to Standard)

Table R 1.6　Data associated information setting example (base station conforming to Standard)

Parameters			Roadside-to-vehicle		Roadside-to-roadside	
EL	header elements	DataAssociatedInformation (Sequence/Total)	1/2		2/2	
		FragmentationNumber(Sequence/Total)	1/2	2/2	1/2	2/2
APL	primitives	DataAssociatedInformation	1/2		2/2	
		CommunicationTypeInformation (in ApplicationAssociatedInformation)	4		6	

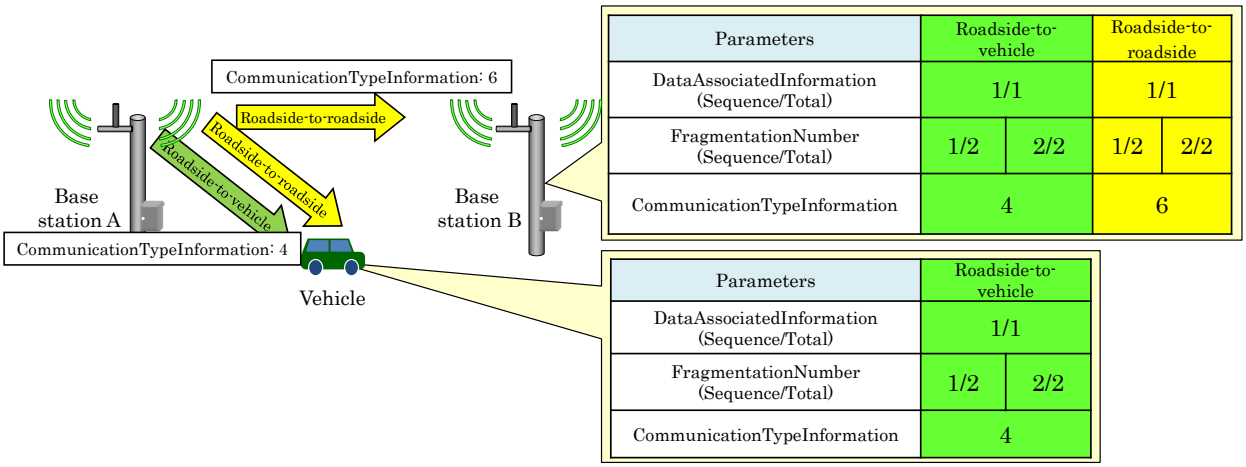
DAF serves to prevent such a situation.

In concrete terms, the base station application, when sending application data, uses the CommunicationTypeInformation specified by the ApplicationAssociatedInformation parameter of the primitive between the application and the Extended Layer to assign the DataSequence and DataTotalNumber values for the DataAssociatedInformation parameter of the same primitive.

For example, if base station A as shown in Figure R1.10 conforms to the Standard, it will assign a separate DataSequence and DataTotalNumber for application data of communication type 4 (roadside-to-vehicle communications) and type 6 (roadside-to-roadside communications). This will ensure that for the vehicle shown in Figure R11, the DataTotalNumber value will match the total number of MSDU received by the Extended Layer, even if only performing reception processing for communication type 4 (roadside-to-vehicle communications).

Table R 1.7　Data associated information setting example (base station conforming to this Guideline)

Parameters			Roadside-to-vehicle		Roadside-to-roadside	
EL	header elements	DataAssociatedInformation (Sequence/Total)	1/1		1/1	
		FragmentationNumber (Sequence/Total)	1/2	2/2	1/2	2/2
APL	primitives	DataAssociatedInformation	1/1		1/1	
		CommunicationTypeInformation (in ApplicationAssociatedInformation)	4		6	



Parameters	Roadside-to-vehicle		Roadside-to-roadside	
DataAssociatedInformation (Sequence/Total)	1/1		1/1	
FragmentationNumber (Sequence/Total)	1/2	2/2	1/2	2/2
CommunicationTypeInformation	4		6	

Parameters	Roadside-to-vehicle	
DataAssociatedInformation (Sequence/Total)	1/1	
FragmentationNumber (Sequence/Total)	1/2	2/2
CommunicationTypeInformation	4	

Figure R1.11　Reception processing with CommunicationTypeInformation only (base station conforming to this Guideline)