ENGLISH TRANSLATION

DEDICATED SHORT-RANGE COMMUNICATION SYSTEM

ARIB STANDARD

VERSION 1.0

ARIB STD－T75

Version 1.0 September 9th 2001

Association of Radio Industries and Businesses (ARIB)

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2.
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FOREWORD

The Association of Radio Industries and Businesses (ARIB) has been investigating and summarizing the basic technical requirements for establishing standards. These will appear in the form of standards and specifications governing the use of radio transmission facilities and equipment. The standards are being developed based on the participation of and discussions with, the various radio equipment manufacturers, operators and users.

The standards and specifications contained herein will serve as guidelines for developing standards for private use based on the publicly established technical standards in Japan. Their purpose is to enable effective use of radio frequencies by avoiding interference among users, conflicts among the standards of individual operators, and so forth, so that all parties involved, including radio equipment manufacturers, users and others will be able to ensure the quality and compatibility of radio facilities and equipment.

These standards are being established principally for “DEDICATED SHORT-RANGE COMMUNICATION (DSRC)”. In order to ensure fairness and openness among all par-ties involved, during drafting stages, we invite radio equipment manufacturers, operators and users both domestically and overseas to participate openly in the activities of the Standard Assembly so as to develop standards with the total agreement of all parties involved.

The scope of application of these standards covers the minimum requirements for communications. They are designed to serve as practical guidelines for operators in developing original specifications and systems that fall within the scope of the standards.

We hope that the standards will aid all parties involved, including radio equipment manufacturers, operators, users, and others in the development of an excellent radio telecommunication system.

NOTE :Although this ARIB Standard contains no specific reference to any Essential Industrial Property Right relating thereto, the holder of such Essential Industrial Property Right states that "YYY" is the holder of the Industrial Property Right "XXX" covering this ARIB Standard and to grant a non-exclusive and non-discriminatory license to the use of such right "XXX" on reasonable terms and conditions to anyone using this ARIB Standard. However this does not apply to anyone who uses this ARIB Standard and also owns and lays claim to any other Essential Industrial Property Right whose scope is included in any or all parts of the contents of the provisions of this ARIB Standard.

List of **Essential Industrial Property Right**

Patent Holder	Name of Patent	Registration No. /Application No.	Remarks
Hitachi, Ltd.	A method of communication and a communication apparatus	2000-223857	
	A method of communication and a communication apparatus	2001-114761	

CONTENTS

Chapter 1 General

1.1 Overview

This standard specifies the radio communication interface between a Land Mobile Station and a Base Station for the Dedicated Short Range Communication system (written as “system” hereunder in this document).

The system shall be in accord with Article 49-26 (including related notifications) of Japanese Radio Facility Regulations when the system is used in Japan.

Mobile stations and the radio station for testing communication to the mobile stations shall be in accord with Article 4-3 of the Japanese Radio Act and Article 6-4-7 of the Enforcement Regulations.

1.2 Scope of application

The system consists of a Road Side Unit (RSU) installed on road side (termed "Base Station") and On-Board Equipment (OBE) (termed "Land Mobile Station" or abbreviated "Mobile Station") ,and Equipment for testing the mobile station (termed “Station for Testing” or abbreviated “Test Equipment ” .

This standard specifies the radio communication interface as indicated in Fig. 1.1.

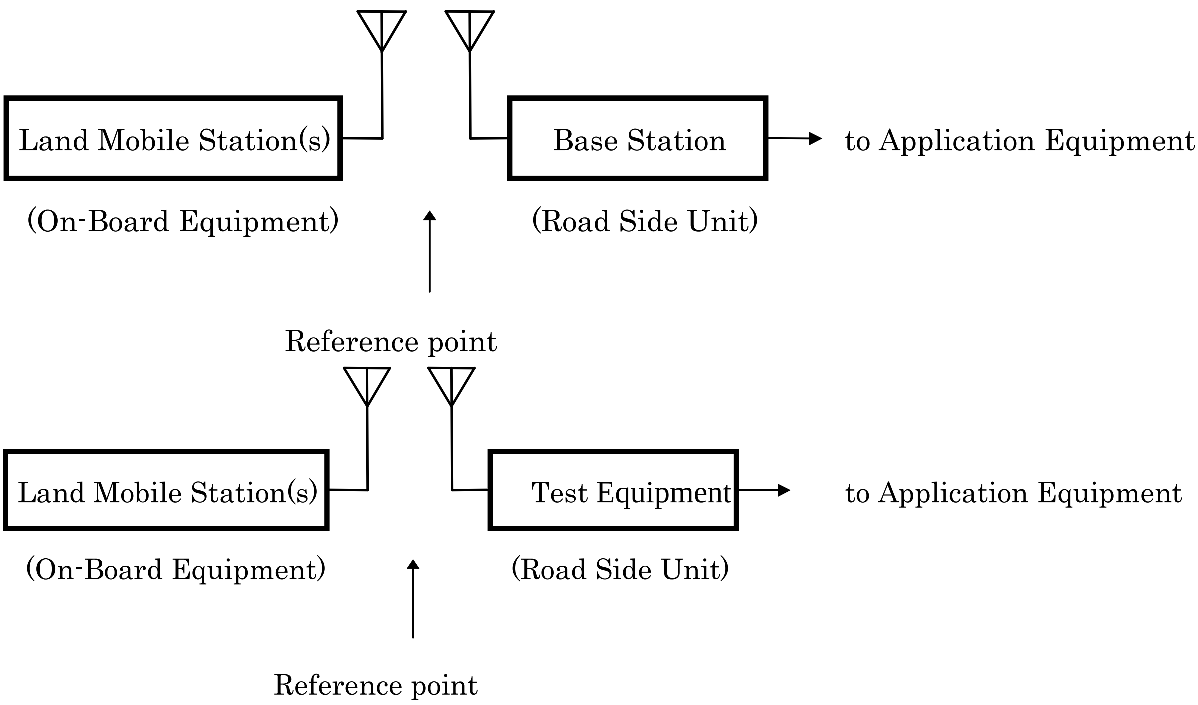


Fig. 1.1 Configuration of the system

1.3 Scope of standardization

In terms of mutual connectivity and compatibility, this standard defines the minimum level of specifications required for basic connections and services as the mandatory requirement, and the specifications required for what free choice is permitted, such as protocols, as optional standard to provide for future expansion.
Further, in order to provide options and future expansion capabilities as much as possible, care has been taken not to place restrictions on non-standardized specifications.

Fig.1.2 outlines the relationship between standardized services and optional protocols used. The standard adopts the 3 Layer structure of the Open Systems Interconnection(OSI) basic reference model and the standardized objects are Layer 1, Layer 2 and Layer 7. As for functions in Layer 3, Layer 4, Layer 5 and Layer 6 defined in the OSI basic reference model, they are specified in the Layer 7 if they are needed for the system, taking into account the fact that the transaction occurs in a short period each time a Mobile Station passes through a small communication zone of the Base Station.

Optional standards are apt to be dependent on the additional services (applications) and, hence, they are put aside as future subjects.

The application sub-layer should accommodates as an option when processing near to the application level is required , and portion where Layer 2 cannot make in order to be compatible with ARIB STD-55

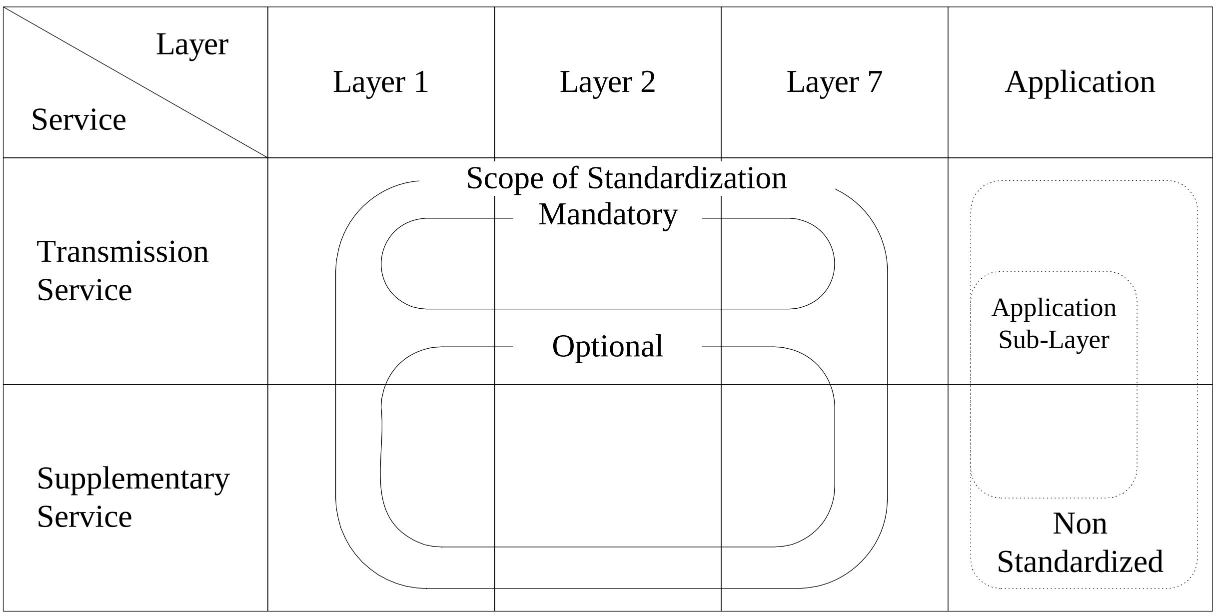


Fig. 1.2 Scope of standardization

Chapter 2 System Overview

2.1 Configuration of the system

The system consists of a Road Side Unit (RSU) installed at the road side (termed "Base Station" hereunder) and On-Board Equipment (OBE) installed in the vehicle (termed "Mobile Station").

2.1.1 Base Station (RSU)

Base Station performs land mobile radio communication with Mobile Station(s). The Base Station is composed of radio equipment with antenna(e), a transmitter and receiver, a control unit and a display unit.
Depending on the radio communication range, Base Station is classified as follows.

Class 1: radio communication range is below 10 m
Class 2: radio communication range exceeds 10 m, but within 30 m

2.1.2 Mobile Station (OBE)

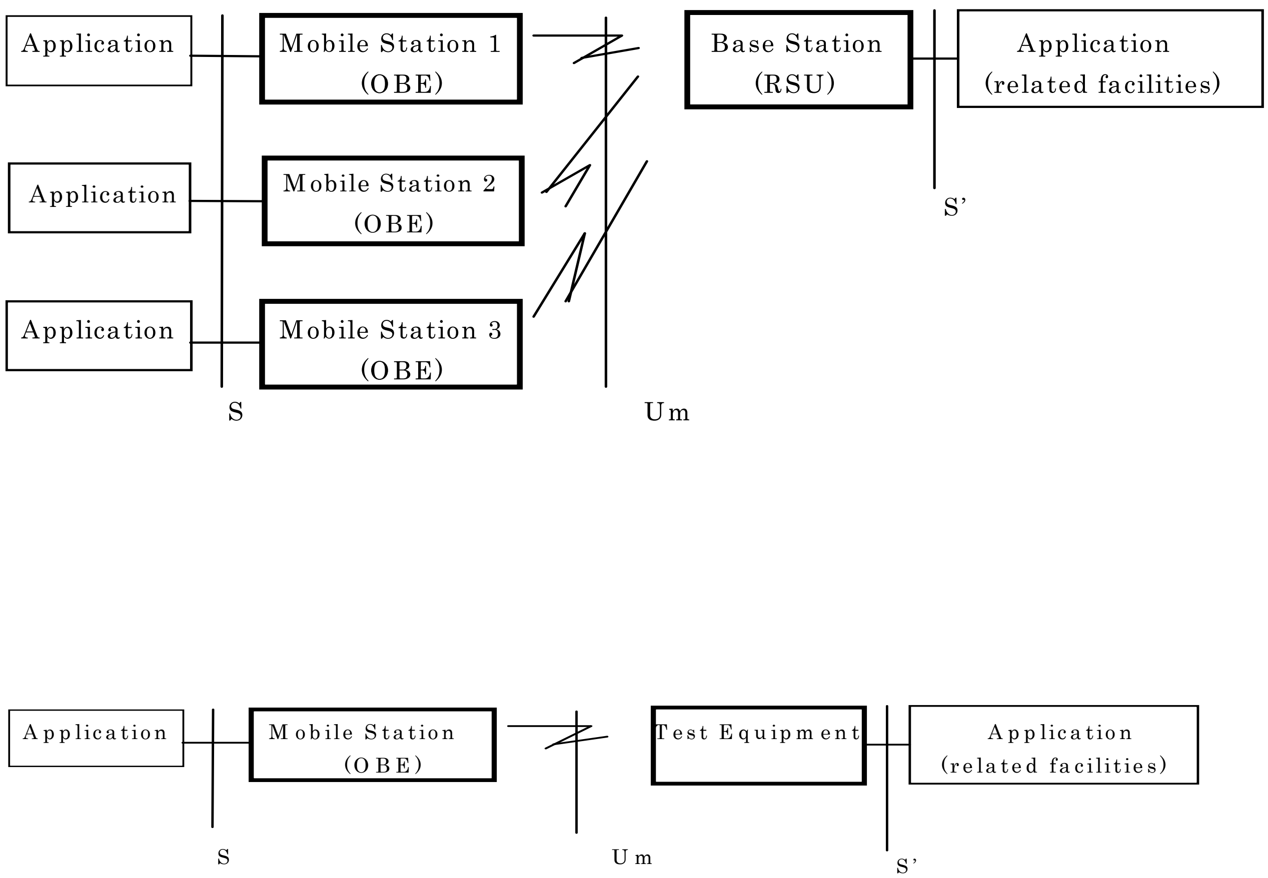
Mobile Station performs land mobile radio communication with Base Station. The Mobile Station consists of radio equipment with antenna(e), a transmitter and receiver, and optional equipment such as an IC card, a control unit and a display unit.

2.1.3 Test Equipment

Test Equipment performs radio communication for testing with Mobile Station. The Test equipment consists of radio equipment with antenna(e), a transmitter and receiver, control unit, and display unit.

2.2 Definition of the interface

In the system, reference points for the interface are as shown in Fig. 2.1.



Um point : reference point for interface between Base Station or Test Equipment and Mobile Station ----- this standard to be applied

S and S' points: reference points for application interfaces with Base Station Mobile Station, and Test Equipment respectively ----- out of scope of this standard (though specified partly)

Fig. 2.1 Reference points for interfaces

2.3 Basic functions of the system

The system is the one used to communicate between Base Station (RSU) and Mobile Stations(OBEs), and achieves:

a. information provision, toll collection by exchanging fast and large amount of data.
b. information provision regarding to road
c. provision of information about local event .
d. provision of information about entertainment facilities
e. . provision of information in emergent disaster

2.3.1 System requirements

The system requirements are described below.

2.3.1.1 Basic functions

(1) The system is duplex short range and small zone communication which connects between Base Station(RSU) and Mobile Stations(OBEs) with high speed radio wave and is capable of being used for multiple applications. It has the following characteristics. :

a. Multiple application use
b. Effective use of frequency by small zone
c. Capable of transmitting fast and large amount of information to moving vehicles
d. Service connecting internet
e. Use for Electronic Toll Collection and other means of electronic payment

The following functions are provided.

a. Connection between OBE and other ITS terminal equipment(e.g. car navigation, in-vehicle network)
b. Interaction between OBE and other information media(e.g. car navigation, 3G cellular phone, digital broadcasting)
c. Protection of security(e.g. account settlement, personal identification, privacy protection, consumer protection)
d. Failure check of terminal equipment by OBE(e.g. communication connection test)
e. Management of users
f. Management of copyright

(2) In the system, functions of the radio facility are as follows:

a. to ensure radio communication for all vehicles equipped with Mobile Stations.
b. To be capable of flexible composition of OBE upon users' needs
c. To be capable of meeting one or more applications with one OBE

d. To be capable of communicating with vehicles running 0 to up to 180km/h. The information volume can be limited based upon the size of communication zone and vehicle speed.
e. To be capable of composing flexible communication zones within the range of 30m x 30m
f. To be capable of setting the size of communication zone as a service provider wants
g. To be capable of having various functions such as electronic payment according to a user's and service provider's needs

2.3.2 Services provided by the system

2.3.2.1 Service features

The services provided by the system have the attributes listed in Table 2.1 below.

Table 2.1 Service attributes

Service attributes	Service items
Information transfer capability	unrestricted digital information
Information transfer rate	1024 kbps or 4096 kbps
Communication configuration	point-to-point, point-to-multipoint

2.3.2.2 Service types

(1) Bearer services
The following functions provided by this service are assumed
a. Account settlement of electronic payment
b. Internet (IP) connection
c. Information provision (road & traffic information, various local information
d. Reservation (public transportation, local facilities, car ferry)
e. Information search
f. Facility management (parking management, check in & out of specific area)
g. Freight management (CVO, container probe)

The followings are ETC services as examples of transmission service through communication channel.
a. Exchange of the information about the toll collection: It is an exchange of needed

information about toll collection, and the reading /writing of the information are performed through the radio facility (lane based antenna) installed at the toll gate.

b. Transmission of the guiding information about the lanes: It is an information transmission in order to guide vehicles equipped with OBE to the dedicated lane and to achieve a smooth operation of traffic lanes. The information is transmitted by the radio equipment (approach antenna) installed ahead of the toll gate.

c. Notification of the route information: It is transmission of information about driven routes, necessary for writing on the through lanes. The information is read/written by radio equipment on the lane (Navigation antenna).

Refer to Fig. 2.2 and Fig. 2.3.

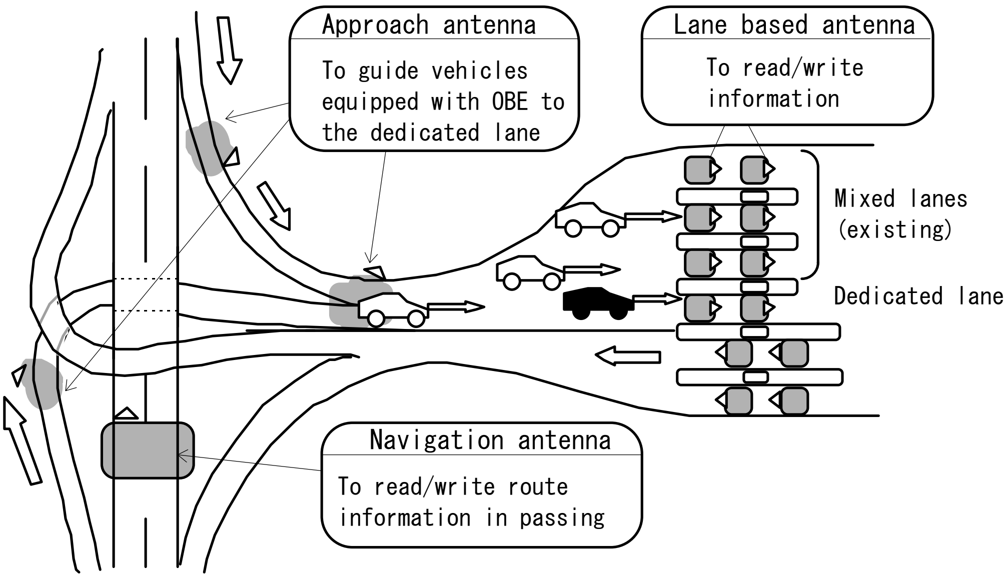
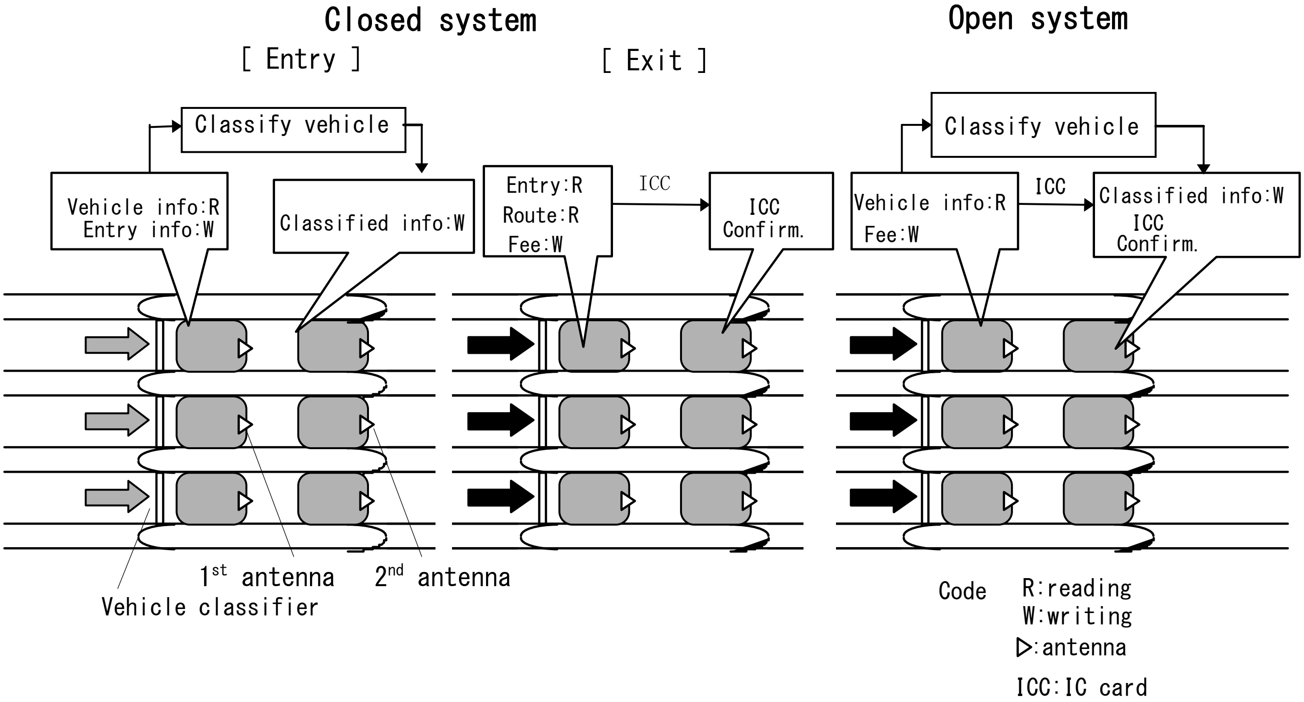


Fig. 2.2 Example of DSRC service (ETC system)



Note : There is a case where there is just one antenna.

Fig. 2.3 Example of transmission service (ETC system at the toll plaza)

2.4 Access method

2.4.1 Type of transmission

The radio access method shall be TDMA-FDD as shown in Table 2.3.

Table 2.3 Transmission parameters

Item	Parameters	
Radio access type	TDMA-FDD	
Multiplexed number of TDMA	less than 8 (2, 4 or 8, variable)	
Carrier frequency difference between transmission and reception	40 MHz	
Modulation method	ASK	π/4 shift QPSK
Bit rate	1024 kbps	4096 kbps
Medium access control method	adaptive slotted ALOHA	

2.4.2 Radio channel control

The basic procedure for communication control shall be synchronous, adaptive slotted ALOHA which is suited to point-to-point, short time, two-way communication between a Mobile Stations and a Base Station. It is a full-duplex communication, which uses different transmission channels (frequencies) for uplink and downlink, respectively. In this standard, a communication control type which also allows half-duplex communication is specified. Fig. 2.4.2-1 and Fig. 2.4.2-2 show examples of communication. Mobile Stations and a Base Station establish the two-way communication in the communication zone.

Fig. 2.4.2-1 shows a communication frame of the half-duplex and the communication with two Mobile Stations.

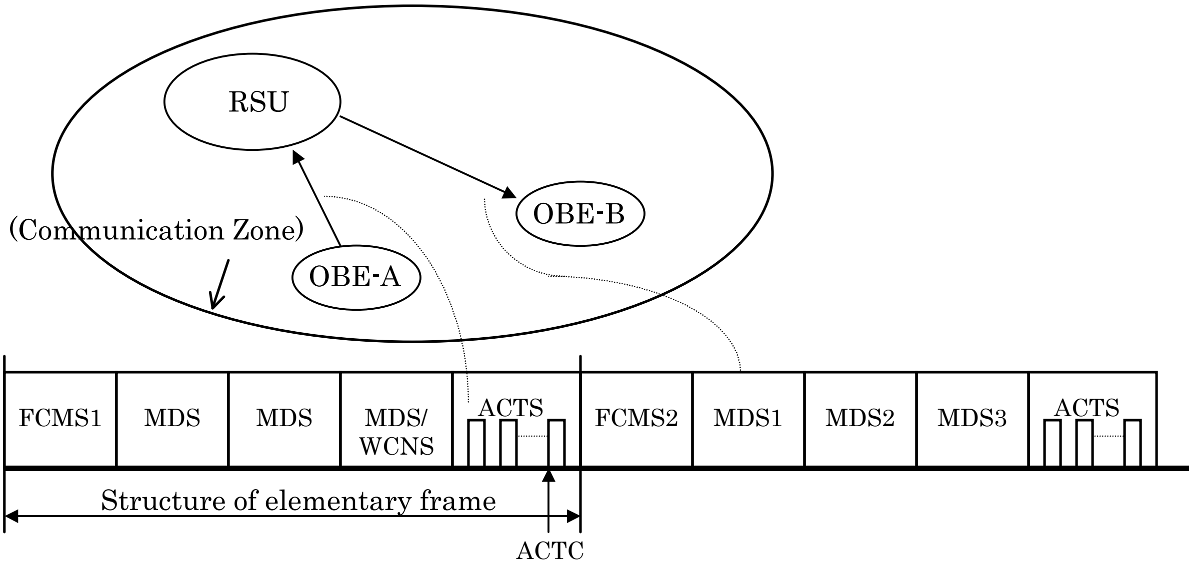


Fig. 2.4.2-1 Example of communication (Example of the half-duplex communication)

A communication frame consists of a frame control message slot (FCMS) which performs an allocation of slots, message data slots (MDS) for data transmission, activation slot (ACTS) for the association (link connection) to Base Station, and a wireless call number slot (WCNS) which transmits wireless ID code (Call sign). The field length of each slot is 100 octets, constant.

Fig. 2.4.2-2 shows an example of the frame structure, including 7 MDSs and a ACTS during the full-duplex communication mode in Base Station. Different transmission channels (frequencies) are used for up and down links, respectively and the data slot portion (MDS) are multiplexed. In the example in the figure, 4 OBE's (A, B, C, D) exchange the MDS's within the same frame during the data communication.

And the figure shows an example of data exchange in up and downlink channels by using different MDS's within the same frame. This operation mode assumes that the user could operate by taking into account the processing delay in the equipment, caused by a limited processing capability of the equipment and by data exchange types, etc. Accordingly, this standard which specifies "Radio communication interface" does not always guarantee the transmission/reception of signals between Mobile Stations in the same frame.

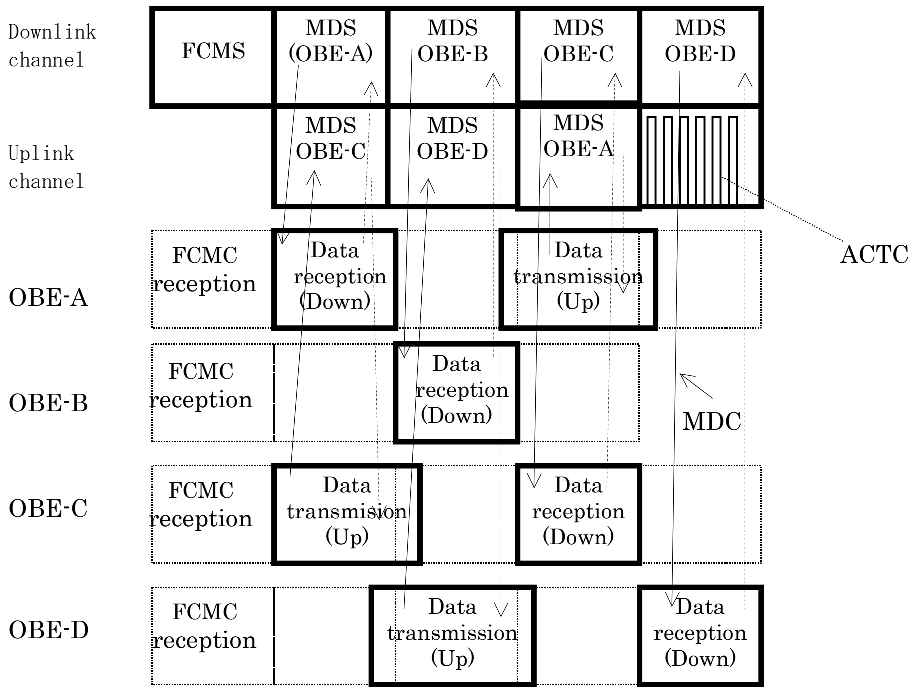


Fig. 2.4.2-2 Example of full- duplex communication

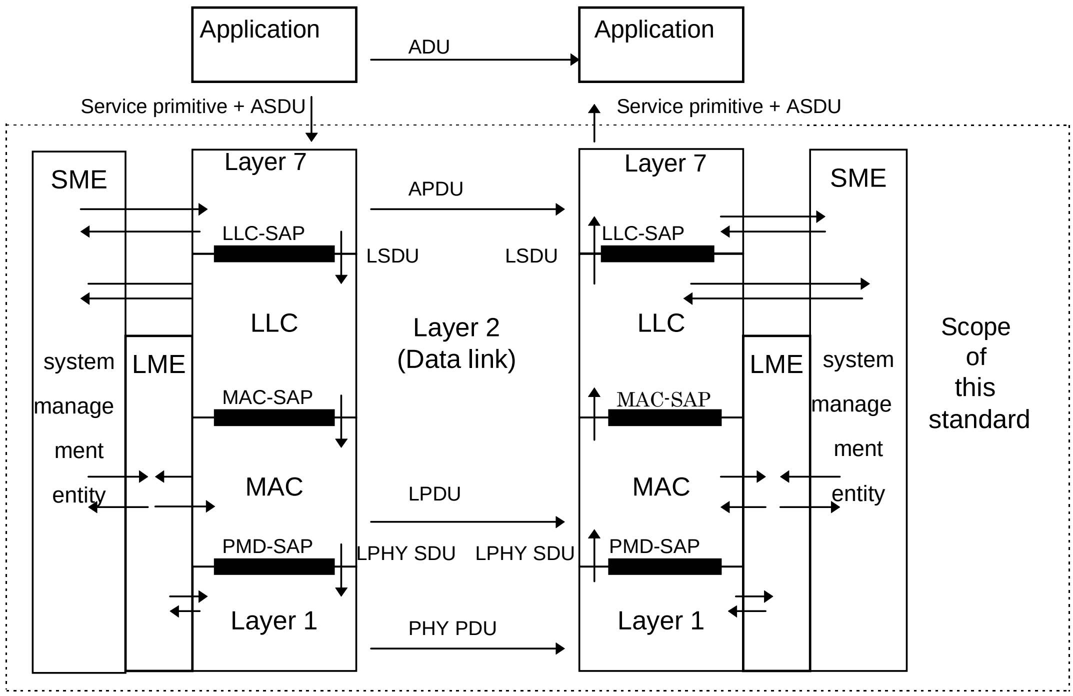
2.5 Basic rules for protocol

2.5.1 Model for protocol

Fig. 2.5.1 shows the signal structure of this standard. Each layer is defined in conformity with ISO 7498 : 1994 (Information Technology - Open Systems Interconnection - Basic Reference Model). This standard adopts 3 layer-structure, namely, Layer 1 (Physical Layer: L 1), Layer 2 (Data Link Layer: L2) and Layer 7 (Application Layer: L 7). And it specifies the service primitives between application and Layer 7, etc.

Further, the Layer 2 is divided into the logical link control sublayer (LLC Sublayer) and the medium access control sublayer (MAC Sublayer). The LLC Sublayer is based on ISO/IEC 8802-2 : 1994 (Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 2 : Logical link control), and some parameters are modified to adapt to this standard.

MAC Sublayer, Layer Management Entity (LME) and System Management Entity (SME) of the Layer 1 are specified. They exchange and manage service primitives of each layer in order to work smoothly as a whole radio system.



APDU：Application Protocol Data Unit
LPDU：Link Layer Protocol Data Unit
LSDU：Link Layer Service Data Unit
SAP ：Service Access Point
PHY PDU：Physical Layer Protocol Data Unit

Fig. 2.5.1 Signal structure

2.5.1.1 Features of Layer 1

Layer 1 provides the radio communication media and performs a separation and configuration of data following Layer 2 or the system management entity. Further to that, Layer 2 or the system management entity conducts construction and separation of physical slot by adding the preamble and the unique word, etc.

2.5.1.2 Features of Layer 2

LLC Sublayer supports 2 types of communication services (Type 1 operation : Unacknowledged connectionless-mode services, Type 3 operation : acknowledged connectionless-mode services). MAC Sublayer supports the following service contents in order to perform communication management of radio channels.

(1) Association (link connection)
(2) Slot (Frame) control
(3) Slot-by- slot data separation and processing
(4) Control of request for partial resend in MAC Sub Layer level
(5) Simplified security communication (scramble)

2.5.1.3 Features of Layer 7

Layer 7 provides the application with communication control tools. It provides the services to the application, and transmits and receives data via LLC sublayer in Layer 2. It can provide the services to more than one application (so-called multi-application). It conducts association process and application management through a linkage with Layer 2.

2.5.2 Communication Service

It is divided into two phases, i.e., the association phase and the communication phase. (By taking the example of Fig. 2.4.2-1, an operation example is shown in Fig. 2.5.2 for reference.)

(1) Association phase

It is a phase where Mobile Station registers to Base Station (entry). It is generally divided into the phase of link channel establishment and the phase of service establishment.

a. The phase of link channel establishment

Mobile Station (OBE) receives FCMC to which communication control information about frame configuration, etc. sent from RSU are added, and, if needed, interprets the communication control information including protocol types.

ⅰ. Mobile Station (OBE) judges the contents of FCMC (Frame Control Message Slot), chooses an ACTC (Activation channel) in ACTS randomly, adds the link address, transfers the ACTC (Activation channel) to Base Station (RSU) and performs a request for association.

ⅱ. In the following frame, Base Station (RSU) allocates a link address and a data slot to a Mobile Station, and transmits after adding information. Mobile Station receives a correct FCMS added with a proper link address, and by interpreting the information the phase of link channel establishment is completed.

After this, normally it proceeds to the phase of service establishment. There is a simplified association (connection) process by which the communication phase is commenced directly and, hence, omitting the phase of service (application) establishment. The operation of the normal phase of service establishment is described hereunder.

b. The phase of Service (Application) establishment

This phase establishes applications selectively, and it shall be decided that Mobile Station performs the communication with which Base Station (RSU) and by which application.

ⅰ. By adding to a Beacon Service Table (BST) and using a message data slot (MDS), Base Station (RSU) transmits parameters of applications, which are available from Base Station (RSU) by using message data slot (MDS).

ⅱ. Mobile Station (OBE) transmits the response, corresponding to the application in the BST, to Base Station (RSU) by using MDS as a vehicle service table (VST), establishes the application for communication and proceeds to the communication phase.

(2) Communication phase

The Base Station allocates a communication slot (MDS) in the uplink or downlink to a requesting unit or plural groups of Mobile Stations and performs data exchange. After sending Ack/Nack by using an Ack channel (ACKC) within the same slot, request for resend control is performed either when Nack is received or Ack/Nack is not received in a limited period of time.

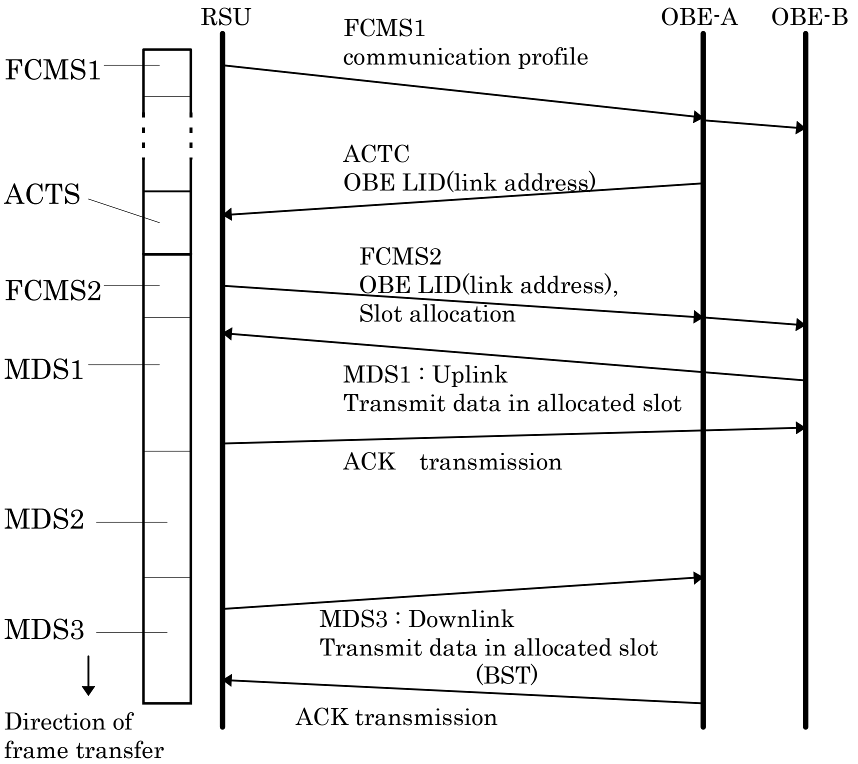


Fig. 2.5.2 Example of communication transaction

2.5.3 Numbering plan (Link address)

It is assumed that Link addresses for communication and the numbers of each type of equipment are different. In order to protect communication privacy, an address with a length of 4 octets, chosen by Mobile Station at random, is to be used as the link address. This address is commonly used as an ID number of SAP (Service Access Point) of Layer 1, Layer 2 and Layer 7 of Base Station and Mobile Station.

The details are defined in the subclause 4.2.4.2.1.8.2.

2.5.4 Other related rules

The SDL* diagrams indicate typical functional states and flows, and a flow which differs from them is also acceptable if it results in equivalent functions.

* SDL : Functional Specification and Description Language specified in ITU-T Z-series recommendations.

2.6 Type of secured communication

A simplified type of security communication is standardized.

Chapter 3　Technical Requirements for Radio Facilities

3.1　Overview

This chapter specifies the technical requirements for radio facilities and equipment.

3.2　General conditions

The radio facilities and equipment shall include carrier frequency oscillator(s).

3.2.1　Radio frequency bands

The radio frequency bands to be used shall be 5.8 GHz bands.

3.2.2　Carrier frequency spacing

The carrier frequency spacing shall be 5 MHz.

3.2.3　Transmit-receive frequency separation

The transmit-receive frequency separation shall be 40 MHz.

3.2.4　Operating method and multiple access

The operating method shall be one-way operation, semi-duplex operation, or duplex operation. The multiple access shall be TDMA (time division multiple access).

3.2.5　Access method

The access method shall be TDMA-FDD (frequency division duplex).

3.2.6　Number of multiplexed circuits

The maximum number of multiplexed circuits on a TDMA channel shall be eight.

3.2.7　Data transmission method

The data transmission method shall be one-way, half duplex, or full duplex for base stations, one-way, or half duplex for mobile stations.

3.2.8　Modulation method

The modulation method shall be an ASK (amplitude shift keying) or $\pi/4$ shift QPSK.　The roll-off rate is applied to only $\pi/4$ shift QPSK and 100% transmission.

3.2.9 Modulation signal

In case of ASK, the bit rate shall be 1024 kbps and the modulation signal rate after coding shall be 2048 kbaud.
In the case of π/4 shift QPSK, the bit rate shall be 4096 kbps and the modulation signal rate 2048 kbps.
The data coding method shall be a split phase code in ASK, and NRZ code in π/4 shift QPSK.
The accuracy of the bit rate shall be $\pm 100\times 10^{-6}$ or less.

3.2.10 Access control method

The access control method shall be an adaptive slotted ALOHA method.

3.2.11 Frame length and slot length

The frame length shall be 9 slots or less including FCMS (frame control message slot).
The slot length shall be 100 octets (800 bits constant) on the basis of bit rate 1024 kbps in case of ASK modulation.

3.2.12 Wireless call number (call sign)

The wireless call number (call sign) memory in mobile stations or test equipment shall be able to store and transmit the wireless call number (call sign) which is managed by the organization approved by the Minister of Public Management, Home Affairs, Posts and Telecommunications.

3.2.13 One cabinet

The radio facilities and equipment, except the following equipment and power supplies, shall be installed inside one cabinet. The cabinet shall not be easily opened.

a. Antenna(s)
b. Displays for showing operational conditions of transmitter or receiver.
c. Additional equipment for data processing and the similar equipment to this.
d. Signal processing equipment, which is not easily removed from the one cabinet above mentioned.

3.2.14 Security measures

The radio facilities and equipment should be designed taking into consideration the authentication and the scrambles (as specified in detail in chapter 4) to avoid a false charge or unfair use.

3.2.15 Countermeasures against electromagnetic interference

Vehicle-mounted mobile stations should be designed to prevent mutual electromagnetic interference between the mobile stations and electrical equipment for automobiles.

3.3 Conditions for modulation method

3.3.1 Modulation method

The modulation method shall be ASK (amplitude shift keying) or π/4 shift QPSK..

3.3.1.1 ASK

3.3.1.1.1 Modulation method

Fig. 3.1 shows a schematic diagram which specifies the modulation method in this standard of ASK. **(Informative)**

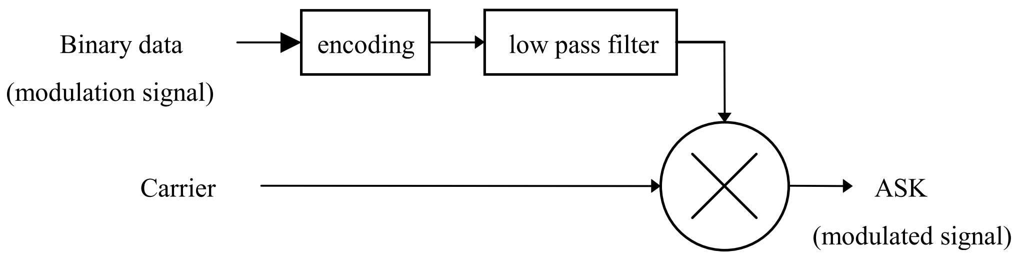


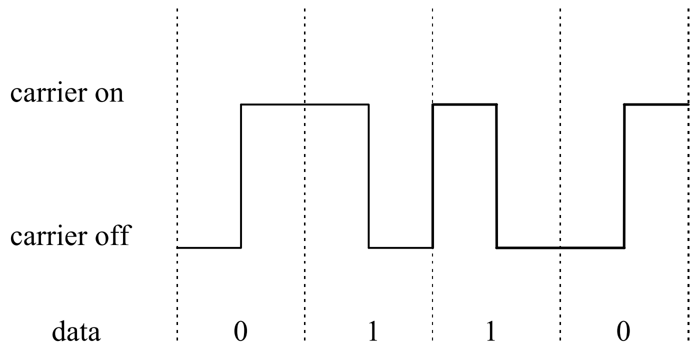
Fig. 3.1 Schematic diagram of ASK modulation circuit

3.3.1.1.2 Data coding method

The data coding method shall be the split phase code (manchester code) method for both base stations and mobile stations.

Data bit “1” : The RF signal is sent in the first half of the bit duration and the RF signal is not sent in the latter half.

Data bit “0” : The RF signal is not sent in the first half of the bit duration and the RF signal is sent in the latter half.



(Example : transmission data is 0110)

Fig. 3.1.1 Split phase code

3.3.1.1.3 Transmission bit rate

Transmission bit rate shall be 1024.000kbps

3.3.1.2 π/4 shift QPSK

3.3.1.2.1 Modulation method

Fig.3.3.1.2.1 shows a schematic diagram which specifies the modulation method of π/4 shift QPSK. **(Informative)**

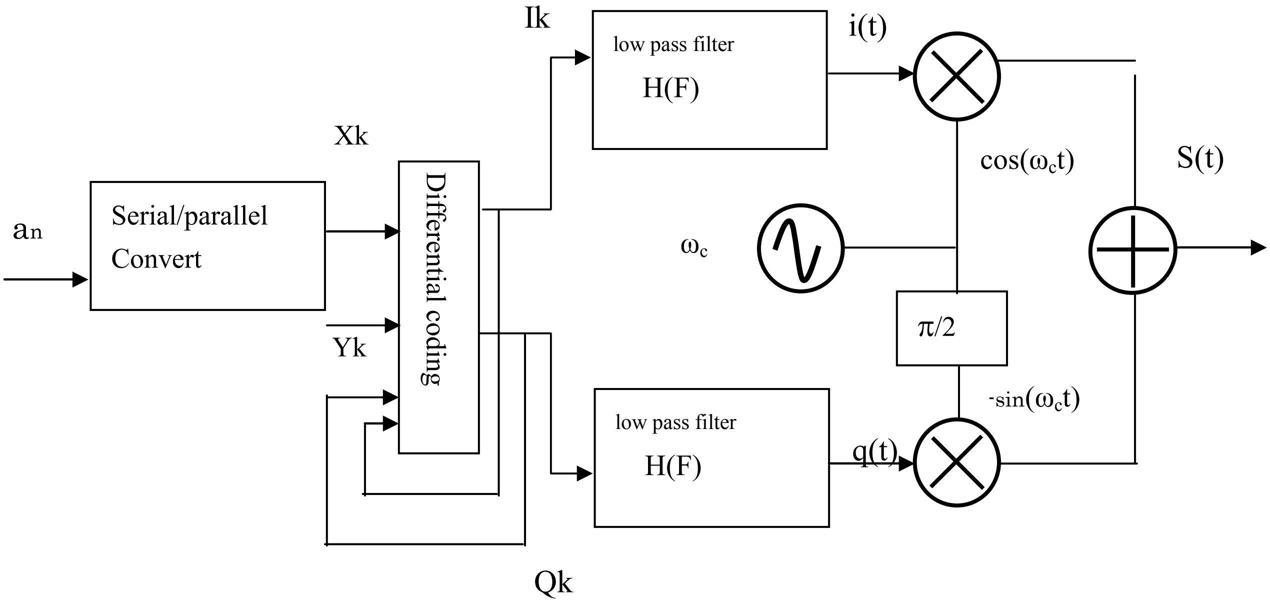


Fig.3.3.1.2.1 π/4 Shift QPSK modulation circuit

3.3.1.2.2 Differential coding

The serial signal is converted to the symbol of (X_k, Y_k) by the serial/parallel converter, and converted to SP signal (I_k, Q_k) by the differential coding unit. The conversion from the serial signal to (X_k, Y_k) (Binary/quadrature convert) is made as follows, and the equation from (X_k, Y_k) to (I_k, Q_k) shall be in Equation3.3-1 and Table 3.3.1.

Binary data series ....a_{n-1} , a_n , a_{n+1},.............

Symbol series (a_n , a_{n+1})

X_k , Y_k

$$I_k = I_{k-1}\cos\{\Delta\Phi(X_k,Y_k)\} - Q_{k-1}\sin\{\Delta\Phi(X_k,Y_k)\}$$

$$Q_k = I_{k-1}\sin\{\Delta\Phi(X_k,Y_k)\} + Q_{k-1}\cos\{\Delta\Phi(X_k,Y_k)\}$$

….(3.3-1)

Table 3.3.1 differential coding rule

X_k	Y_k	$\Delta\Phi$
1	1	$-3\pi/4$
0	1	$3\pi/4$
0	0	$\pi/4$
1	0	$-\pi/4$

（2）The signal space diagram shall be in Fig3.3.1.2.2.

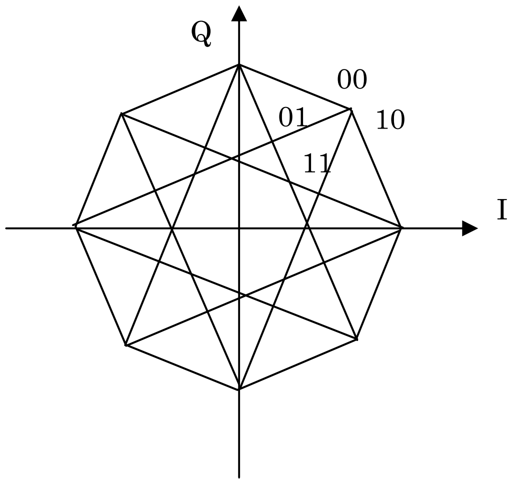


Fig.3.3.1.2.2 The signal space diagram of π/4 shift QPSK

3.3.1.2.3 Base band regulation

（1） The base band regulation shall be expressed by Nyquist bandwidth H(f) in Equation 3.3-2

$$|H(f)| = \begin{cases} 1 & 0 \le |f| < (1-\alpha)/2T \\ \cos^2[(T/4\alpha)(2\pi|f| - \pi(1-\alpha)/T)] & (1-\alpha)/2T \le |f| < (1+\alpha)/2T \\ 0 & (1+\alpha)/2T \le |f| \end{cases}$$

where, $T = \frac{1}{2048} \times 10^{-3}$ sec

…..(3.3-2)

（2） Roll off rate

The cosine roll off rate shall be 1.0. (transmission; 100%)

（3） The phase characteristics of H(f) shall be linear.

3.3.1.2.4 Method of orthogonal modulation

S(t) in Fig.3.3.1.2.1 shall be withdrawn by the following equation.

$$S(t) = \mathrm{Re}\,[\{i(t) + j * q(t)\}\exp(j\omega_c t)] = i(t)\cos(\omega_c t) - q(t)\sin(\omega_c t) \quad \text{…..(3.3-3)}$$

where,

$$I(t) = F^{-1}[H(f) * F\{I_k(t)\}]$$
$$q(t) = F^{-1}[H(f) * F\{Q_k(t)\}] \quad \text{…..(3.3-4)}$$

$F(X)$, $F^{-1}(x)$ show Fourier transformation , reverse Fourier transformation of X , x.
$I_k(t)$, $Q_k(t)$ show the continuous impulse function which owns energy proportional to the square of each amplitude of I_k , Q_k.

3.3.1.2.5 Transmitting spectrum

See 3.4.2.4

3.3.1.2.6 Transmission bit rate

Transmission bit rate shall be 4096.000kbps

3.4 Conditions relating to transmitter and receiver

3.4.1 Carrier frequencies and carrier numbers

The relationship between carrier frequencies and carrier numbers is listed in Table 3.1.(*1)

Table 3.1 Relationship between carrier frequencies and carrier numbers

Carrier number	Carrier frequency(MHz)	application	remarks
D7	5,775.000	Downlink	
D6	5,780.000	Downlink	
D5	5,785.000	Downlink	
D4	5,790.000	Downlink	
D1	5,795.000	Downlink	(*2)
D3	5,800.000	Downlink	
D2	5,805.000	Downlink	(*2)
U7	5,815.000	Uplink	
U6	5,820.000	Uplink	
U5	5,825.000	Uplink	
U4	5,830.000	Uplink	
U1	5,835.000	Uplink	(*2)
U3	5,840.000	Uplink	
U2	5,845.000	Uplink	(*2)

(*1) : Carrier number Di and Ui shall be in pairs.
A pair of carrier numbers D1 and U1 corresponds to A mode, and a pair of D2 and U2 corresponds to B mode. Refer to subclause 4.2.4.2.1.3 (3).
Downlink : Transmission from base station or test equipment to mobile stations.
Uplink : Transmission from mobile stations to base station or test equipment.
(*2) : D1,D2,U1,U2 are used in ETC.

3.4.2 Transmission characteristics

3.4.2.1 Transmit power

(1) Definition

a. Facilities and equipment having antenna connector : Power fed to antenna.

b. Facilities and equipment in which antenna is installed : Antenna radiation power measured at the test site or measured using a RF coupler which is calibrated at the test site.

Note) The transmit power of ASK shall be expressed in the peak envelope power and the power of QPSK shall be expressed in the average power of the burst.

(2) Specification

a. Base station

Maximum transmit power : Shall be 10 mW for class 1 base station, 300 mW for class 2 base station.

Transmission power accuracy : Shall be within +20 % and -50 %.

b. Mobile stations

Maximum transmit power : Shall be 10 mW.

Transmission power accuracy : Shall be within +50 % and -50 %.

c. Test equipment

Maximum transmit power : Shall be 1 mW.

Transmission power accuracy : Shall be within +20 % and -50 %.

3.4.2.2 Mobile station maximum e.i.r.p.

(1) Definition

Power supplied to an antenna multiplied by the absolute gain of the antenna in a given direction is called equivalent isotropic radiation power (e.i.r.p.) and an e.i.r.p. of the antenna directed to a maximum radiated power is called maximum e.i.r.p.

(2) Specification

The mobile station maximum e.i.r.p. shall be within 8.0 dBm e.i.r.p. and 14.8 dBm e.i.r.p.

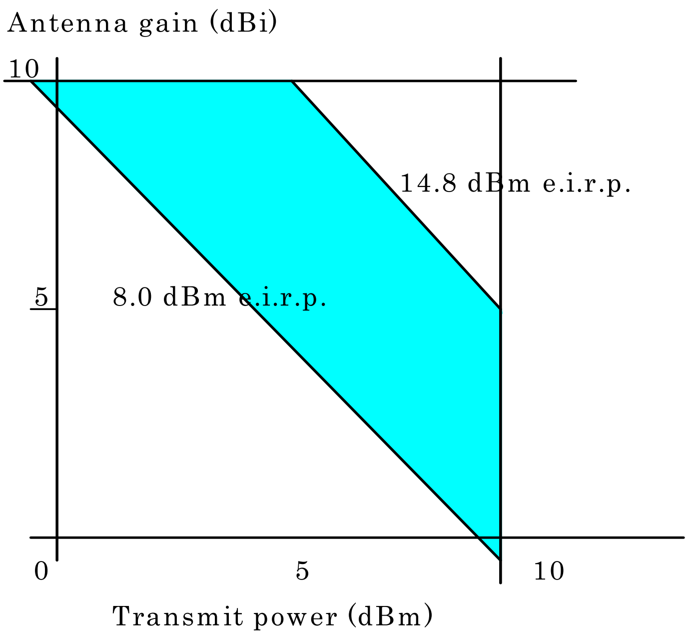


Fig. 3.1.2 Mobile station maximum e.i.r.p.

3.4.2.3 Transmission of wireless call number (call sign)

The wireless call number is specified in Appendix C. Refer to subclause 3.2.1.

3.4.2.4 Adjacent channel leakage power

(1) Definition

The adjacent channel leakage power shall be defined as the ratio to the power (peak envelope power in ASK, *average power of the burst in QPSK* refer to subclause 3.4.2.1) that is radiated within a bandwidth of ±2200 kHz, of which center frequency is separated by 5 MHz (adjacent) and 10 MHz (adjacent-adjacent) from the subject carrier frequency when the subject carrier is modulated with the reference coded test signal at the same bit rate as that of transmission bit rate.

(2) Specification

The adjacent channel leakage power shall be –30dB or less (adjacent) and -40 dB or less (adjacent-adjacent) for base station, mobile stations, and test equipment.

3.4.2.5 Eye pattern

(1) Definition

Free decision distance in width and height of a digital signal. An ideal digital signal has a decision height of 100 % which is equal to the difference of high level and low level.

Eye pattern (amplitude) = 2B/(A+B).

where, A : max. amplitude,

B : min. amplitude.

Eye pattern (time) = 2B’/(A’+B’).

where, A’ : max. zero-cross time width,

B’ : min. zero-cross time width.

(2) Specification

a: The eye pattern (amplitude) shall be 80 % or more in ASK.

b: The eye pattern (time) shall be 80 % or more in ASK.

The eye pattern is not specified for π/4 shift QPSK.

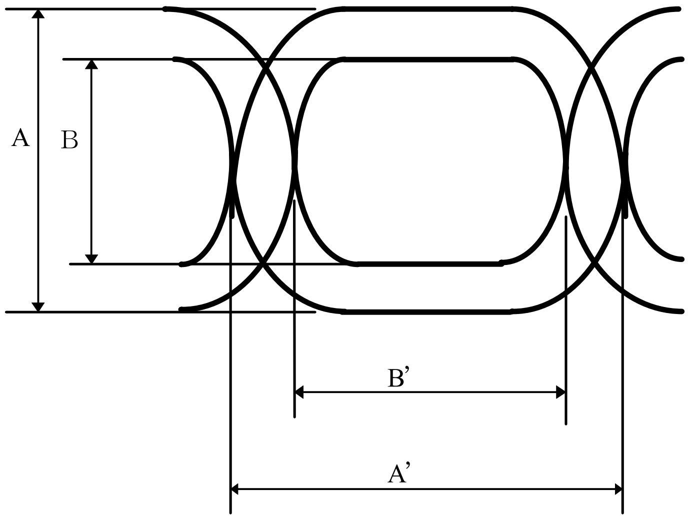


Fig. 3.2 Eye pattern

3.4.2.6 Burst transmission transient response time

(1) Definition

The burst transmission transient response time for both base station and mobile stations shall be defined by the duration of a burst signal modulated by the digital bit stream;

to fall off from the average power over the transmit burst to LP

or

to rise from LP to the average power over the transmit burst.

Where, LP is the specification for leakage power during carrier off period (refer to Section 3.4.2.7).

(2) Specification

a. Time characteristics : $2|\Delta Tabs| + Tbst < 15.625\ \mu S$

Where, $\Delta Tabs$: Refer to subclause 3.4.2.13

Tbst : Burst transmission transient response time.

b. The leakage power during carrier off period shall meet the specification of subclause 3.4.2.7.

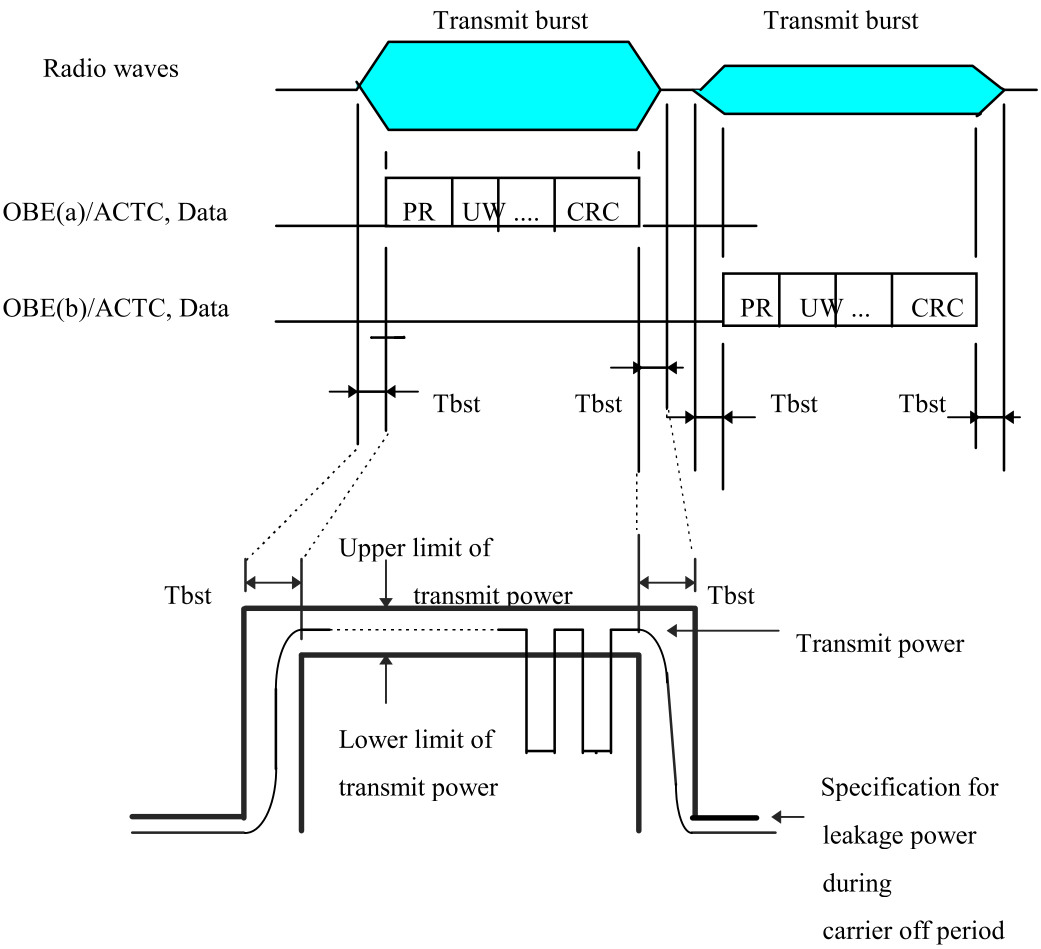


Fig. 3.3 Specification for burst transmission transient response time

Note) This Fig is applied to ASK.
In case of QPSK, the mask shall be same as this; turn on during the R (ramp bit) added before PR and the time shall be set at the start point of PR same as ASK.

3.4.2.7 Leakage power during carrier off period

(1) Definition
The leakage power during carrier off period shall be defined as the power radiated in the occupied bandwidth of the subject carrier during carrier off period.

(2) Specification
Base station, mobile stations, and test equipment : 2. 5 µW or less.

(3) Measurement
Measurement shall be carried out during the communication.

3.4.2.8 Transmission spurious

(1) Definition
The transmission spurious shall be defined as the average power of spurious (note) emissions at the individual frequencies fed to the feeder.

Note :
Spurious emissions refer to radio wave emissions on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions at frequencies above and below the fundamental frequency, parasitic emissions, intermodulation products and frequency conversion products, but exclude emissions at frequencies immediately outside the necessary bandwidth which result from the modulation process for transmission of information.

(2) Specification
The transmission spurious shall be 25 μW or less for both base station and mobile stations.

(3) Measurement
Measurement shall be carried out during the communication.

3.4.2.9 Occupied bandwidth

(1) Definition
The occupied bandwidth shall be defined as the width of a frequency band such that, below the lower and above the upper frequency limits, the mean power emitted are each equal to 0.5 % of the total mean power of a given emission.

(2) Specification
The occupied bandwidth shall be 4.4 MHz or less for both base station and mobile stations.
The transmit cosine roll off, roll off rate shall be 1.0 in case of QPSK.

3.4.2.10 Frequency tolerance

(1) Definition
The frequency tolerance shall be defined as the maximum permissible departure by the center frequency of the frequency band occupied by an emission from the assigned frequency. The frequency tolerance is expressed in parts per 10^6.

(2) Specification
ASK
Base station : $\pm 20 \times 10^{-6}$ or less.
Mobile stations : $\pm 50 \times 10^{-6}$ or less.
QPSK
Base station : $\pm 5 \times 10^{-6}$ or less.
Mobile stations : $\pm 20 \times 10^{-6}$ or less.
Test equipment shall be $\pm 5 \times 10^{-6}$ or less for both ASK and QPSK.

3.4.2.11 Modulation index, Modulation accuracy

3.4.2.11.1 Modulation index (ASK)

(1) Definition
The modulation index shall be defined as the size of the variation of the modulation pa-

rameter (frequency, amplitude, phase) caused by the modulation signal (data signal). It is expressed as follows in ASK.

Modulation index = (Vmax-Vmin) / (Vmax+Vmin).

Where, Vmax : Crest of amplitude waveform after detection by diode.

Vmin : Bottom of amplitude waveform after detection by diode.

(2) Specification

The modulation index shall be within 0.75 and 1.0 for base station, mobile stations, and test equipment.

3.4.2.11.2 Modulation accuracy (QPSK)

(1) Definition

The modulation accuracy shall be the effective value of vector error at signal point.

(2)Specification

The modulation accuracy for base station, mobile station, and test equipment shall be 12.5% or less.

3.4.2.12 Cabinet radiation

Cabinet radiation shall be 2.5 μW or less for base station, mobile station, and test equipment.

3.4.2.13 Allowable deviation of absolute signal transmission time

(1) Definition

The allowable deviation of absolute signal transmission time shall be defined as the deviation of time after the start of base station control signal FCMC (Frame Control Message Channel) transmission until the end of each slot reception from the reference time. Refer to Fig. 3.4.

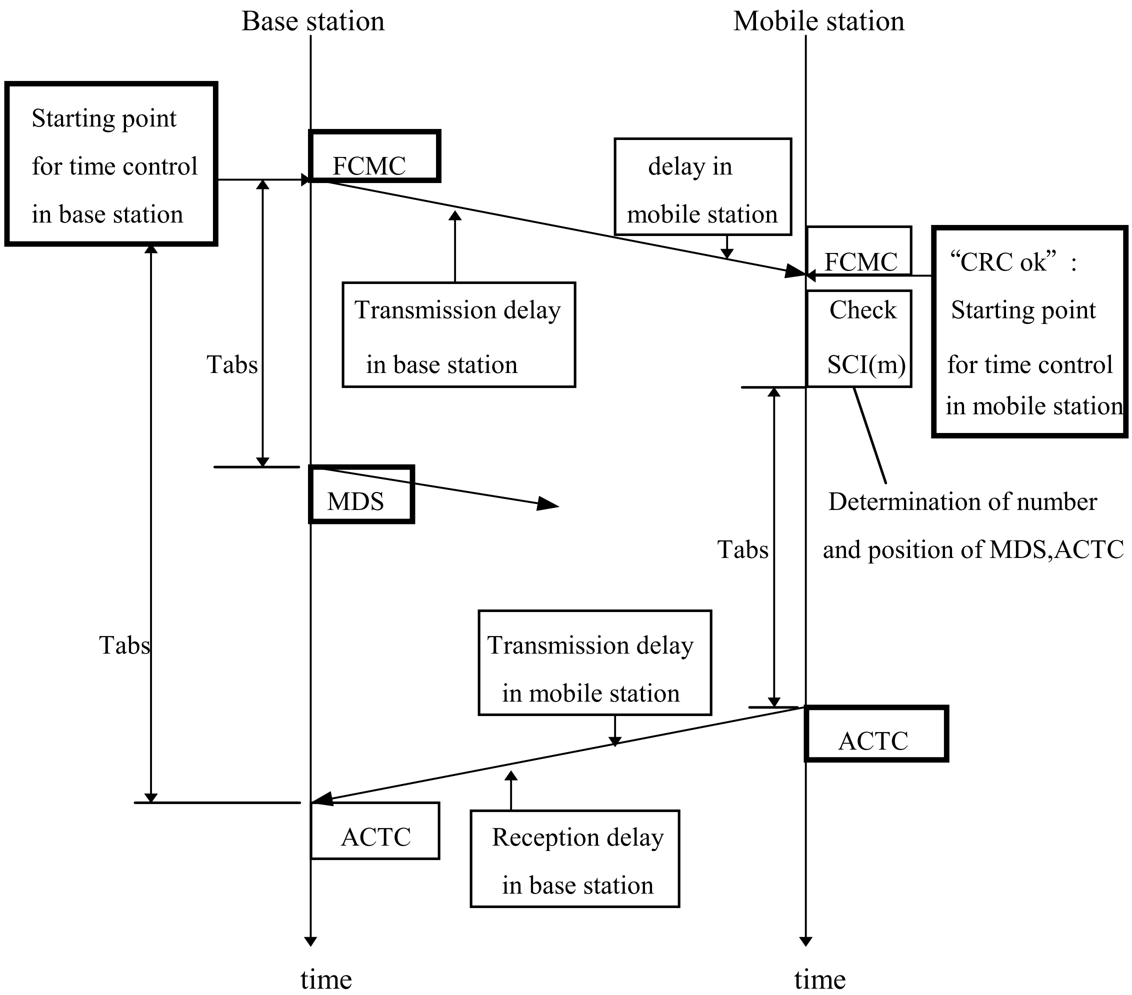
(2) Specification

$2|\Delta Tabs| + Tbst < 15.625\ \mu S.$

$\Delta Tabs < 5\ \mu S.$

Where, ΔTabs : Deviation of absolute signal transmission time.

Tbst : Burst transmission transient response time. Refer to subclause 3.4.2.6.



Tabs : Absolute signal transmission time

Fig. 3.4 Examples of absolute signal transmission time

3.4.3 Reception characteristics

3.4.3.1 Frequency tolerance of local oscillator

(1) Definition

The frequency tolerance of the local oscillator shall be defined by the maximum tolerance of the oscillator frequency.

(2) Specification

The frequency tolerance of the local oscillator is not specified in this standard.

3.4.3.2 Reception sensitivity

(1) Definition

The reception sensitivity shall be defined by the incident power (dBm e.i.r.p.) or the receiver input level (dBm) which yields a bit error rate (BER) of $1x10^{-5}$ when a signal with a length of $1x10^{6}$ bits or more modulated by the pseudo random binary sequence.

(2) Specification

a. e.i.r.p. specification

The BER of mobile stations shall be $1x10^{-5}$ or less for the incident power within -60.5 dBm e.i.r.p. and -39.6 dBm e.i.r.p. at the direction of antenna bore sight.

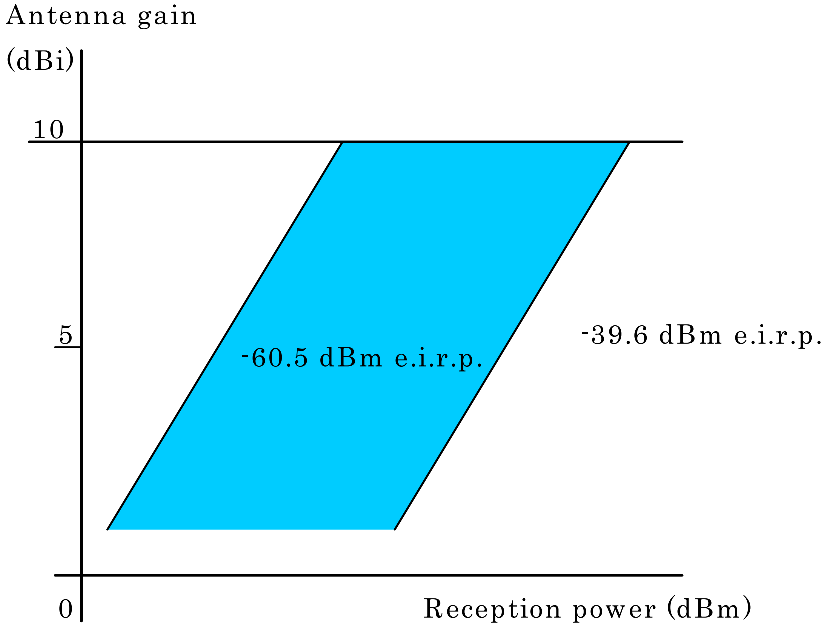


Fig. 3.4.1 Reception sensitivity of mobile stations

b. No response specification

The mobile station shall not respond to the data transmission from a base station for the incident power of -70.5 dBm e.i.r.p. or less.

c. Reception sensitivity (Informative)

ASK

Base station : Class 1 : The reception sensitivity should be -65 dBm or less.
Class 2 : The reception sensitivity should be -75 dBm or less.

Mobile stations : The reception sensitivity should be -60 dBm or less.

QPSK

Not specified.

Test equipment

Not specified.

(3) Definition of specified reception sensitivity

The specified reception sensitivity shall be defined as follows.

ASK

Base station : Class 1 : The specified reception sensitivity shall be -65 dBm.

Class 2 : The specified reception sensitivity shall be -75 dBm.

Mobile stations : The specified reception sensitivity shall be -60 dBm.

QPSK

Not specified. However, it is recommended the sensitivity of Class 1 Base station be –65dBm, Class 2 station be –75dBm, and Mobile station be –65dBm.

Test equipment

Not specified

3.4.3.3 Bit error rate performance

(1) Definition

The bit error rate performance shall be defined by the bit error rate measured with a signal modulated by a pseudo random binary sequence at the specified reception sensitivity.

(2) Specification

The bit error rate performance is not specified in this standard.

(3) Informative

The bit error rate performance should be $1x10^{-5}$ or less.

3.4.3.4 Receiver bandwidth

(1) Definition

The receiver bandwidth shall be defined as the 3 dB bandwidth of the receiver.

(2) Specification

The receiver bandwidth is not specified in this standard.

3.4.3.5 Power limits within communication zone

(1) Definition

The power limits within communication zone shall be defined by the minimum and maximum values of incident power in front of the antenna. These two values also specify the dynamic range of the receiver. Power values are measured without any additional losses due to rain or misalignment.

(2) Specification

ASK

Base station : For the receiver of class 1 base station :

The minimum incident power shall be -58 dBm e.i.r.p.

The maximum incident power shall be -46 dBm e.i.r.p.

For the receiver of class 2 base station :

The minimum incident power shall be -72 dBm e.i.r.p.

The maximum incident power shall be -48 dBm e.i.r.p.

Mobile stations : For the receiver of mobile station responding to class 1 base station :
The minimum incident power shall be -54 dBm e.i.r.p.
The maximum incident power shall be -41 dBm e.i.r.p.
For the receiver of mobile station responding to class 2 base station :
The minimum incident power shall be -56 dBm e.i.r.p.
The maximum incident power shall be -40 dBm e.i.r.p.

QPSK
Not specified.

3.4.3.6 Adjacent signal selectivity

(1) Definition
The adjacent signal selectivity shall be defined as the level ratio of the interfering signal to the desired signal, specified by the following statement:
The level of desired signal shall be set to +3 dB higher than the level of the specified reception sensitivity* . The level of interfering signal shall be the one yielding a bit error rate of 1×10^{-5} on the desired signal. The interference signal shall be detuned by F Hz and modulated by a pseudo random binary sequence.
(* Refer to Section 3.4.3.2 (3) for the specified reception sensitivity)

(2) Specification
The adjacent signal selectivity shall meet the following requirements for both base station and mobile stations.

Base station
Class 1
F = 10 MHz off : 15 dB or higher.
F = 30 MHz off : 20 dB or higher.
F = 50 MHz off : 20 dB or higher.
Class2
F = 10 MHz off : 20 dB or higher.
F = 30 MHz off : 20 dB or higher.
F = 50 MHz off : 20 dB or higher

mobile stations and test equipment
F = 10 MHz off : 15 dB or higher.
F = 30 MHz off : 20 dB or higher.
F = 50 MHz off : 20 dB or higher

3.4.3.7 Intermodulation performance

(1) Definition
The intermodulation performance shall be defined as the level ratio of the either of the two interfering signals to the desired signal.

(2) Specification
The intermodulation performance is not specified in this standard.

3.4.3.8 Spurious response rejection ratio

(1) Definition

The spurious response rejection ratio shall be defined as the level ratio of the interfering signal to the desired signal, specified by the following statement:
The level of desired signal shall be set to +3 dB higher than the level of the specified reception sensitivity* . The level of interfering signal shall be the one yielding a bit error rate of $1x10^{-5}$ on the desired signal. The interference signal shall be detuned inside or outside the 5.8 GHz ISM band and modulated by a pseudo random binary sequence.
(* Refer to subclause 3.4.3.2 (3) for the specified reception sensitivity.)
Where, Inside the 5.8 GHz ISM band : 5.725 - 5.875 GHz.

(2) Specification

a. Base station :

For the receiver of class 1 base station:

Inside the 5.8 GHz ISM band : The spurious response rejection ratio shall be 2328 dB or more.

Outside the 5.8 GHz ISM band : The spurious response rejection ratio shall be 16 dB or more.

For the receiver of class 2 base station;(Informative)

Inside the 5.8 GHz ISM band : The spurious response rejection ratio shall be 30 dB or more.

Outside the 5.8 GHz ISM band : The spurious response rejection ratio shall be 26 dB or more.

b. Mobile stations : (Informative)

Inside the 5.8 GHz ISM band : The spurious response rejection ratio shall be 24 dB or more.

Outside the 5.8 GHz ISM band : The spurious response rejection ratio shall be 18 dB or more.

Note : Image response is excepted.

c. Test equipment

Not specified.

3.4.3.9 Strength of secondary radio emissions

(1) Definition

The strength of secondary radio emissions shall be defined as the strength of radio waves emitted from the antenna terminal when the stations are in the receive mode.

(2) Specification

The strength of secondary radio emissions shall be 2.5µW or less for base station, mobile station, and test equipment.

3.4.3.10 Cabinet radiation

The cabinet radiation from the receiver is not specified in this standard.

3.4.4 Antenna

3.4.4.1 Classification of antenna [Informative]

(1) The classification of antenna is shown in Table 3.3.

Table 3.3 Classification of antenna (Example of ETC)

Class	Application
Type 1	• Lane based antenna • Shall be connected to class 1 base station
Type 2	• Navigation antenna (Wide-area) • Shall be connected to class 2 base station
Type 3	• Navigation antenna • Shall be connected to class 2 base station
Type 4	• Approach antenna • Shall be connected to class 2 base station
Mobile antenna	• Shall be connected to mobile station

(2) Installation condition of antenna (Informative)

Type 1 - 4 antennae are installed on a gantry or a single pole on the roadside.

Each antenna beam is directed downward to a predetermined communication zone.

Typical installation heights of antennae are as follows above the road surface.

Type 1 antenna : 5 m

Type 2 and type 3 antennas : 6 m

Type 4 antenna : 10 m

The mobile antenna is installed to a forward section inside or outside a vehicle and its beam is directed upward to receive the radio waves from or transmit to type 1 - 4 antennas.

The installation height of the mobile antenna is about 1 to 2 m above the road surface and different depending on the vehicle type.

(1) Communication zone (Informative)

a. Communication zone of type 1 antenna

Examples of communication zone of type 1 antenna are shown in Fig. 3.5 and Fig. 3.6. The communication zone is about 4m in length along the road, about 3m in width and 1m in height above the road surface.

The figures on the lane width etc. are the representative value in Fig. 3.5 and Fig. 3.6 (this is the same as Fig. 3.7 through Fig. 3.9).

b. Communication zone of type 2 antenna

An example of communication zone of type 2 antenna is shown in Fig. 3.7.

c. Communication zone of type 3 antenna

An example of communication zone of type 3 antenna is shown in Fig. 3.8.

d. Communication zone of type 4 antenna

An example of communication zone of type 4 antenna is shown in Fig. 3.9.

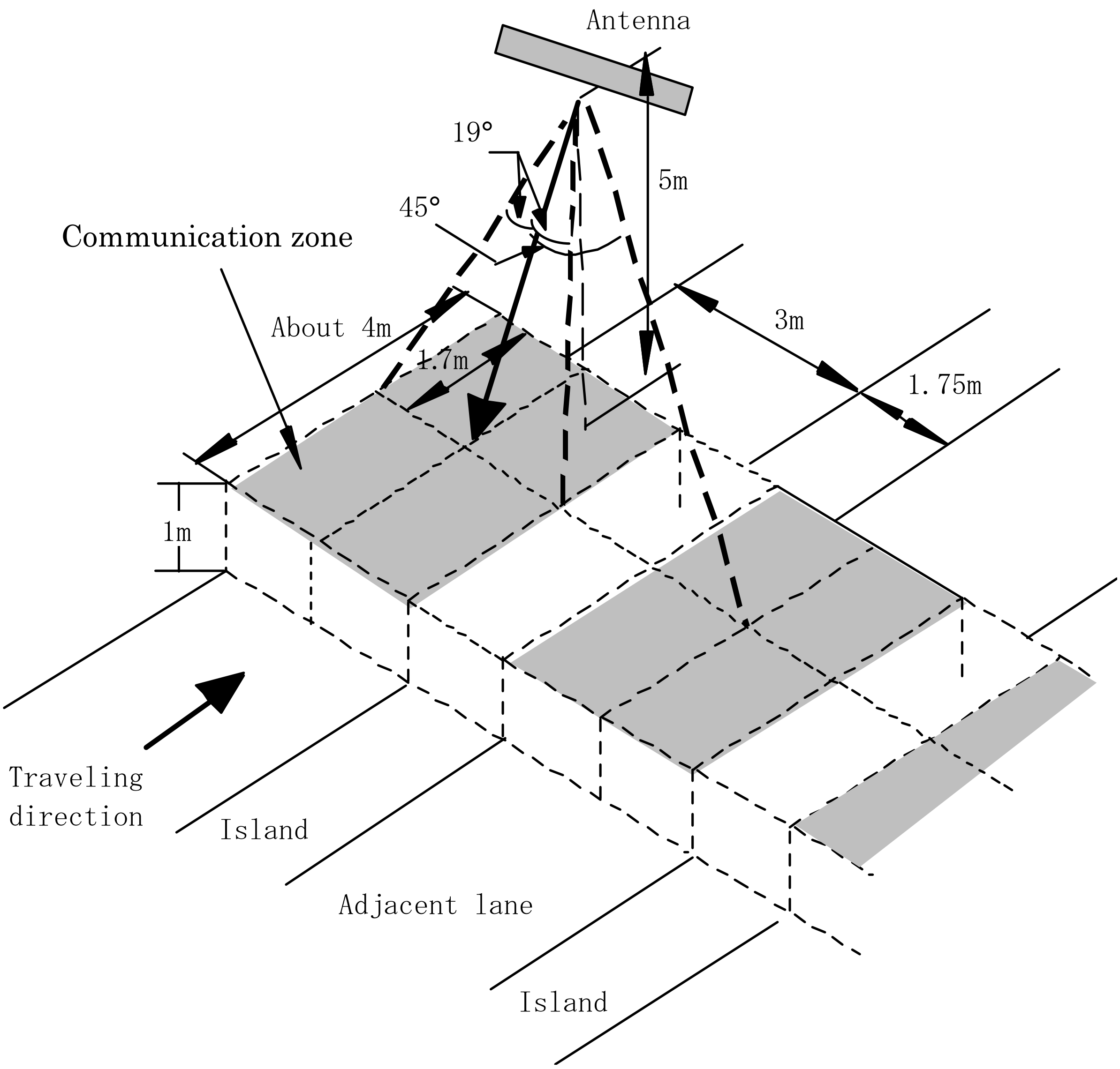


Fig. 3.5　Example of communication zone - Type 1 antenna

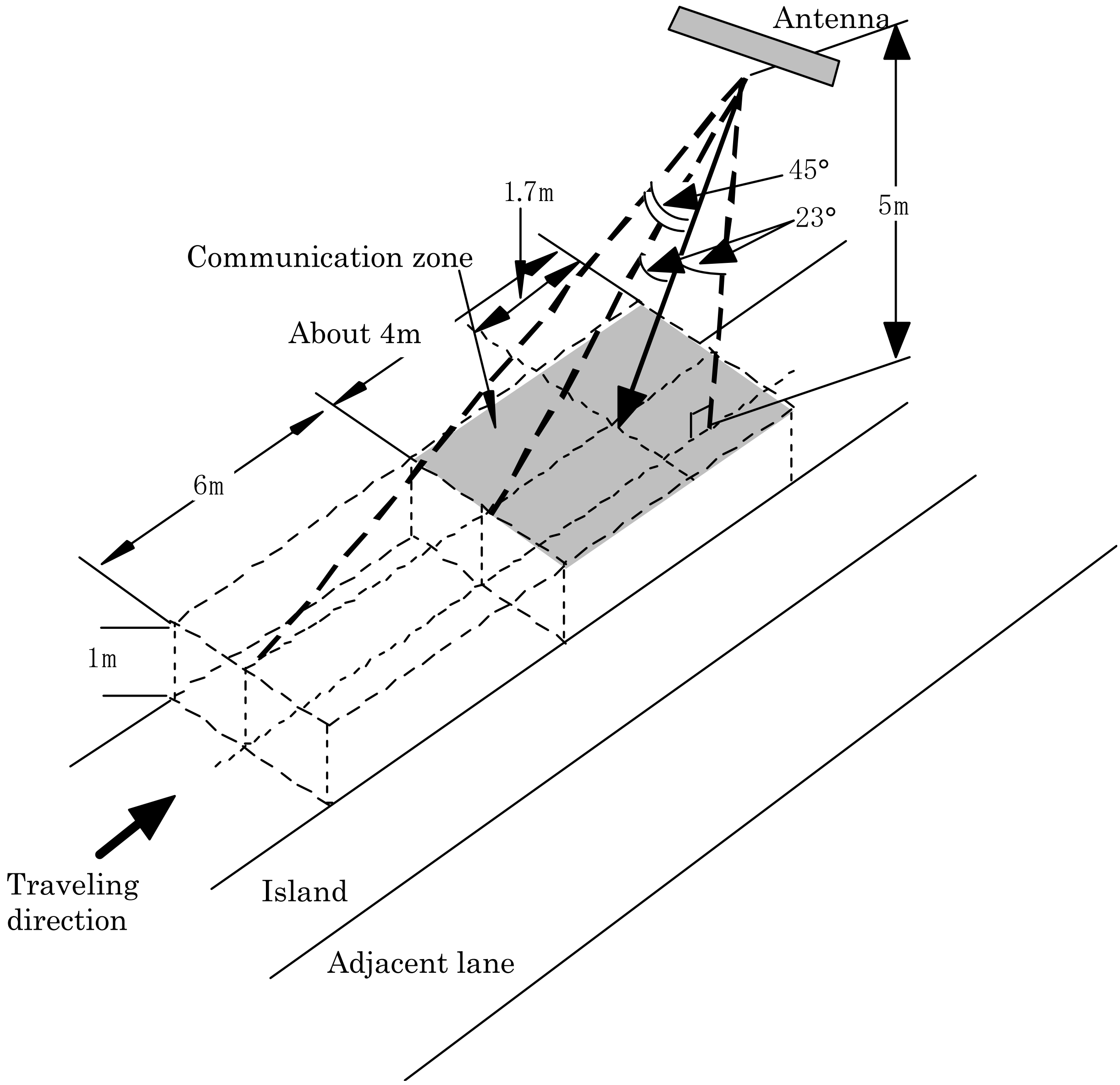


Fig. 3.6 Example of communication zone - Type 1 antenna

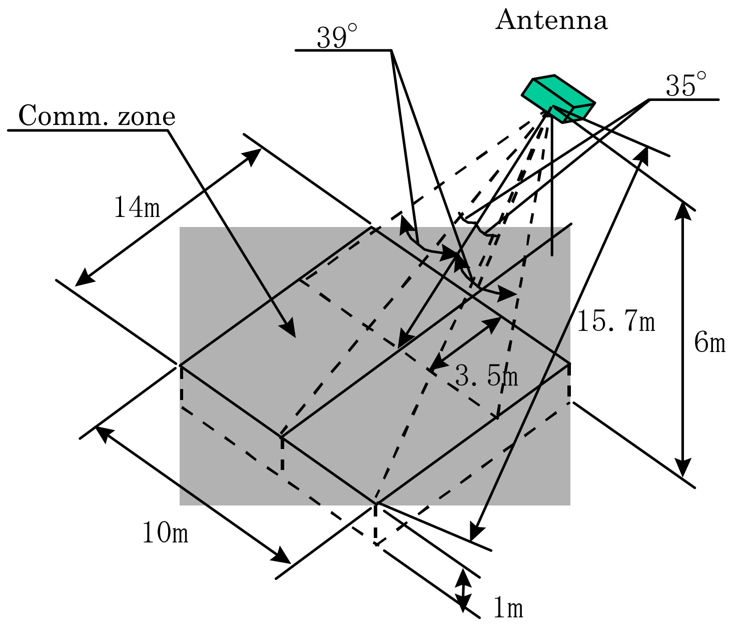


Fig. 3.7 Example of communication zone - Type 2 antenna

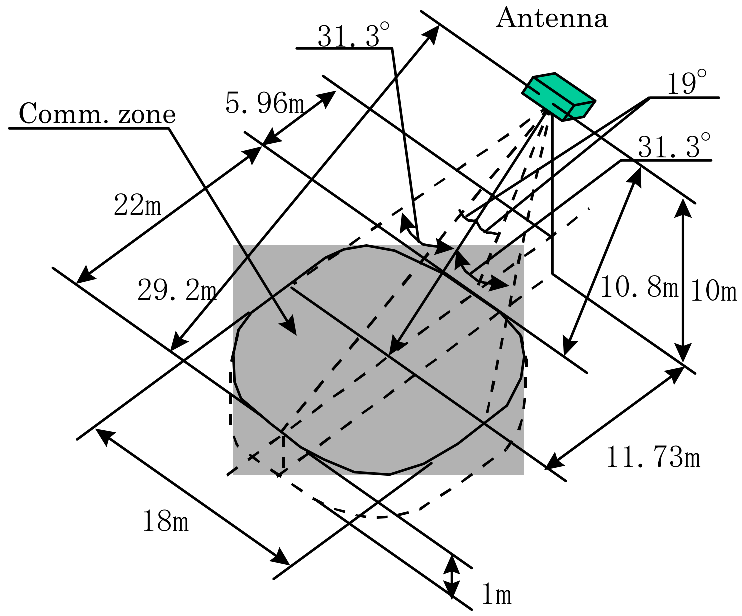


Fig. 3.8 Example of communication zone - Type 3 antenna

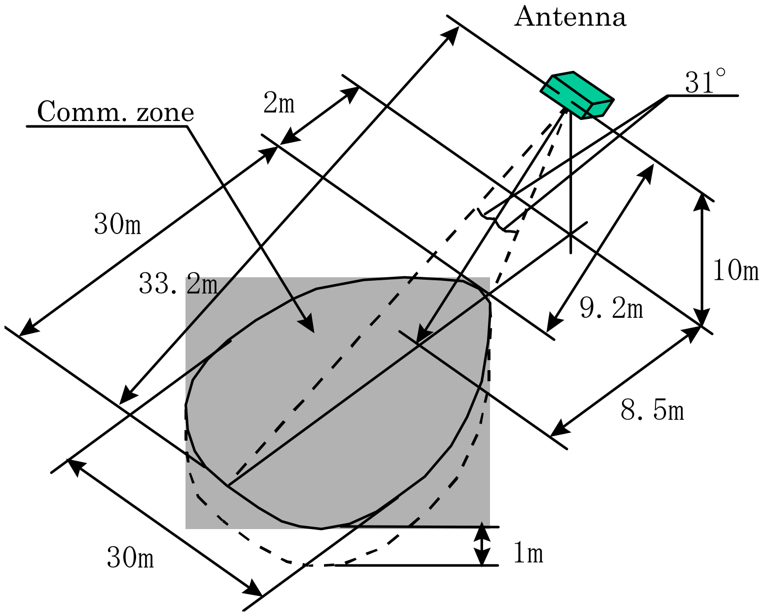


Fig. 3.9　Example of communication zone - Type 4 antenna

3.4.4.2 Gain of antenna

(1) Definition

The gain of antenna shall be defined as the ratio, usually expressed in decibels, of the power required at the input of a loss-free reference antenna to the power supplied to the input of the given antenna to produce, in a given direction, the same field strength or the same power flux-density at the same distance. When not specified otherwise, the gain refers to the direction of maximum radiation. The gain may be considered for a specified polarization.

The absolute gain shall be defined as the gain when the reference antenna is an isotropic antenna isolated in space.

(2) Specification

a. Base station : The antenna which is connected to the base station shall have the absolute gain of 20 dBi or less.

b. Mobile stations : The antenna which is connected to the mobile station shall have the absolute gain of 10 dBi or less.

c. Test equipment: The antenna which is connected to the test equipment shall have the absolute gain of 10 dBi or less.

3.4.4.3 Polarization

(1) Definition

The right-hand (clockwise) polarized wave shall be defined as the elliptically- or circularly-polarized wave, in which the electric field vector, observed in any fixed plane, normal to the direction of propagation, whilst looking in the direction of propagation, rotates with time in a right-hand or clockwise direction.

The left-hand (anticlockwise) polarized wave shall be defined, by the same way, as the rotation in a left-hand or anticlockwise direction.

(2) Specification

The polarization shall be the right-hand circular for both base station and mobile stations.

3.5 Test equipment

3.5.1 Maximum e.i.r.p of test equipment

(1) Definition

Power supplied to an antenna multiplied by the absolute gain of the antenna in a given direction is called equivalent isotropic radiation power (e.i.r.p.) and an e.i.r.p. of the antenna directed to a maximum radiated power is called maximum e.i.r.p.

(2)Specification

The test equipment maximum e.i.r.p. shall be 5.0 dBm e.i.r.p. or less. It shall be the lowest value required for testing.

Chapter 4 Communication Control System

4.1 Overview

This chapter specifies the communication control system of the radio interface utilized for the radio communication system. Hereafter, the radio interface is specified regarding the protocol model described in chapter 2.

4.1.1 Outline of Relationship between Layers, Layer Managements and System Management

Fig. 4.1.1 indicates an OSI reference model of this radio communication system. An entity of each layer provides data transmission service for a higher layer. Each layer management entity has an inherent management information base (MIB) providing access service to the higher layer management entities or the system management entity. Furthermore, the layer 2 management entity provides services for the association control. The system management entity provides services for management information service users.

The layer 2 management entity has the MIB in the MAC sublayer and does not have any MIB in the LLC sub layer (Parameters utilized for the LLC sublayer is specified by the MIB in the MAC sublayer management.). Moreover, either a layer 1 or a layer 7 management entity is not specified.
Each MIB is the virtual information data base consisted of variables or parameters utilized for elements of procedures of the each layer. Access to the same layer MIB is executed as direct reference and access to another layer MIB is executed as indirect reference using service primitives provided by each layer.

Service primitives and details of MIB for each layer and layer management entity are definitely specified in the layer standards.

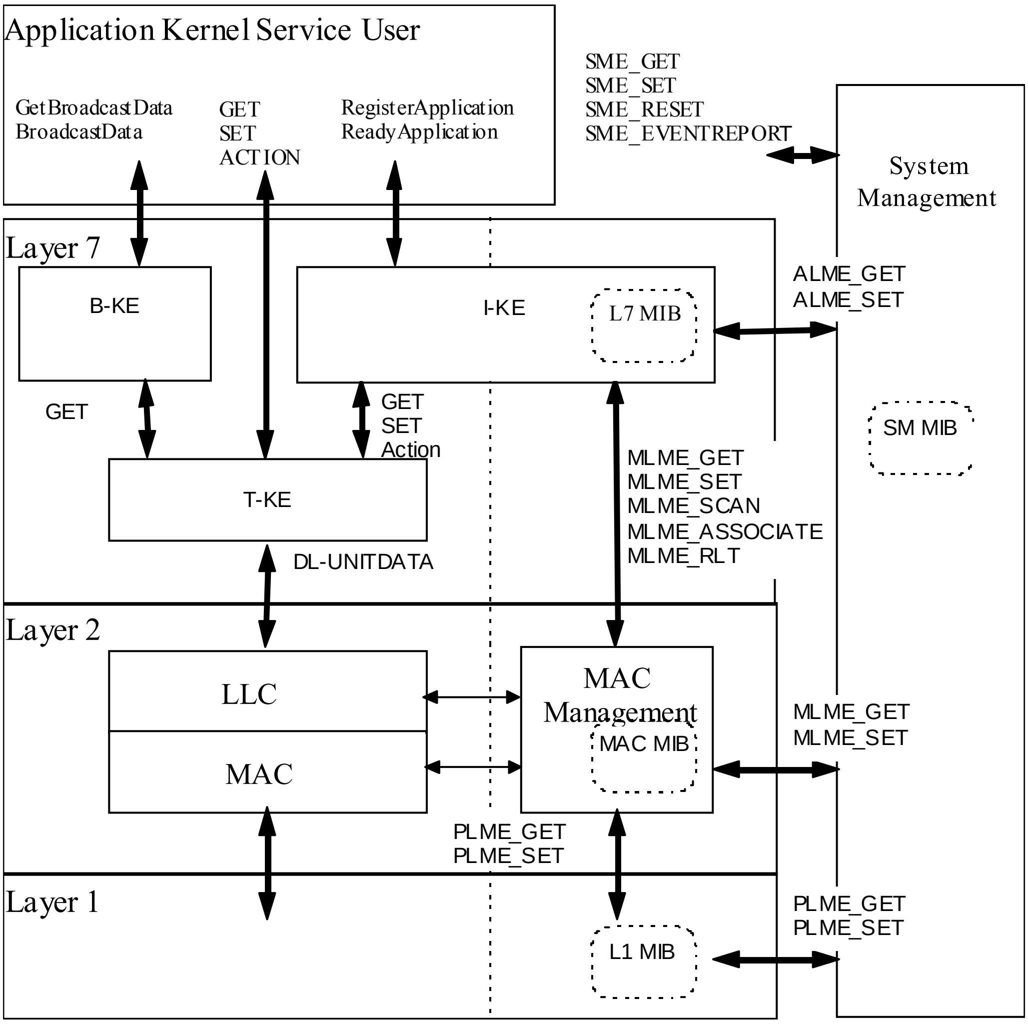


Fig. 4.1.1 Outline of Relationship between Layers, Layer Managements and System Management

4.2 Layer 1 Standards

4.2.1 Overview

This subclause specifies the physical portion of the radio communication system, including the structure of the frame, the structure of slots, the assignment of slots, different channel types, the structure of channels and the structure of signals, etc.

4.2.2 Mobile Station types and base station types

4.2.2.1 Mobile Station Types

Not specified.

4.2.2.2 Base Station Types

Depending on the maximum transmit power (defined in subclause 3.4.2.1), two classes of the base station are specified.

4.2.2.3 Test equipment

Not specified.

4.2.3 Service Characteristics

4.2.3.1 Outline

The layer 1 provides services for the layer 2 and the system management entity and in turn, receives services from layer 2 and the system management entity. The layer 1 has the inherent management information base (physical management information data base; L1 MIB).

4.2.3.2 Service Access points

Service access points that exist between the layer 1 and the layer 2 and interface with transmission service are defined as units of link addresses.

4.2.3.3 Services provided by the layer 1

4.2.3.3.1 Facilities of transmission

The layer 1 provides the transmission function using the frame control channel (FCMC) and message data channels (MDC), time function and synchronization function for the association and the data transmission.

4.2.3.3.2 Channel Activate / Deactivate

The layer 1 provides signal transmission functions and procedures turning the frame control channel, message data channels and activation channels Activate / Deactivate controlled from applications (terminals).

4.2.3.3.3 Maintaining the radio link

The layer 1 provides the functions and procedures for maintaining the radio link (Channel signal level measurement etc.).

4.2.3.3.4 Maintenance and state indication

The layer 1 provides signal transmission functions, procedures and the layer 1 functions required for maintenance functions. The layer 1 also provides indication functions of the state of the layer 1 to the layer management entity and/or system management entity.

4.2.4 Communication (TDMA) Frame

4.2.4.1 The structure of the communication (TDMA) Frame

Transmission frame shall comprise a set of variable sub-slots; a frame control message slot (FCMS), message data slot (s) (MDS (s)), or Wireless Call Number slot (WCNS) having wireless call number channel (WCNC; call sign) or activation slot (s) (ACTS (s)). The time length of the entire slot including FCMS shall be equal and 100 octets on the basis of the bit rate of 1024kbps (400 octets on the basis of the bit rate of 4096kbps).

Furthermore, the communication profile and the frame structure are multiplexed by the control information multiplexed on FCMS, and the details are defined in subclause 4.2.4.1.

4.2.4.1.1 Half-duplex Frame Format

The frame format of half-duplex mode shall be set as illustrated in Fig. 4.2.4.1.1. The number of MDSs shall be n1 and the number of ACTS shall be k1. A half-duplex mode frame format may also be as a communication frame dedicated to one-way communication from the base station to the mobile station besides two-way communications. In this case, both WCNS and ACTSs may be eliminated. The maximum number of variable slots shall be $n1+k1 \leq 8$ (when the ACTS are applied) or $n1 \leq 8$ (having no activation slots).

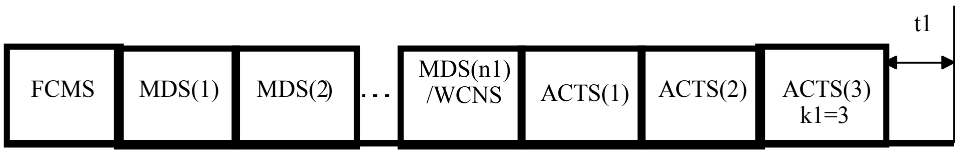


Fig. 4.2.4.1.1 Half-duplex Frame Format

(1) Frame control message slot (FCMS)
This FCMS provides control information. The FCMS shall be located at the head of the frame. A FCMC (Frame control message channel) contained frame control information and slots assignment information is multiplexed on this slot. It is downlink dedicated, and the base station performs its transmission.

(2) Message data slot (MDS)
This MDS is a message multiplexed slot. One or more slots are allocated per frame following after FCMS. This slot is used in two-way communication. The base station multiplexes a message on the downlink, and the mobile station multiplexes a message on the uplink. The maximum number of slot n1max shall be 8. This slot also comprises a set of MDCs (Message Data Channels) and ACKCs (Ack Channels) used for uplink or downlink frame.

(3) Activation slot (ACTS)
This is an Activation channel multiplex slot. Zero or more slots per frame are allowed. This slot shall be uplink dedicated. The windows for 6 ACTCs (Activation channel) per one ACTS are allocated for the association of mobile stations with the base station. At the link establishment phase, a mobile station transmits one ACTC using one of windows selected from these slots. The maximum numbers of slot k1max shall be 3.

(4) Wireless call number slot (WCNS)

The WCNC is multiplexed on this slot. The WCNC contains the peculiar number (call sign) of the mobile station. This slot shall be uplink dedicated, and a mobile station transmits a WCNC on the indication from the base station using the assigned WCNS.

In the test equipment, this slot is used as WCNC assigned to the down link. And the test equipment transmits a WCNC on the indication in this slot.

4.2.4.1.2 Full-duplex Mode Frame Format

The frame format of full-duplex mode shall be set as illustrated in Fig. 4.2.4.1.2. The frame consists of n2 of MDS and k2 of ACTS with its length variable. A part of message data slot of the uplink is also used as ACTS (Activation slot). The interpreting of attributes of the slot is made by the control information that is multiplexed on the FCMC, and the details are defined in subclause 4.2.4.2.1.5 and 4.2.4.2.1.8.

The maximum number of slots, which are variable, in the full-duplex communication frame format shall be n2+k2 ≦4.

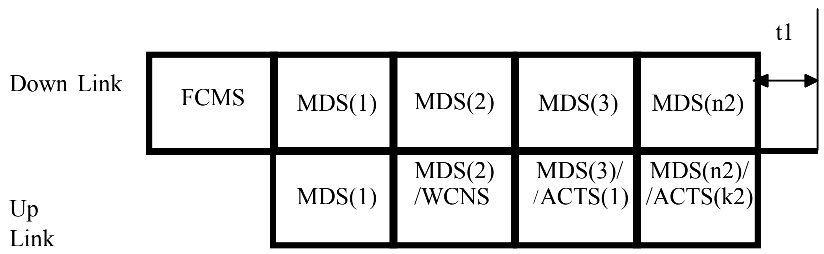


Fig. 4.2.4.1.1 Full-duplex (RSE) Frame Format

(1) Frame control message slot (FCMS)

This FCMS provides control information. The FCMS shall be located at the head of the frame. A FCMC (Frame control message channel) contained frame control information and slots assignment information is multiplexed on this slot. It is downlink dedicated, and the base station performs its transmission.

(2) Message data slot (MDS)

This MDS is a message multiplex slot. One or more slots are allocated per frame following after FCMS. This slot is used in two-way communication. This slot also comprises a set of MDCs (Message Data Channels) and ACKCs (Ack Channels) used for uplink or downlink frame. The base station multiplexes a message on the downlink, and the mobile station multiplexes a message on the uplink. The maximum number of slots n2max shall be 4.

(3) Activation slot (ACTS)
This is an Activation channel multiplex slot. Zero or more slots per frame are allowed. This slot shall be uplink dedicated. The windows for 6 ACTCs (Activation channel) per one ACTS are allocated for the association of mobile stations with the base station. At the link establishment phase, a mobile station transmits one ACTC using one of windows selected from these slots. The maximum locatable number of slot k2max shall be 3.

(4) Wireless call number slot (WCNS)
The WCNC is multiplexed on this slot. The WCNC contains the peculiar number (call sign) of the mobile station. This slot shall be uplink dedicated, and a mobile station transmits an inherent WCNC on the indication from the base station using the assigned WCNS.
In the test equipment, this slot is used as WCNC assigned to the down link. And the test equipment transmits a WCNC on the indication in this slot.

4.2.4.2 Channel types and the relationship between slot types

Channel types and the relation with the slot are shown in Fig. 4.2.4.2. The detail of each channel is specified in the following subclause.

FCMS	FCMC (Frame Control Message Channel)	: down link
MDS	MDC (Message Data Channel)	: up link, down link
	ACKC (Ack Channel)	: up link, down link
ACTS	ACTC (Activation Channel)	: up link
WCNS	WCNC (Wireless Call Number Channel)	: up link, down link

Fig 4.2.4.2 Configuration of the layer 1 channels and slots

4.2.4.2.1 Frame Control Message Slot (FCMS)

The subfield format within an FCMS shall be set as illustrated in Fig. 4.2.4.2.1-1 and Fig. 4.2.4.2.1-2. FCMS contains the FCMC which has frame control information and slot assignment information and, it is transmitted from the base station. The FCMC shall consist of the following subfields: two octets of an information field SIG (Signaling) for the layer 1, one octet of an identification number subfield FID (Fixed Equipment ID) of the base station, one octet of a frame structure information field FSI (Frame Structure identifier), one octet of a release timer information field RLT (Release Timer Information field), 7 octets of a service application information field SC (Service Code) of the base station, and a slot control information field SCI (Slot Control Identifier) for allocation of communication slots.

The SCI shall consist of one octet of the control information subfield CI (Control Information) and four octets of a link address subfield LID (Link address). The number of assigned slots following after the FCMS (m) shall be defined in the FSI field. Therefore, the number of valid SCIs (n) is equal to m (m_{max} is equal to $n1_{max}$) in the half-duplex mode. In the case of full duplex mode, the number of valid SCIs (n) is equal to 2m (n_{max} is equal to $2m_{max}$). The mobile station can distinguish of the number of slots by interpreting the FSI field. The details of the FSI field are defined in subclause 4.2.4.2.1.5.

Two octets (ASK system) or sixteen octets (π/4 shift QPSK system) of a preamble signal PR, four octets of a unique word signal UW1 and two octets of an error check sequence field CRC shall be added to these signals. Guard time t0 and t2 shall be set before and after the FCMC. Furthermore, in the case of π/4 shift QPSK system, the ramp bit (R) of 1 octet length (4 symbols) shall be added before a preamble signal PR.

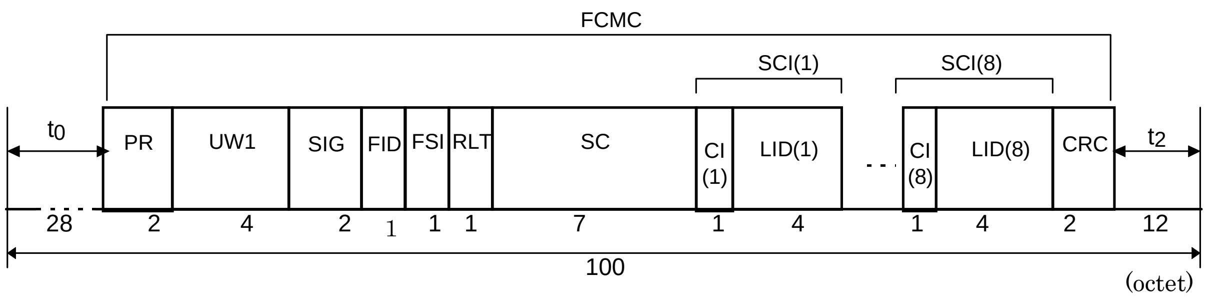


Fig 4.2.4.2.1-1 FCMS format (ASK system)

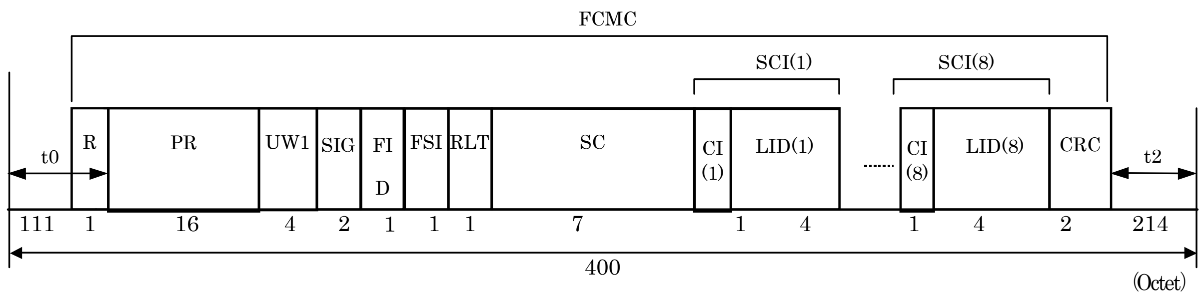


Fig 4.2.4.2.1-2 FCMS format (π/4 shift QPSK system)

4.2.4.2.1.1 Preamble (PR)

A preamble shall be 16 bits in length as follows. This field shall be transmitted least significant bit (LSB) first in a bit string in the expressed sequence.

ASK system

LSB MSB
[1010101010101010] (16 bits)

π/4 shift QPSK system

LSB MSB
[1001100110011001…………1001] (128 bits)

4.2.4.2.1.2 Unique Word (UW1)

A unique word is used for TDMA frame synchronization. An UW1 shall be 32 bits in length as follows. This field shall be transmitted least significant bit (LSB) first in a bit string in the expressed sequence.

ASK system

LSB MSB
[00011011101010000100101100111110]

π/4 shift QPSK system

LSB MSB
[01101011100010011001101011110000]

4.2.4.2.1.3 Transmission Channel Control Field (SIG)

A transmission channel control field shall be two octets in length and indicates the attributes of the layer 1. The sub-field format of SIG shall be set as illustrated in Fig. 4.2.4.2.1.3. The bit numbers 3 through 8 (b3 to b8) of the first octet are reserved for the future system and shall be set to zero.

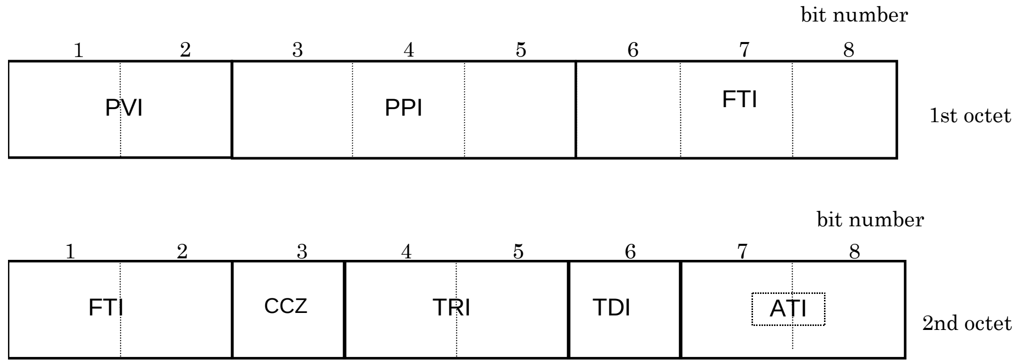


Fig 4.2.4.2.1.3 SIG format

(1) Protocol Version Identifier (PVI)
A PVI subfield indicates the communication protocol version of base station. It shall be invariant in size and placement across all revision of this standard. The Details are shown in Annex P about PVI. And the operation procedure of mobile station to the PVI that a base station transmits is shown in Annex J.

Table 4.2.4.2.1.3-1 PVI

bit number b1 b2	Version of communication protocol
0 0	0
1 0	1
0 1	2
1 1	3

Note 1) The basic underlying assumption is that device implemented new protocol version is able to communicate device implemented previous protocol version.
Note 2) The PVI of the base station that needs to communicate with the mobile station in the electronic toll collection system (ETC) shall be ”0”.

(2) Physical Profile Identifier
A PPI subfield indicates the physical profile with which the layer1 of a base station is equipped. When a mobile station has the physical profile that a base station specifies by PPI, the mobile station can do the association (initialization) procedures.

A base station and a mobile station shall perform communication by the physical profile specified by PPI. This is effective between the communication transaction end including the association (initialization) procedures of layer7.
Set up the physical profile of PPI in consideration of the compatibility of the communication profile to which the physical profile belongs.
The Details are shown in Annex P about PPI.

Table 4.2.4.2.1.3-2 PPI

bit number b3	b4	b5	Value of Physical Profile Identifier
0	0	0	0
1	0	0	1
0	1	0	2
1	1	0	3
0	0	1	Reserved
1	0	1	Reserved
0	1	1	Reserved
1	1	1	Reserved

(3) Operation mode (Frequency Type) Identifier (FTI)
A FTI subfield indicates the Frequency Type of the base station. The FTI subfield of 1st octet (b6, b7, b8) and the FTI subfield of 2nd octet (b1, b2) shall be set as shown in Table 4.2.4.2.1.3-3. Others codes are reserved for the future system.

Note) Refer to Table 3.1 in subclause 3.4.1.

Table 4.2.4.2.1.3-3 FTI (Operation Mode)

Bit number b6 b7 b7 b1 b2 (1st octet) (2nd octet)	Radio Frequency		Remarks
	Down link	Up link	
0 0 0 0 0	5795MHz	5835MHz	ex. Electronic Toll Collection
0 0 0 1 1	5805MHz	5845MHz	ex. Electronic Toll Collection
0 0 0 0 1	5800MHz	5840MHz	
0 0 1 1 0	5775MHz	5815MHz	
0 1 0 1 0	5780MHz	5820MHz	
0 1 1 1 0	5785MHz	5825MHz	
1 0 0 1 0	5790MHz	5830MHz	

(4) Continuous Communication Zone (CCZ)

This bit number 3 (b3) in 2nd octet indicates the allocation of different base stations (different FIDs) in the traveling direction. In the case where these base stations are linked to each other in any way, the CCZ may be set to “1”. If it indicates usual stand-alone type communication zone, the CCZ shall be set to “0”. In the case where a TRI is “01” or “10” (TRI is not equal “00” or “11”), it is specific to exceptional communication zone and expects particular processing in the layer 2. This exceptional communication zone is specified with subclause 4.2.4.2.1.3(4)

(5) Transmitter / Receiver Identifier (TRI)

A Transmitter/Receiver Identifier (TRI) is the identifier for the distinction between base stations allocated in the traveling direction of the continuous communication zone. The subfield of TRI shall be set as shown in Table 4.2.4.2.1.3-4.

In the case where the TRI is “00”, the definition of the CCZ=”1” shall be ignored. The code “11” is reserved for future systems. In the case where the TRI is “10” or “01”and of CCZ= “1”, the transmitter / receiver are defined by TRI.

Table 4.2.4.2.1.3-4 TRI

Bit number b4	b5	Description
0	0	stand alone
1	0	Front(first) transmitter/receiver in the traveling direction
0	1	Rear(2nd) transmitter/receiver in the traveling direction
1	1	Reserved

In the case of CCZ= “0”, TRI=“01” or “10”:
One base station has two transmitter / receivers (antennas) located in the traveling direction and performs transmission / reception frames in communication zone of each transmitter / receiver (antenna). If the frame is a transmission / reception frame from a transmitter / receiver that is located relatively in the front compared to another transmitter/receiver in the traveling direction, the TRI shall be set to “10”. If a transmission / reception frame with a transmitter / receiver that is located relatively in the rear compared to another transmitter/receiver in the traveling direction, the TRI shall be set to “01”. The codes “01” and “10” should be used as a pair of codes. In the case of the TDI=“1”, it indicates the communication frame is transmitted or received from each transmitter/receiver (base station) in time division.

Note 1) The underlying assumption is that two transmitter/receivers designated TRI=“01” or “10” are allocated close to each other and a chain of application transactions is performed while a mobile station communicates with the transmitter / receiver (antennas) passing the each communication zone in sequence.

In the case of CCZ=“1”, TRI=”01” or “10”:
Two different base stations are allocated in the traveling direction and they each perform communication transactions in the communication zones by themselves. If the frame with a base station (transmitter / receiver) is located relatively in the front compared to another base station (transmitter / receiver) in the traveling direction, the TRI shall be set to “10”. If the frame with a base station (transmitter / receiver) is located relatively in the rear compared to another the base station (transmitter / receiver) in the traveling direction, the TRI shall be set to “01”. The codes of “01” and “10” should be used as a pair of codes. In the case of the TDI= “1”, it indicates the communication frame is transmitted or received from each base station in time division.

Note 2) The underlying assumption is that different base stations defined TRI=“01” or “10” are allocated close to each other. And a chain of application transaction is performed while a mobile station is provided one application from the first base station, hereafter provided

another application from the 2nd base station passing the each communication zone in sequence.
Note 3) Relation between the CCZ and the TDI and communication environment is indicated in Annex B for reference only.

(6) Time Division Identifier (TDI)
The bit number 6 (b6) is a Time Division Identifier (TDI). This identifier indicates whether or not the base stations transmit / receive of frames in time division. When communication transaction is performed in time division, the TDI shall be set to “1”. When communication transaction is not performed in time division, the TDI shall be set to “0”.

(7) Area type identifier (ATI)
This subfield indicates the type of communication area (zone) (transmission output power) of the base station. If it indicates a small area communication zone, the ATI subfield (b7, b8) shall be set to “00”. If it indicates a wide area communication zone, the ATI shall be set to “11” as shown in Table 4.2.4.2.1.3-5. When ATI is set to "10", it specifies employment with a test equipment.
Others codes are reserved for future systems.

Table 4.2.4.2.1.3-5 ATI Communication Area Modes

Bit number b7 b8	Description
0 0	Class 1 (Small area zone)
1 1	Class 2 (Wide area zone)
1 0	Test equipment
Others	Reserved

4.2.4.2.1.4 Fixed Equipment ID (FID)

The length of the fixed equipment ID shall be one octet. The FID number shall be generated by modulus 256. The establishment of the FID is outside of the scope of this standard.
The FID is indicated in Annex M for reference only.

4.2.4.2.1.5 Frame Structure Identifier (FSI)

The subfield format of a Frame Structure Identifier (FSI) shall be set as illustrated in Fig. 4.2.4.2.1.5. The bit numbers 5 through 8 (b5-b8) are reserved for future systems and shall be set to zero.

bit number

1	2	3	4	5	6	7	8
CM		SLN		O	O	O	O
				Reserved			

Fig 4.2.4.2.1.5 FSI format

(1) Communication mode (CM)

The bit number 1 (b1) is the information field for setup of the communication mode. If the half-duplex mode is adopted, the CM shall be set to “1”, and if the full duplex mode (the base station) is adopted, the CM shall be set to “0”.

(2) Slot Number (SLN)
A SLN (m) indicates the number of assigned slot(s) following after the FCMS. The subfield of b2, b3, b4 shall be coded as shown in Table 4.2.4.2.1.5. The number of valid SCIs is equal to m in the half-duplex mode (b1="1") and equal to twice m in the full duplex mode (b1="0"). In the case of the subfield of b4="1", the subfield of the SLN is invalid.

Table 4.2.4.2.1.5 Slot Number

SLN	Number of assigned slots	
b2 b3 b4	CM (b1)=1 (half-duplex)	CM(b1)=0 (full-duplex)
0 0 0	1	1(2)
1 0 0	2	2(4)
0 1 0	3	3(6)
1 1 0	4	4(8)
0 0 1	5	invalid
1 0 1	6	invalid
0 1 1	7	invalid
1 1 1	8	invalid

4.2.4.2.1.6 Release Timer Information field (RLT)

It indicates the timer for the restriction of the re-link entry (re-association) to the base station from the mobile station that has once accomplished the communication transaction. The parameter shall be set as shown in table 4.2.4.2.1.6. The bit number 1 (b1) is a validation bit and the bit numbers 2 through 8 (b2-b8) are a release timer field.

The release timer is a kind of timer which is set in the layer 7 of the mobile station after the accomplishment of the association (initialization procedures) with the base station on receiving the FCMC. This release timer activates after the accomplishment of the communication transaction.

When the release timer is activating at the time of receiving a FCMC, the validation bit indicates whether or not the restriction of the association would continue.

If it indicates that the release timer field is valid and the restriction of the association procedures would continue when the release timer is activated at the timing receiving a FCMC, the validation bit shall be set to “1” (b1=“1”). On receiving a FCMC in which the validation bit is “0” (b1=“0”), the mobile station could cancel the restriction of the association. The time calculation according to the release timer field shall be made by multiplying the RLT value (b4~b8: it indicates that the range of timer values is 0 through 31) by the RLT unit values (b2~b3) which are shown in Table 4.2.4.2.1.6.

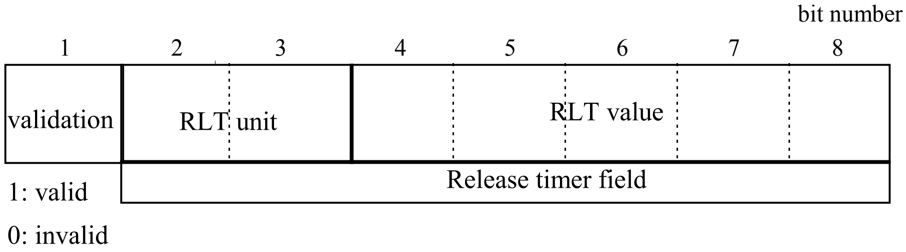


Fig 4.2.4.2.1.6 RLT format

Note) The definition of the completion condition of application (association) and the ways of management or action of the release timer are refereed to layer 7 standards.

Table. 4.2.4.2.1.6 Unit of RLT

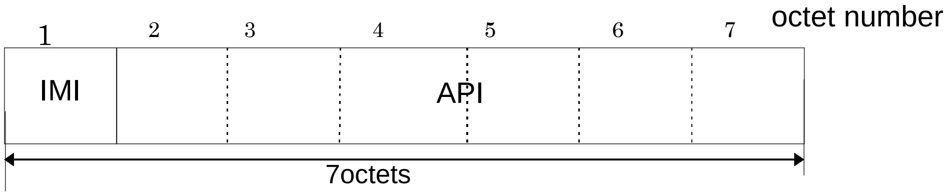
bit number b2 b3	Description
0 0	0.2 second
1 0	2 second
0 1	20 second
1 1	200 second

4.2.4.2.1.7 Service Application Information field (SC)

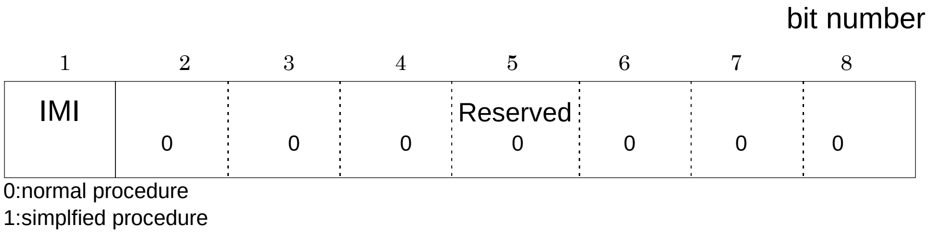
A SC indicates the outline of application services provided from a base station. The SC is used for the comparison with applications possessed by a mobile station for the prevention of congestion of communication traffic. Furthermore, it indicates the identification of the association procedures (a normal association (initialization) procedures or a simplified association (initialization) procedures) in the layer 7.

The field format shall consist of 1 octet of the initialization mode identifier field (IMI) and 6 octets of the application identifier field (API) as shown in Fig. 4.2.4.2.1.7.1(a).

If it indicates that the layer 7 of the base station provides a normal association (initialization) procedures, the IMI bit (b1 of the first octet) shall be set to “0”. If it indicates that the layer 7 of the base station provides a simplified association (initialization) procedures, the IMI (b1 of first octet) shall be set to “1” as shown in Fig. 4.2.4.2.1.7.1(b).



(a) Subfield format of SC



(b) Subfield format of IMI

Fig. 4.2.4.2.1.7.1 SC Format (1)

For reference, the example of the construction of the SC field is shown in Fig. 4.2.4.2.1.7.2 This figure shows the configuration of the SC in both cases of a normal association (initialization) procedures and a simplified association (initialization) procedures. Hence, APIs are application identifiers specified by applications and EIDs are element identifiers specified according to an AID. Either an AID field or an EID field has the length of 7 bits. The first bit of each EID or AID is an extender. In the case where a following octet is valid, the extender is set to “0”. In the case where a following octet is invalid, the extender is set to “1”. However, EIDs are not definitely specified in general, when the simplified association (initialization) procedures is adopted, it assumes that a specified EID is defined common in a base station and mobile stations that have the function of this procedures.
In the case where there is no matched application between the base station and the mobile station, the association procedure is not performed so as to prevent congestion of communication traffic.

Note 1) Definition of the AIDs and EIDs used for API are indicated in Annex I.
Note2) When the AID is stored in API field, the bit field by the side of MSB should be used. And the bit by the side of other LSB should be set as "0". When the AID is a 5bits definition, numbers 4-8 (b4-b8) should be used. And the numbers 2 and 3 (b2, b3) should be set to "0". In addition, the bit number 1 (b1) is an extension.
Note3) When the AID is not set up by the test communication etc., the bit numbers 2 and 3 of API of SC should be set to "11". The AID value of the octet set up like this is invalid. Therefore, the processing should not be performed to a receive side. In this case, it is recommend that the value of the octet is set to "FF" (the AID is invalid and there is no AID to continue.)

1	2	3	4	5	6	7 (octet number)
IMI	API				00--00	00--00
	AID(1)	AID(2)	AID(3)	AID(4)	reserved	reserved

(a) Field format of the SC in the normal association (initialization) mode

1	2	3	4	5	6	7 (octet number)
IMI	AID(1)	EID(2)	Attribute Information	00--00 reserved	00--00 reserved	00--00 reserved

(b) Field format of the SC in the simplified association (initialization) mode

LSB MSB

1	2	3	4	5	6	7	
Extender	Application Identifier(AID, EID)						

0: continued
1: not continued

(c) Field format of API

Fig. 4.2.4.2.1.7.2 SC Format (2)

4.2.4.2.1.8 Slot Control Identifier (SCI)

A SCI shall consist of one octet of the control information subfield CI as slot assignment information and 4 octets of the link address subfield LID.

If the communication mode is the half-duplex mode, the slots, which follow FCMS, shall correspond to the SCIs in the sequence shown in Fig. 4.2.4.2.1.8-1.

If the communication mode is the full-duplex mode, odd-numbered SCI (1), SCI (3) ... shall indicate downlink information, and even-numbered SC I (2), SCI (4) ... shall indicate uplink information as shown in Fig. 4.2.4.2.1.8-2.

The assignment of the WCNS as shown in Fig. 4.2.4.2.1.8-1 and Fig. 4.2.4.2.1.8-2 are examples of the assignment and the base station indicates it. The available number of slots following after the FCMS are 2,4,8 in the half-duplex mode and 2,4 in the full-duplex mode in general rules defined in subclause 4.2.4.2.1.5(2).
Note) It shall not assign the ACTS at the first slot following after the FCMS.

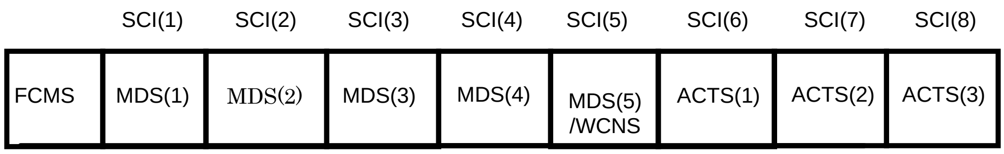


Fig. 4.2.4.2.1.8-1 Example of frame format (Half-duplex mode)

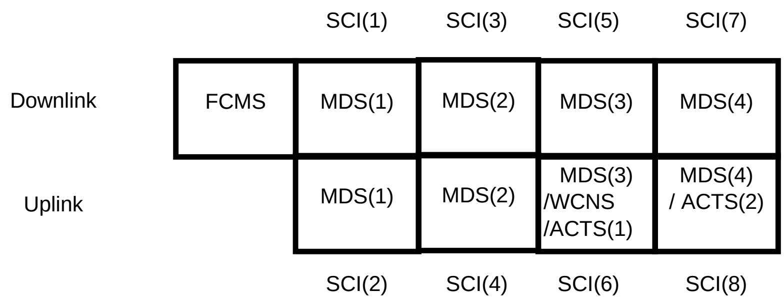


Fig. 4.2.4.2.1.8-2 Example of frame format (Full-duplex mode)

4.2.4.2.1.8.1 Control Information Identifier of SCI field (CI)

This is a control field for the assignment of slots. The subfield format of Control information Identifier (CI) shall be set as illustrated in Fig. 4.2.4.2.1.8.1. (Three types of subfield formats depending on the value of slot identifier (SI) are specified.). The bit numbers 3,4,5 (b3, b4, b5) within the ACTS control field are reserved for the future system and shall be set to zero.

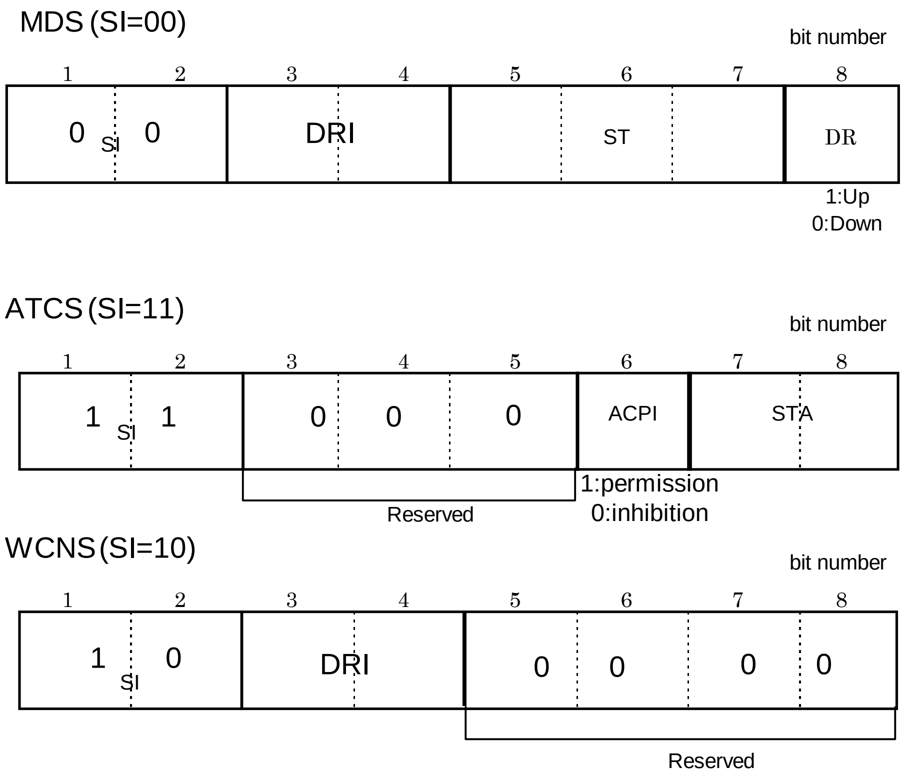


Fig. 4.2.4.2.1.8.1 CI format

(1) Slot Identifier (SI)

A SI indicates the attributes of the slot. The subfield format shall be coded as shown in Table 4.2.2.8.1-1. If the slot is assigned as a MDS, the bit numbers 1,2 (b1, b2) of the SI shall be set to “00”. If the slot is assigned as an ACTS, it shall be set to “11” and if the slot is assigned as a WCNS, it shall be set to “10”.

In the case where the SI indicates an activation slot, the subsequent LID can be ignored.

Table 4.2.4.2.1.8.1-1 Contents of Slot identifier

Bit number b1 b2	Description
0 0	Assigned for MDS
1 1	Assigned for ACTS
1 0	Assigned for WCNS
0 1	Reserved

(2) Data Rate Identifier (DRI)
A DRI indicates the signal transmission speed that discriminates the data transmission speed of MDC and WCNC. This subfield format shall be coded as shown in Table 4.2.4.2.1.8.1-2. In the case of ASK system of bit rate 1024kbps, the bit numbers 3 and 4 should be set to “00”. In case of π/4 shift QPSK system of bit rate 4096kbps, those bits shall be set to “11”. And in case of others, it is the reservation of the future for system extension. When two or more MDCs of the same link address are assigned within the same frame, all MDCs should be the same signal transmission speed (bit rate).

(3) Status of data field (ST)
The bit numbers 5,6,7 (b5, b6, b7) shall be coded as shown in Table 4.2.4.2.1.8.1-2. The ST indicates the contents of the MDC. If it indicates that the MDC is a normal data channel, the bit numbers 5,6,7 (b5, b6, b7) of the ST shall be set to “111”. If it indicates that the MDC is an empty data channel, it shall be set to “011”. If it indicates that the MDC is an idle signal channel, it shall be set to “100”, and if it indicates that the MDC is a data channel assigned with priority, it shall be set to “000”.

For the idle signal channel, all of the LPDU fields of the MDC shall take the value of “0”. For the non-data channel, the LID of the SCI and the data of corresponding MDC are invalid.

Table 4.2.4.2.1.8.1-2 ST

Bit number b5 b6 b7	Description
1 1 1	Normal data channel
0 1 1	empty data channel
1 0 1	Reserved
0 0 1	Reserved
1 1 0	Reserved
0 1 0	Reserved
1 0 0	Idle signal channel
0 0 0	Data channel assigned with priority

Note) Refer to (5) in subclause 4.3.3.5.2.2.2.1 for the control procedure of a mobile station when ST specifies an idol channel.

(4) Direction (DR)
A DR bit indicates the direction of transmission of the MDC. If the transmission is made in the uplink direction (from the mobile station to the base station), the DR shall be set to “1”, and if transmission is made in the downlink direction (from the base station to the mobile station), the DR shall be set to “0”.

(5) Activation possibility identifier (ACPI)
An ACPI bit is information field of ACTS transmission operation. If the base station allows mobile stations to make an attempt to associate with the base station communication link by transmitting an ACTC, the ACPI shall be set to “1”. If the transmission of the ACTC is inhibited, the ACPI shall be set to “0”. This indication shall be set to the same value over ACTSs within one frame.

Table 4.2.4.2.1.8.1-3 STA

Bit number b7 b8	Activation probability
0 0	100 - 50%
1 0	Less than 50 - 25%
0 1	Less than 25 - 12.5%
1 1	less than 12.5%

(6) State of acceptance of ACTCs (STA)
The subfield of STA (b7, b8) broadcasts the activation (acceptance) state of the ACTC at the base station. It prevents deadlocking of the traffic caused by excessive associations (link entries).

Table 4.2.4.2.1.8.1-3 indicates the relationship between the STA and the activation (acceptance of ACTCs) probability at the base station. It indicates that the smaller the value of start probability, the larger the traffic. This indication shall be set to the same value over ACTSs within one frame.

4.2.4.2.1.8.2 Link Address Field (LID)

Link address LID is available in three types.
(1) A private link address for the point to point two-way communication between a mobile station and a base station.

(2) A broadcast link address for the transmission of data, etc., in broadcast type from a base station to plural mobile stations.

(3) A multicast (group) link address for the transmission/reception of data, etc., from a base station to plural groups of mobile stations.

This LID shall be a link address that is common to the base station and the mobile station, and the same link address shall be used in the layer 1, layer 2 (the MAC sublayer and the LLC sublayer) and the layer 7 for identification of the service access points. The same LID shall be used while the communication is continuously performed. Establishment of numbers to LIDs is described in subclause 4.3.2. The subfield format of LID shall be set as illustrated in Fig. 4.2.4.2.1.8.2. The bit number 1 (b1) of each octet shall use an extender. When the first bit of octet is “0”, the subsequent octet shall be an extension of the address field. An octet having the address field “1” in the bit number 1 (b1) shall terminate. However, since the SCI is defined in fixed length of five octets, LID is of fixed length of four octets (32 bits). Therefore, the first bit (b1) of the 2nd and 3rd octet is always “0”. Where the first octet only is valid (first bit (b1) of first octet is “1”), the other octets cannot be deleted. All subfield of the other octets shall be set “0” in this case.

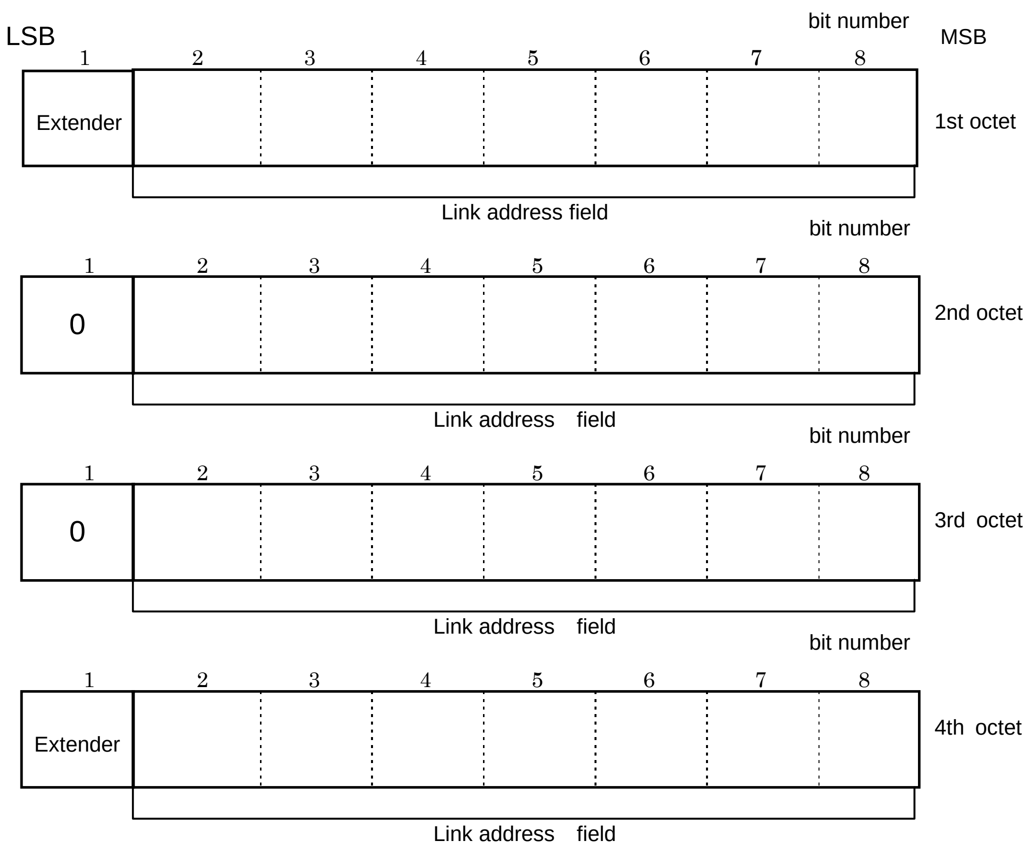


Fig. 4.2.4.2.1.8.2 LID format

The 1st octet address of eight “1” bits (“11111111”) shall be reserved as the broadcast link address. All single octet addresses except for the broadcast link address (“1xxx xxxx”) shall be reserved for the multicast (group) link address.

Note 1) A private link address shall be used the 28 bits of bit No. 2 - 8 of four octets and the first bit (b1) of 4th octet shall be set to “1”.Moreover, the generation method of a private link address is specified in Annex N.

Note 2) Allocation of multicast (group) link addresses are outside of the scope of this standard. Moreover, they are specified in Annex O.

4.2.4.2.1.9 Cyclic Redundancy Error Check Sequence (CRC)

A 16-bits CRC code is used for data check sequence for error detection purposes. The contents of the FCMC field excluding the PR and the UW1 field shall be contained in the calculation of the FCMC field. The generator polynomial shall be as follows.

Generator polynomial: $X^{16}+X^{12} + X^{5}+1$

4.2.4.2.2 Message Data Slot (MDS)

A format of MDS according to the contents of Data Rate Identifier (DRI) specified to Table 4.2.4.2.1.8.1-2 is shown in Fig 4.2.4.2.2-1 and Fig 4.2.4.2.2-2. The MDS shall consist of the following subfield format: a message data channel (MDC) for data transmission and an acknowledgment channel (ACKC) that indicates the transmission originating station whether or not the received the MDC was correct. The guard times t3 and t4 shall set before and after the ACKC.

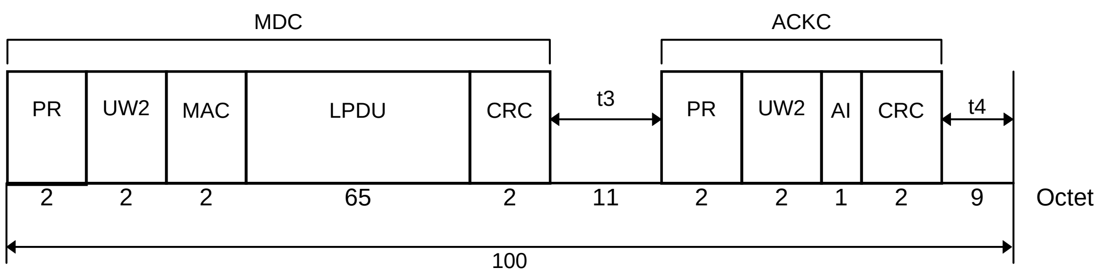
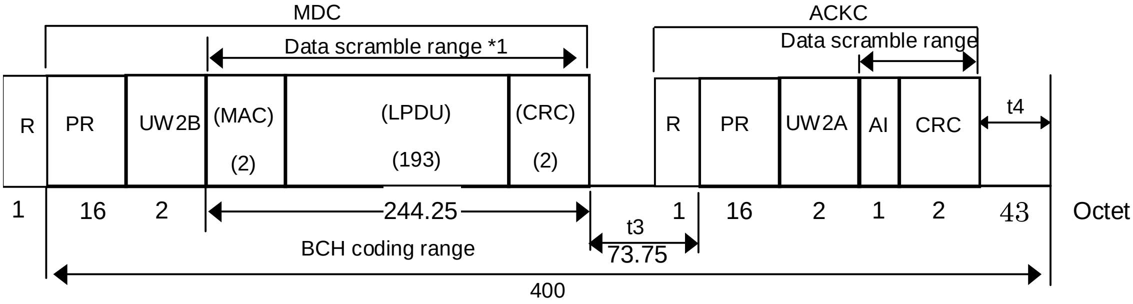


Fig. 4.2.4.2.2-1 MDS format (in case of ASK system (1024kbps))



*1: shows the data length of MPDU.

Fig. 4.2.4.2.2-2 MDS format (in case of π/4 shift QPSK system (4096kbps))

4.2.4.2.2.1 Message Data Channel (MDC)

(1) ASK system

The subfield format within the message data channel (MDC) shall be set as illustrated in Fig. 4.2.4.2.2.1-1. The MDC shall contain an LPDU of 65 octets, a MAC control field (MAC) of two octets and a preamble signal PR, a unique word signal UW2 and a CRC code. Each length of field is 2 octets.

The LPDU, which is delivered from the LLC sublayer, should be have been aligned in octet units, and unaligned data shall be discarded. The LPDU having a length of over 65 octets shall be fragmented into 65-octet units in the MAC sublayer, and will be transmitted using plural frames. In the case where the data length is less than 65 octets, zeros shall be added in the MAC sublayer up to 65 octets, and the data is a unit of 65 octets.

Furthermore, the data scrambling (simple encryption system) showed in subclause 4.2.6 should be adapted to the LPDU and CRC.

The LPDU has an LLC control field and an LSDU (link service data unit). The format of the LLC control field is specified in detail in subclause 4.3.4.4.1.

The PR, the UW2 and the CRC code that each length of field is 2 octets are further added to these signals, and transmission is made in the physical medium channel in the layer 1.

In the case of where an LPDU is fragmented, the LLC field is only contained in the first MSDU.

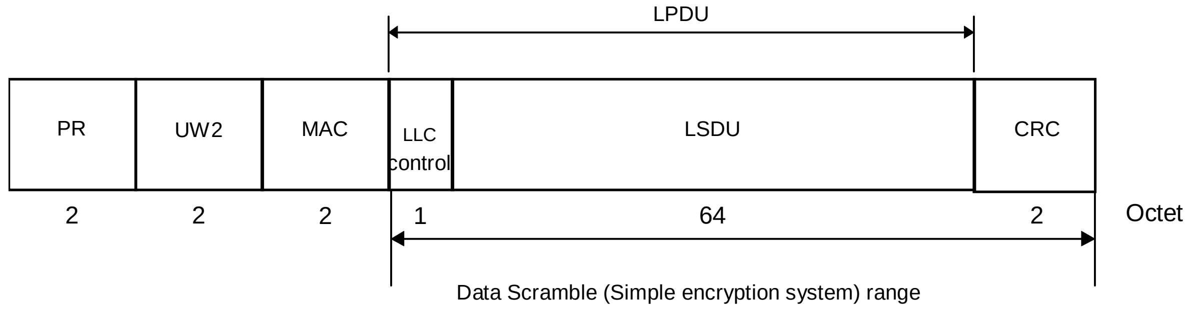


Fig. 4.2.4.2.2.1-1 MDC format (ASK system)

(2) π/4 shift QPSK system

The subfield format within the message data channel (MDC) shall be set as illustrated in Fig. 4.2.4.2.2.1-2. The MDC shall contain a LPDU of 193 octets, a MAC control field (MAC) of two octets, a ramp bit, and a preamble signal PR of 16 octets, a unique word signal UW2B of 2 octets and a CRC code of 2 octets. The encryption scramble (simple encryption system in subclause 4.2.6) process shall be preformed to a LPDU and a CRC field. Then, BCH error correction processing shall be performed to a MAC and the encryption scramble (simple encryption system) field. Furthermore, the data scramble (subclause 4.2.6 prescribes) processing shall be performed to this “244 octets + 2 bits” field. This processing procedure is shown in Fig 4.2.4.2.2.1-2.

The LPDU, which is delivered from the LLC sublayer, should be have been aligned in octet units, and unaligned data shall be discarded. The LPDU having a length of over 193 octets shall be fragmented into 193 octet units in the MAC sublayer, and will be transmitted using plural frames. In the case where the data length is less than 193 octets, zeros shall be added in the MAC sublayer up to 193 octets, and the data is a unit of 193 octets. Furthermore, the data scrambling (simple encryption system) showed in subclause 4.2.6 should be adapted to the LPDU and CRC. The LPDU has an LLC control field and an LSDU (link service data unit). The format of the LLC control field is specified in detail in subclause 4.3.4.4.1.

The ramp bit of 1 octet, the PR of 16 octets, the UW2B of 2 octets and the CRC code of 2 octets are further added to these signals, and transmission is made in the physical medium channel in the layer 1. In the case of where an LPDU is fragmented, the LLC field is only contained in the first MSDU.

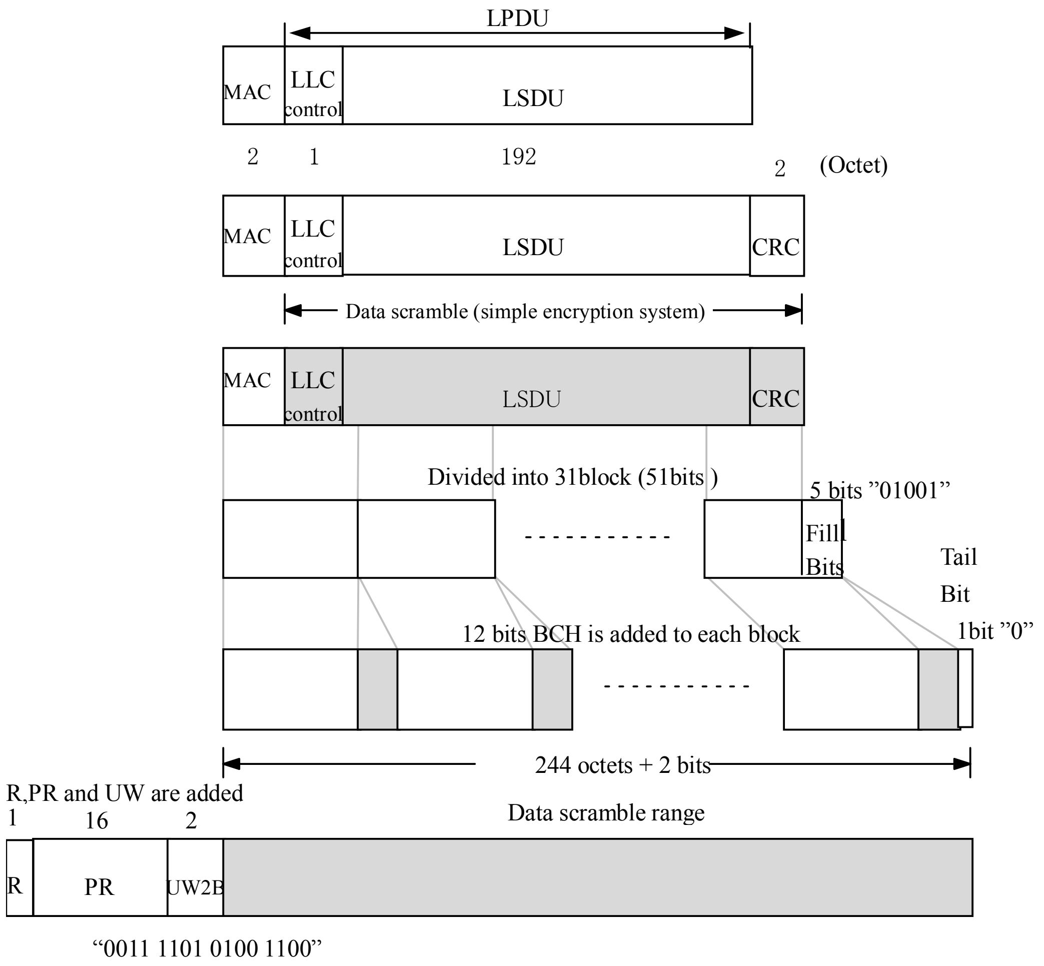


Fig. 4.2.4.2.2.1-2 MDC format (π/4 shift QPSK system)

4.2.4.2.2.1.1 Preamble (PR)

(1) ASK system

A preamble shall be 16 bits in length as follows. This field shall be transmitted least significant bit (LSB) first in a bit string in the expressed sequence.

LSB MSB
[1010101010101010]

(2) π/4 shift QPSK system

A preamble shall be 128 bits in length as follows. This field shall be transmitted least significant bit (LSB) first in a bit string in the expressed sequence.

LSB MSB
[10011001……1001]

4.2.4.2.2.1.2 Unique Word (UW2, UW2B)

A unique word is used for TDMA frame synchronization. The UW2 shall be 16 bits in length described as follows. This field shall be transmitted least significant bit (LSB) first in a bit string in the expressed sequence.

(1) ASK system (UW2)
LSB MSB
[0100101100111110]

(2) π/4 shift QPSK system (UW2B)
LSB MSB
[0011110101001100]

4.2.4.2.2.1.3 MAC control field (MAC)

The subfield format within the MAC control field shall be set as illustrated in Fig. 4.2.4.2.2.1.3. The bit number 3 (b3) of the first is reserved for future systems and shall be set to zero. Each subfield is specified as follows;

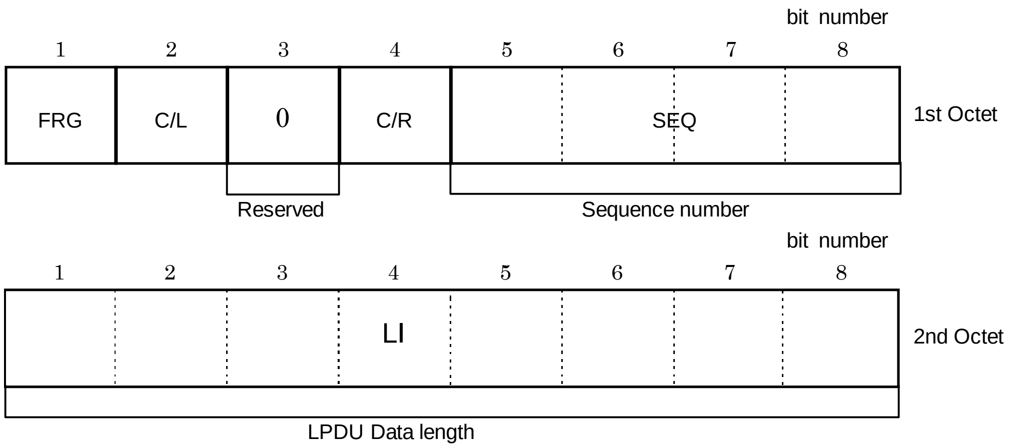


Fig. 4.2.4.2.2.1.3 MAC Control field format

(1) Fragmentation (FRG)
This subfield of a FRG is used for the identification of whether or not the received message was fragmented. If it indicates that fragmentation is made, the FRG shall be set to “1”, and if it indicates that fragmentation is not made, the FRG shall be set to “0”.

(2) Continuous/Last (C/L)
A C/L bit is used for identification of whether or not a message is continued after the received message. If it indicates that the MDC to be transmitted continuously occurs, the C/L shall be set to "1", and if it indicates that the corresponding MDC is the last MDC, the C/L shall be set to "0". If the data (LPDU) transmission is performed using one MDC, it shall be set to "0".

(3) Command/Response (C/R)
The bit number 4 (b4) of the 1st octet is command/response identifier of an LPDU. Where the LPDU is a command LPDU, the b4 shall be set to "0" and where the LPDU is a response LPDU, the b4 shall be set to "1"

(4) Sequence Number (SEQ)
The bit numbers 5 through 8 (b5, b6, b7, b8) of the 1st octet shall indicate the sequence number that indicates fragmented data transmission sequence. The sequence number SEQ shall be created by modulus 16. This SEQ is used to prevent receipt of the duplicated message and also make the fragmentation / de-fragmentation of data in the MAC sublayer.
The least significant bit shall be b5.

(5) Length indicator information field of LPDU (LI)
The subfield of LI shall indicate valid data length of LPDU. The unit of L1 shall be octet.

4.2.4.2.2.1.4 Cyclic Redundancy Error Check Sequence (CRC)

A 16-bit CRC code shall be used for data check sequence for error detection purposes. The contents of the MDC field excluding a PR and an UW2 field shall be contained in the calculation of MDC field. The generator polynomial shall be as follows.

Generator polynomial: $X^{16}+X^{12} + X^{5}+1$

4.2.4.2.2.2 ACK channel (ACKC)

(1) ASK system
The sub-field format within an ACKC shall be set as illustrated in Fig. 4.2.4.2.2.2-1 It is an acknowledgment subfield AI of one octet only. A preamble signal PR of two octets, a unique word signal, an UW2 of two octets and a CRC code of two octets shall be added to these signals, and transmission is made in the physical medium channel of the layer 1.

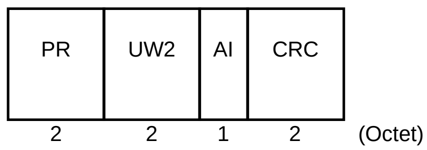


Fig. 4.2.4.2.2.2-1 ACKC format (ASK system)

(2) π/4 shift QPSK system
The sub-field format within an ACKC shall be set as illustrated in Fig. 4.2.4.2.2.2-2. It is an acknowledgment subfield AI of one octet only. A ramp bit R of one octet, a preamble signal PR of 16 octets, a unique word signal, an UW2A of two octets and a CRC code of two octets shall be added to these signals, and transmission is made in the physical medium channel of the layer 1.The data scramble system which it specifies in subclause 4.2.6 shall be applied to AI and CRC.

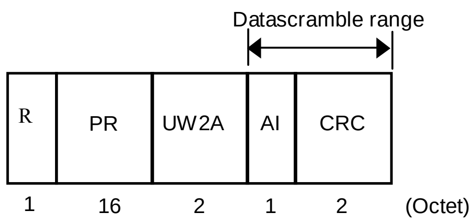


Fig. 4.2.4.2.2.2-2 ACKC format (π/4 shift QPSK system)

4.2.4.2.2.2.1 Preamble (PR)

(1) ASK system
A preamble shall be 16 bits in length as follows. This field shall be transmitted least significant bit (LSB) first in a bit string in the expressed sequence.

LSB MSB
[1010101010101010]

(2) π/4 shift QPSK system
A preamble shall be 128 bits in length as follows. This field shall be transmitted least significant bit (LSB) first in a bit string in the expressed sequence.

LSB MSB
[10011001……1001]

4.2.4.2.2.2.2 Unique Word (UW2,UW2A)

An unique word is used for TDMA frame synchronization. An UW2 shall be 16 bits in length as follows. This field shall be transmitted least significant bit (LSB) first in a bit string in the expressed sequence.

(1) ASK system
LSB MSB
[0100101100111110]

(2) π/4 shift QPSK system
LSB MSB
[1110000101001001]

4.2.4.2.2.2.3 Acknowledgment Identifier (AI)

The subfield format within an acknowledgment identifier (AI) shall be set as illustrated in Fig. 4.2.4.2.2.2.3. The bit numbers 1 through 7 (b1-b7) are reserved for future system improvement and shall be set to “0”. If an Ack signal that indicates that data was correct, the AK shall be set to “1”. If a Nack signal that indicates that data was not correct, the AK shall be set to “0”.

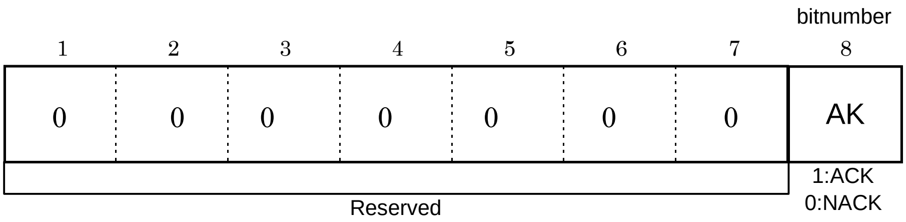


Fig. 4.2.4.2.2.2.3 AI format

4.2.4.2.2.2.4 Cyclic Redundancy Error Check Sequence (CRC)

A 16-bit CRC code shall be used for data check sequence for error detection purposes. The contents of the ACKC field excluding a PR and an UW2 field shall be contained in the calculation of ACKC field. The generator polynomial shall be as follows.

Generator polynomial: $X^{16}+X^{12}+X^{5}+1$

4.2.4.2.3 Activation Slot (ACTS)

(1) ASK system
The activation slot shall contain windows for the ACTC (Activation Channel). The window format of ACTS shall be set as illustrated in Fig. 4.2.4.2.3-1 A mobile station transmits an ACTC using one window selected at random in the association procedures. If plural ACTSs exist, the mobile station shall select one ACTS at random. Guard times t5 and t6 shall be set between windows and after last windows (ACTC (6)). The procedures for transmission of the ACTC specified in the layer 2 standards.

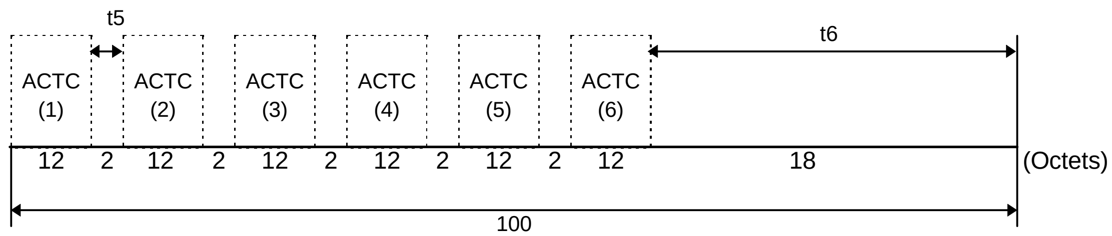


Fig. 4.2.4.2.3-1 ACTS format (ASK system)

(2) π/4 shift QPSK system
The activation slot shall contain windows for the ACTC (Activation Channel). The window format of ACTS shall be set as illustrated in Fig. 4.2.4.2.3-2 A mobile station transmits an ACTC using one window selected at random in the association procedures. If plural ACTSs exist, the mobile station shall select one ACTS at random. Guard times t5 and t6 shall be set between windows and after last windows (ACTC (6)). The procedures for transmission of the ACTC are specified in the layer 2 standards.

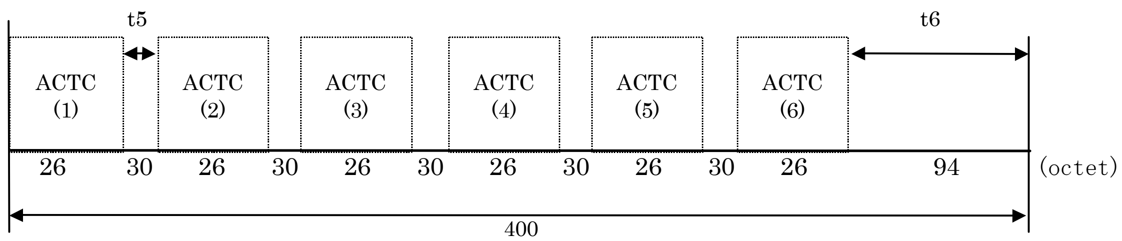


Fig. 4.2.4.2.3-2 ACTS format (π/4 shift QPSK system)

4.2.4.2.3.1 Activation Channel (ACTC)

(1) ASK system
The subfield format within the ACTC shall be set as illustrated in Fig. 4.2.4.2.3.1-1 It shall

consist of the following subfields: a link request (association request) subfield LRI for the ACTC (one octet in length), a link address of four octets and identification number FID of the base station. A preamble signal PR (two octets in length), an unique word signal UW2 (two octets in length) and a error check signal CRC code (two octets in length) are further added to these signals, and transmission is made in the layer 1.

PR	UW2	FID	LID	LRI	CRC	
2	2	1	4	1	2	(Octets)

Fig. 4.2.4.2.3.1-1 ACTC Format (ASK system)

(2) π/4 shift QPSK system

The subfield format within the ACTC shall be set as illustrated in Fig. 4.2.4.2.3.1-2 It shall consist of the following subfields: a link request (association request) subfield LRI for the ACTC (one octet in length), a link address of four octets and identification number FID of the base station. A ramp bit(one octet in length), a preamble signal PR (16 octets in length), an unique word signal UW2A (two octets in length) and a error check signal CRC code (two octets in length) are further added to these signals, and transmission is made in the layer 1. The data scramble system which it specifies in subclause 4.2.6 shall be applied to FID, LID, LRI and CRC.

			Data scramble renge			
R	PR	UW2A	FID	LID	LRI	CRC
1	16	2	1	4	1	2

(octet)

Fig. 4.2.4.2.3.1-2 ACTC Format (π/4 shift QPSK system)

4.2.4.2.3.1.1 Preamble (PR)

(1) ASK system

A preamble shall be 16 bits in length described below. This field shall be transmitted least significant bit (LSB) first in a bit string in the expressed sequence.

LSB MSB

[1010101010101010]

(2) π/4 shift QPSK system

A preamble shall be 128 bits in length described below. This field shall be transmitted least significant bit (LSB) first in a bit string in the expressed sequence.

LSB MSB

[10011001……..1001]

4.2.4.2.3.1.2 Unique word (UW2, UW2A)

A unique word is used for TDMA frame synchronization. An UW2 shall be 16 bits in length as follows. This field shall be transmitted least significant bit (LSB) first in a bit string in the expressed sequence.

(1) ASK system (UW2)

LSB MSB

[0100101100111110]

(2) π/4 shift QPSK system (UW2A)

LSB MSB

[1110000101001001]

4.2.4.2.3.1.3 Fixed Equipment ID (FID)

The length of a FID shall be one octet in length. The FID contained within the FCMS transmitted from the base station is multiplexed as it is.

4.2.4.2.3.1.4 Link Address Field (LID)

The link address LID is a private link address for making point to point two-way communication between the mobile station and the base station.

The sub-field format of LID shall be as illustrated in Fig. 4.2.4.2.1.8.2. The private link address shall use the 28 bits of bit number 2 through 8 of four octets. The bit number 1 (b1) of 1st octet shall be set to “0” and the bit number 1 (b1) of 4 the octet shall be set to “1”.

4.2.4.2.3.1.5 Link Request Information field (LRI)

A link request (association request) information field LRI is used for link request (association request) from the mobile station. The LRI shall be set as illustrated in Fig. 4.2.4.2.3.1.5.

The bit number 1 (b1) is the identifier whether or not the association request of the MDS assignment with priority is made. If the mobile station requests association with priority, it shall be set to “1”. If the mobile station requests association without priority, it shall be set to “0”.

When a request, the bit of which is “1”, is detected, the MDS is assigned in the uplink with the highest priority at the earliest opportunity. The mobile station may use this bit only when the conditions for assignment with priority are satisfied.

The bit number 2 (b2) is a response information field associated with the IMI of the SC. Where the base station set the IMI= “1” and a mobile station intends to associate using a simplified association (initialization) procedures indicated by the layer 7, it shall be set to “1”. If the mobile station can not or does not want to use a simplified association (initialization) procedures, it shall be set to “0”.

The bit numbers 3,4 (b3, b4) is a response information field for the PVI in the SIG. Using this subfield, the mobile station responds whether protocol version indicated by the base station is available or not. The definition of response parameter is to be developed at the time of the revision of the protocol defined in this standard. Therefore, it shall be set to “00”.

The bit numbers 5 through 8 (b5~b8) are application identifier flags. This subfield is used for the indication of comparison results of available applications and applications indicated by the base station. The comparison results are registered in the subfield of bit 5 through bit 8.

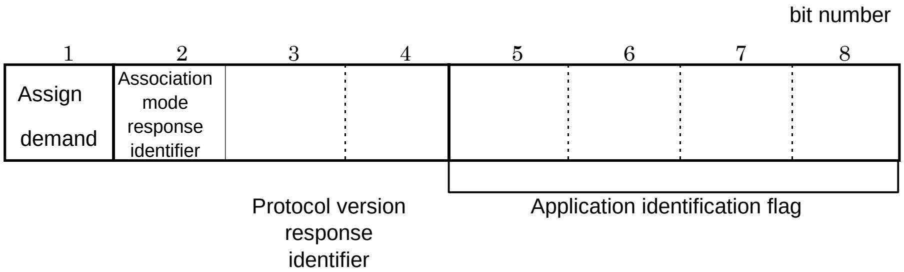


Fig. 4.2.4.2.3.1.5 LRI format

Note1) Underlying assumption is as follows.
The number of applications defined in Fig. 4.2.4.2.1.7.2(a) is 4. In the case of the normal association procedures, the bit number 5 (b5) is a registration field for an application (AID) indicated in the 2nd octet defined in Fig. 4.2.4.2.1.7.2(a). In the same manner, the bit number b6 corresponds to an application (AID) of the third octet, the bit number b7 corresponds to an application (AID) of the fourth octet and the bit number b8 corresponds to an application (AID) of the fifth octet. When the comparison result shows correspondence, it is set to “1”. When comparison result does not show correspondence, it is set to “0”.

Note2) The bit number 1 (b1) is specified for use at the time of emergency reporting from a *mobile station to a base station. The conditions for assignment with priority are to be defined elsewhere, but it is outside of the scope of this standard.*

4.2.4.2.3.1.6 Cyclic Redundancy Error Check Sequence (CRC)

A 16-bits CRC code shall be used for data check sequence for error detection purposes. The contents of the ACTC field excluding PR and UW2 field shall be contained in the calculation of ACTC field. The generator polynomial shall be as follows.

Generator polynomial: $X^{16}+X^{12}+X^{5}+1$

4.2.4.2.4 Wireless Call Number slot (WCNS)

The sub-field format of the WCNS (Call sign) of the mobile station and test equipment shall be set as illustrated in Fig. 4.2.4.2.4-1(ASK system) and Fig 4.2.4.2.4-2(π/4 shift QPSK system). This WCNS contains a window for a WCNC (wireless call number channel). A wireless call number is an approval number granted from the government certification office as an inherent wireless mobile terminal. WCNC shall transmit using specified window according to indication from the base station. Guard times t7 and t8 shall be set before and after the window. The format of WCNC (Call sign) shall conform to Annex C.

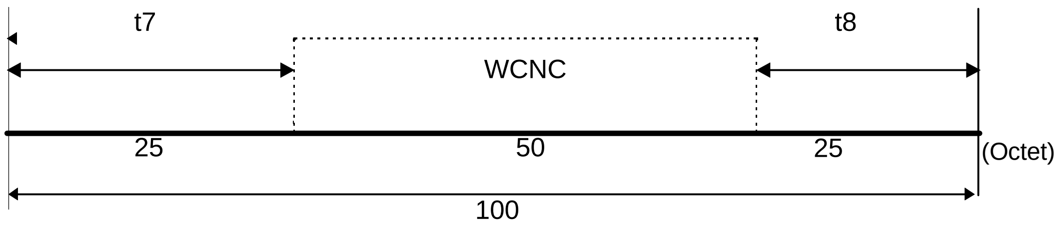


Fig. 4.2.4.2.4-1 WCNS format (ASK system)

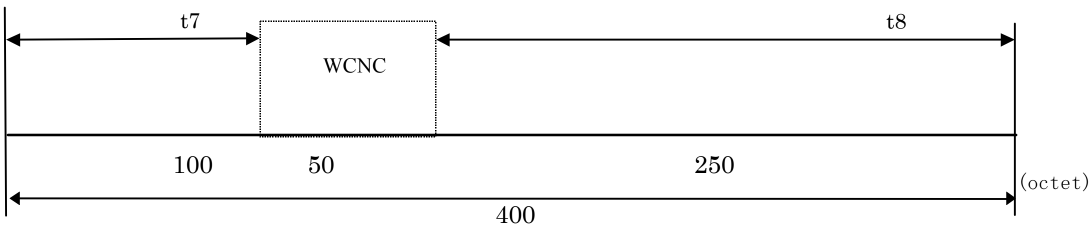


Fig. 4.2.4.2.4-2 WCNS format (π/4 shift QPSK system)

Note) Even if transmission of WCNC is delayed by other internal processings, the window width of WCNC which included the margin so that it could surely transmit is specified.

4.2.4.3 Frame Check Sequence

A 16-bit CRC code shall be used for data check sequence for error detection purposes. This error check sequence shall apply to each channel. The field for the CRC calculation is specified in subclause corresponding to each channel.

This CRC shall be conform with 16 bits frame check sequence (FCS) as defined according to ITU-R recommendation. The generator polynomial shall be the expression as follows, and initial value used shall be FFFF (all "1"). The ones complement of the remainder shall be transmitted as the 16 bits FCS. The CRC field shall be transmitted commencing with the coefficient of the highest order term.

Generator polynomial: $X^{16}+X^{12}+X^{5}+1$

4.2.4.4 Forward Error Correction (FEC)

The FEC is used for MDC of the up link and down link in π/4 shift QPSK system. An error correcting code shall use BCH(63,51), and shall be calculated according to the following procedure.
First, it will become 1581bits if 5bits of "01001" is added to a total of 197 octets from the bit next to UW2B of MDC to the last bit of CRC at the end in bit order. It is divided into 31 blocks every 51 bits. A 12bits error correcting code is added to each block. Next, it adds tail bit of one bit "0" to the next of the last (the 31st) block, and create the total "244 octet + 2bit" field (Fig 4.2.4.2.2.1-2). Furthermore, the method of addition of an error correcting code in each block is defined below.

In each block, the 51 information bits are assumed to be "b_{50}、b_{49}、b_{48}、b_{47}、b_{46}、b_{45}、b_{44}、b_{43}、b_{42}、b_{41}、b_{40}、b_{39}、b_{38}、b_{37}、b_{36}、b_{35}、b_{34}、b_{33}、b_{32}、b_{31}、b_{30}、b_{29}、b_{28}、b_{27}、b_{26}、b_{25}、b_{24}、b_{23}、b_{22}、b_{21}、b_{20}、b_{19}、b_{18}、b_{17}、b_{16}、b_{15}、b_{14}、b_{13}、b_{12}、b_{11}、b_{10}、b_{9}、b_{8}、b_{7}、b_{6}、b_{5}、b_{4}、b_{3}、b_{2}、b_{1}、b_{0}" in the bit order. Furthermore, if the bits which added the error correction code are assumed to be "a_{62}、a_{61}、a_{60}、a_{59}、a_{58}、a_{57}、a_{56}、a_{55}、a_{54}、a_{53}、a_{52}、a_{51}、a_{50}、a_{49}、a_{48}、a_{47}、a_{46}、a_{45}、a_{44}、a_{43}、a_{42}、a_{41}、a_{40}、a_{39}、a_{38}、a_{37}、a_{36}、a_{35}、a_{34}、a_{33}、a_{32}、a_{31}、a_{30}、a_{29}、a_{28}、a_{27}、a_{26}、a_{25}、a_{24}、a_{23}、a_{22}、a_{21}、a_{20}、a_{19}、a_{18}、a_{17}、a_{16}、a_{15}、a_{14}、a_{13}、a_{12}、a_{11}、a_{10}、a_{9}、a_{8}、a_{7}、a_{6}、a_{5}、a_{4}、a_{3}、a_{2}、a_{1}、a_{0}" in the bit order, each of these bits (a62 to a0) equal to the coefficient of terms (62nd degree to 0th degree).
These coefficients are equal to the coefficients of the polynomial (shown below) on the finite field that the order is 2.

$$X^{12} \cdot \left(\sum_{i=0}^{50} b_i X^i\right) + R(X)$$

Here, the R(X) is defined as the remainder polynomial when dividing

$$X^{12} \cdot \left(\sum_{i=0}^{50} b_i X^i\right) \quad \text{by} \quad (X^{12}+X^{10}+X^{8}+X^{5}+X^{4}+X^{3}+1).$$

And the 11th order to the 0th coefficient of R (X) expresses a11 to a0 of the added 12-bit error correction code.

4.2.5 Bit Order

Each sub-field shall be transmitted least significant bit (LSB) first, i.e. low order bit first (the first bit of transmitted data has a weight of 2^0). However, the protocol data unit consisting of MDC's MAC control field and LPDU is defined in subclause 4.3.

4.2.6 Scramble System

This standard specifies this communication system using a simple encryption system (encryption scramble system) with an encryption key delivery in the layer 2 as means for the privacy protection and countermeasures against the radio interception at the minimum level. Moreover, apart from the encryption scramble system for the simple encryption described above, the data scramble system for the code balance maintenance at the time of radio transmission of $\pi/4$ shift QPSK system is defined separately.
Fig. 4.2.6 shows an outline of the data scramble system .

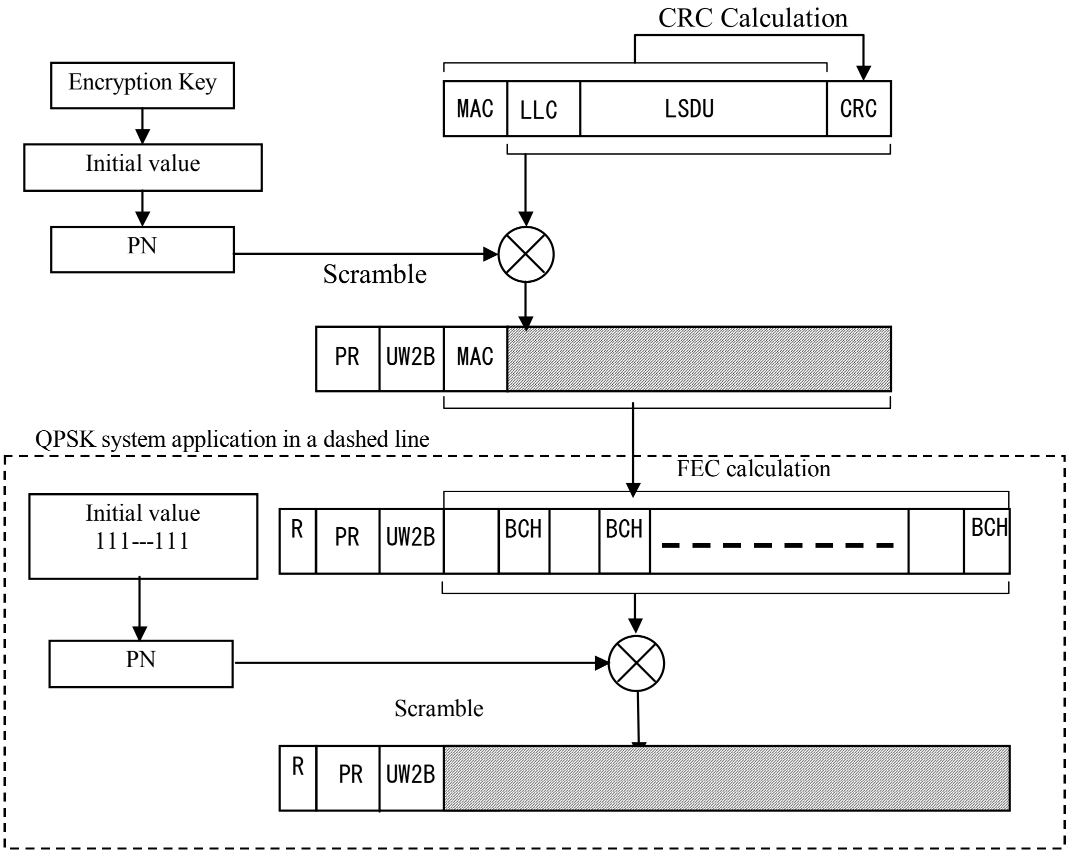


Fig 4.2.6 Overview of data scramble system

4.2.6.1 Simple encryption scramble

The simple encryption (encryption scramble) shall be adopted only with MDC.

4.2.6.1.1 Encryption Key

An encryption key is used for the initial values of shift register for scramble. The key length is two octets (16 bits).

The encryption key makes use of the link address exchanged in the communication establishment phase of the base station and the mobile station. The same conversion table prepared previously at the base station and the mobile station shall be used for converting this link address and generating the encryption key.

The method for generation of the conversion table is specified in Annex D.

4.2.6.1.2 Encryption Scramble System

The encryption key determines the initial value of the shift register for scramble.
A PN pattern of 16 stages, an M series is used for scramble. The generator polynomial shall be as follows.

Generator polynomial: $1 + X + X^3 + X^{12} + X^{16}$

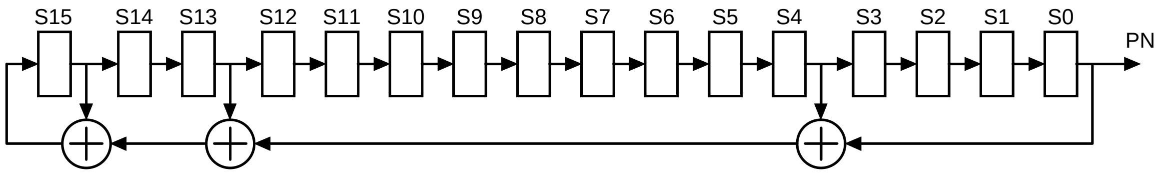


Fig. 4.2.6.1.2 PN Pattern Generation

A typical PN pattern generation circuit (shift resistor composition) for the scramble shall be used as shown in Fig. 4.2.6.1.2 The scramble is of initial value set type with which the initial value of the shift register is set for each communication between the base station and the mobile station.

4.2.6.2 Data scramble

This standard specifies a data scramble system for the modulation balance maintenance of 0 and 1 at the time transmission with π/4 shift QPSK system. This data scramble shall be adopted with all transmission channels.

4.2.6.2.1 Data scramble system

The initial value of the shift register for scramble is determined as ‘1111….111’. A PN pattern of 12 stages, an M series is used for scramble. The generator polynomial shall be as follows.

Generator polynomial: $1 + X + X^4 + X^6 + X^{12}$

A typical PN pattern generation circuit (shift resistor composition) for the scramble shall be used as shown in Fig. 4.2.6.2.1 The scramble is of initial value set type with which the initial value of the shift register is set for each communication between the base station and the mobile station.

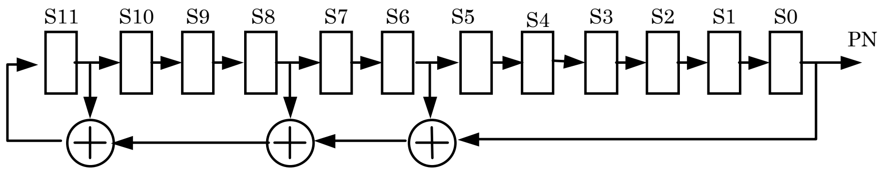


Fig. 4.2.6.2.1 PN Pattern Generation

4.2.6.2.2 Relationship between Data Scramble, Encryption Scramble and Error Check Code (CRC), Forward Error Correction Code (BCH)

A CRC calculated itself of the MDC is described in subclause 4.2.4.3, and BCH calculation is described in subclause 4.2.4.4. The sequence of the scramble generation procedures, the CRC calculation and the BCH calculation are specified in this subclause.

4.2.6.2.3 Sequence of CRC Calculation, FEC Calculation (BCH) and simple encryption and Data Scramble

The processing procedures at the time of transmission are specified as follows.
The receiver side is of the sequence opposite to this sequence.
(1) CRC calculation is performed and the result (CRC) is added after LSDU.
(2) Execution of simple encryption scramble
(3) Execution of forward error correction code (BCH) calculation (only in case of π/4 shift QPSK system)
(4) Execution of data scramble (only in case of π/4 shift QPSK system)
(5) Transmission

4.2.6.2.4 Range of CRC Calculation, FEC Calculation (BCH), simple encryption scramble, and Data Scramble

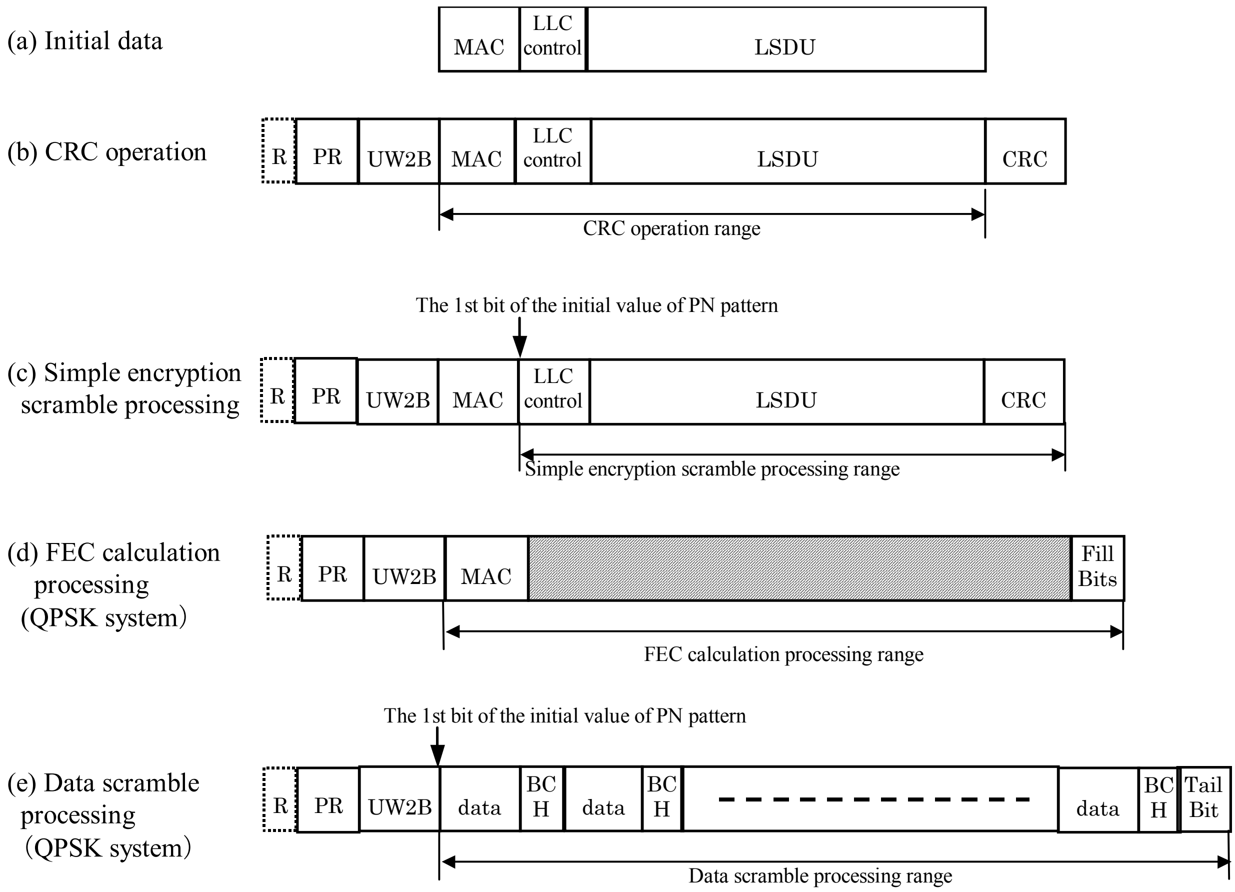
Only in case of π/4 shift QPSK system, the FEC calculation and the data scramble are applied.

4.2.6.2.4.1 Scope of application and processing procedure in the MDC

The scope of application in the MDC is shown in Fig.4.2.6.2.5.1. Each processing is shown below.

(1) CRC calculation ... From the bit next to UW2B to the last bit of LSDU.
(2) Simple encryption scramble ... From the bit next to MAC control field to the last bit of CRC.
(3) FEC calculation (only in case of π/4 shift QPSK system) …From the bit next to UW2B to the last of Fill bits.
(4) Data scramble (only in case of π/4 shift QPSK system) …From the bit next to UW2B to the Tail bit.

Note) Where an LPDU is fragmented, the LLC field is only contained in the first MSDU.



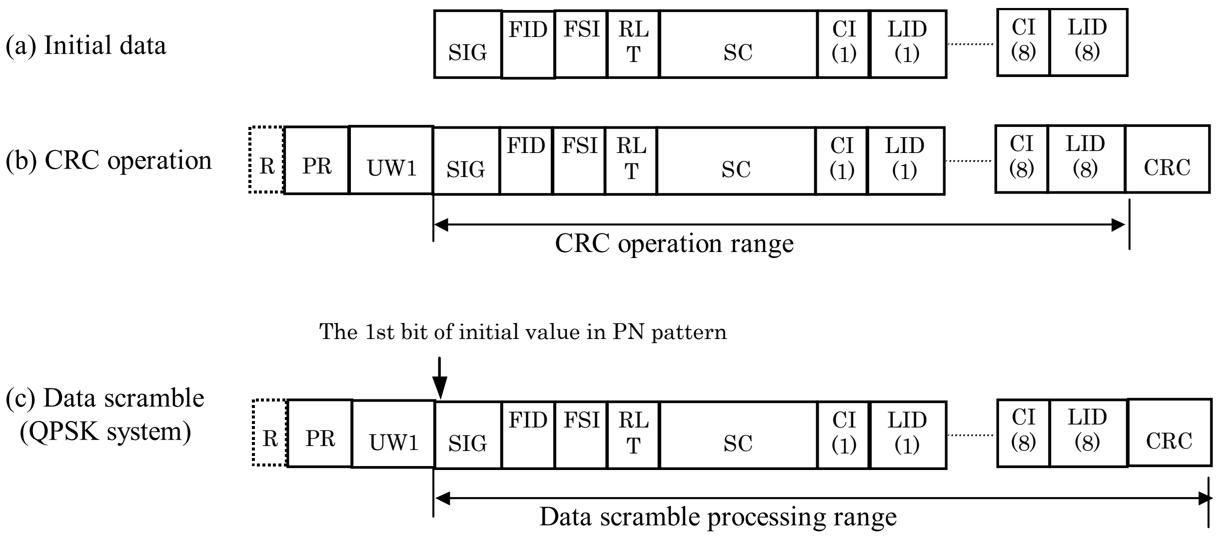
Note) In case of π/4 shift QPSK system, a ramp bit is added at the time of transmission.

Fig.4.2.6.2.5.1 Processing of scramble in the MDC

4.2.6.2.4.2 Scope of application and processing procedure in the FCMC

The scope of application in the FCMC is shown in Fig.4.2.6.2.5.2. Each processing is shown below.

(1) CRC calculation ... From the bit next to UW1 to the last bit of LID.
(2) Simple encryption scramble ...Not specified.
(3) FEC calculation …Not specified.
(4) Data scramble (only in case of π/4 shift QPSK system) …From the bit next to UW1 to the last bit of the CRC.



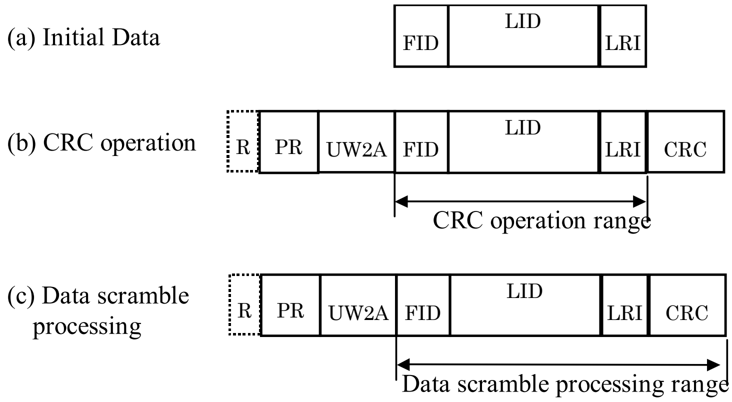
Note) In case of π/4 shift QPSK system, a ramp bit is added at the time of transmission.

Fig.4.2.6.2.5.2 Processing of scramble in the FCMC

4.2.6.2.4.3 Scope of application and processing procedure in the ACTC

The scope of application in the ACTC is shown in Fig.4.2.6.2.5.3. Each processing is shown below.

(1) CRC calculation ... From the bit next to UW2A to the last bit of LRI.
(2) Simple encryption scramble ...Not specified.
(3) FEC calculation …Not specified.
(4) Data scramble (only in case of π/4 shift QPSK system) …From the bit next to UW2A to the last bit of the CRC.



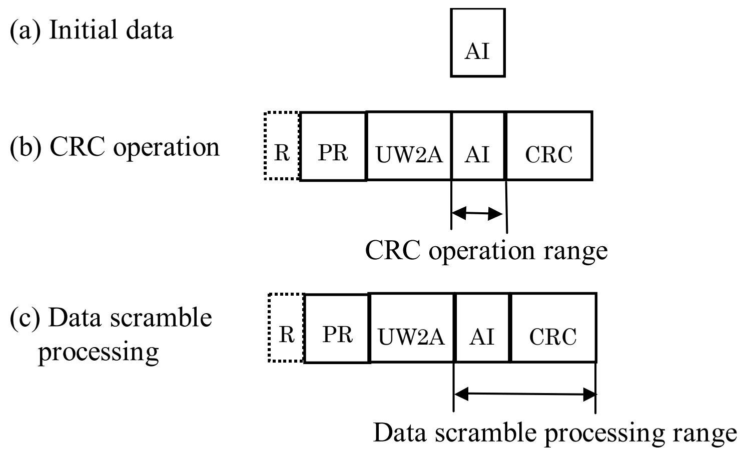
Note) In case of π/4 shift QPSK system, a ramp bit is added at the time of transmission.

Fig.4.2.6.2.5.3 Processing of scramble in the ACTC

4.2.6.2.4.4 Scope of application and processing procedure in the ACKC

The scope of application in the ACKC is shown in Fig.4.2.6.2.5.4. Each processing is shown below.

(1) CRC calculation ...All the bits of the AI..
(2) Simple encryption scramble ...Not specified.
(3) FEC calculation …Not specified.
(4) Data scramble (only in case of π/4 shift QPSK system) …From the bit next to UW2A to the last bit of the CRC.



Note) In case of π/4 shift QPSK system, a ramp bit is added at the time of transmission.

Fig.4.2.6.2.5.4 Processing of scramble in the ACKC

4.2.7 Guard time

The guard times of the basic frame or channels shall be set as shown in Table 4.2.7 by octet length. In case of time conversion in ASK system, guard time is the calculation of the multiplied of the indicated units by 7.8125 μs. And in case of time conversion in π/4 shift QPSK system, guard time is the calculation of the multiplied of the indicated units by 1.9531 μs.

These values shall be adapted conformable to the following specifications.
(1) Accuracy of the modulation signal rate (subclause 3.2.9)
(2) Burst transmission transient response time (subclause 3.4.2.6)
(3) Allowable deviation of absolute signal transmission time (subclause 3.4.2.13)
(4) Transmission / reception switching time (subclause 4.2.10)

Table 4.2.7 Guard Time of Basic System

Parameter	ASK system Set time (octets)	π/4 shift QPSK system Set time (octets)	Remarks
t0	28	112	See subclause 4.2.4.2.1
t1	0	0	See subclause 4.2.4.1
t2	12	214	See subclause 4.2.4.2.1
t3	11	73.75	See subclause 4.2.4.2.2
t4	9	43	See subclause 4.2.4.2.2
t5	2	30	See subclause 4.2.4.2.3
t6	18	94	See subclause 4.2.4.2.3
t7	25	100	See subclause 4.2.4.2.4
t8	25	250	See subclause 4.2.4.2.4

Note) The ramp bit R in the π/4 shift QPSK system is not contained in this time conversion table.

4.2.8 Channel selection procedures on the mobile station

4.2.8.1 Channel selection procedure

(1) Definition
This is the procedures when a mobile station selects one correct frequency channel from specified plural channels on receiving the radio signal and from a base station in a defined radio communication zone.

(2) Setting priority channels
It is recommended that priority channels be set in order to reduce time for frequency channel selection. When a mobile station implements an application for electronic toll collection (ETC) systems, it shall assign two channels for ETC systems to the first priority channels and give higher priority to these channels in frequency channel selection.

Regarding applications other than ETC systems, a mobile station can assign a specific channel to the second priority channel and give higher priority to this channel in frequency channel selection, so that the time for frequency channel selection will be reduced.

(3) Recommend procedures
Base station:
Previously, one frequency transmission channel shall be preset.

Mobile station:
On receiving the FCMC signal with signal level higher than the specified level, the FCMC may execute error detection procedures using CRC field. (On receiving different frequency channel signals simultaneously, it is desired that the mobile station determines, which signal level is higher, if possible.) Where it does not show an error in corresponding FCMC, the mobile station may set one radio frequency channel according to FTI within the corresponding FCMC.

(4) Procedures of the mobile station
(a) It is desired that the mobile station select one radio frequency channel after error checking if plural FCMCs are received continuously.
Firstly, after the FCMC has selected correctly, the mobile station sets one radio frequency channel according to FTI within the corresponding FCMC. Secondly, using following FCMC, the mobile station transmits an ACTC. Adopting this procedures, it is the same as executing error detection procedures of FCMC twice.

(b) Ways of setting radio frequency channel in the mobile station
1) High-speed frequency switching through all frequencies (e.g. high-speed frequency

switching of a local oscillator, etc.)

2) Frequency channel selection using priority channels

Here are some examples of frequency channel selection method:

i) The priority channels are given higher priority in frequency scan; the other channels are scanned less frequently.

ii) Among priority channels, the first priority channel is given the highest priority in frequency scan. The second priority channel is scanned less frequently than the first priority channel, and the other channels are scanned even less frequently.

3) Presetting data concerning the next base station to transact, based on the data concerning the previous transaction

(e.g. In lane-based systems, data concerning transaction with the first antenna can be used for transaction with the second antenna. This allows a mobile station to skip the frequency selection procedure for the second antenna.)

4) Other way

(c) Setting window of the mobile station.

Considering the mobile station which cannot previously know a period of transmission of FCMC from the base station, in the case of adopting a searching signals way, it may be suitable for the mobile station to use a window (time slot) for the channel selection procedures.

4.2.8.2 Channel change procedures [Informative]

(1) Definition

This is the procedure to be followed when a mobile station changes the current frequency channel to a different one within the same radio communication zone based on the frequency data obtained from the base station. This is also the procedure to be followed when a mobile station selects a frequency channel to use in the next radio communication zone and changes to it based on the frequency data obtained from the base station or by other means.

(2) Procedures

- Procedure of the base station

The base station shall conduct any one of the following operations:

a. Sets a specific value as a FCMC parameter. (Refer to Note 4 of Section 3 in Annex B.)

b. Transmits frequency data in an application data format by wireless communication.

c. Other

- Procedure of the mobile station

The mobile station shall conduct any one of the following operations:

a. Recognizes a specific value as a FCMC parameter and sets a frequency channel. (Refer to Note 4 of Section 3 in Annex B.)

b. Recognizes frequency data transmitted in an application data format by wireless communication and sets a frequency channel.
c. Recognizes frequency data obtained by other means and sets a frequency channel.
d. Other

(3) Setting a frequency channel by the mobile station

a. The mobile station shall determine whether the obtained frequency data is the one concerning frequency channel change within the current radio communication zone or the one concerning frequency channel change in the next radio communication zone.
b. If the data is concerning frequency channel change in the next radio communication zone, the mobile station shall stop the normal frequency channel selection procedure and set a specific frequency channel using the systems management interface from the application after it has completed the communication at the frequency of the current radio communication zone or detected departure from the current radio communication zone.
c. If the data is concerning frequency channel change within the current radio communication zone, the mobile station shall stop the normal frequency channel selection procedure and set a specific frequency channel using the systems management interface from the application.
d. As soon as communication at a changed frequency channel has been completed, the mobile station shall return to the normal frequency channel selection procedure.
   Note) The procedures for transmission of frequency data in an application data format by wireless communication and setting a frequency channel by the mobile station are detailed in Annex E.

(4) Frequency data transmitted in an application data format by wireless communication
Although the details of frequency data are governed by this standard, it is desirable that attribute IDs and the like be defined in a way that they will be applicable to multiple applications.

4.2.8.3 Channel selection procedure in overlapping radio communication zones by the mobile station

(1) Definition
This is the procedure for the mobile station to receive radio signals from the base station and select a frequency channel for use in wireless communication in overlapping radio communication zones.

(2) Channel selection procedure in overlapping communication zones
The mobile station shall use the normal frequency channel selection procedure in overlapping

radio communication zones.

(3) Channel change procedures after frequency channel selection in overlapping radio communication zones
Not specified.

4.2.9 Channel selection time of the mobile station

(1) Definition
A channel selection time specifies the time that the mobile station completes its channel selection procedures. When the wake-up process is adopted, it assumes that a channel selection time contains the wake-up process time. Furthermore, adopting switching antenna method, switching time is also included in the channel selection time.

(2) Specification
The channel selection time required for the mobile station to select the first priority channel used in ETC systems, shown in Table 3.1, shall be the time of 9 frames or less. The time for the other channels in Table 3.1 is not specified.

(3) Frame length and Channel selection time
The channel selection time of the mobile station shall be based on a data transmission rate of 1024kbps. The number of MDSs is basically classified in series 2,4,8. According to the number of MDSs, frame classes are classified as shown in Table. 4.2.9. In addition, the absolute channel selection time (9-frame lengths) according to the frame classes are shown in this figure.

Table. 4.2.9 Relationship between frame length and channel selection time

Frame Class	Frame length (unit: slot)	Frame Period (ms)	Selection Time (ms)	zone
A	1FCMS+2MDS= 3 slots	3 x 0.78125ms =2.34375	21.09375	Lane based (narrow area) etc.
B	1FCMS+4MDS= 5 slots	5 x 0.78125ms =3.90625	35.15625	Free flow (wide area) etc.
C	1FCMS+8MDS= 9 slots	9 x 0.78125ms =7.03125	63.28125	Free flow (wide area) etc.

Note) 1slot =100 octets. It is equal to 0.78125 ms in data transmission rate of 1024 kbps.

4.2.10 Transmission / Reception Switching time

(1) Definition
A transmission / reception switching time specifies the transient time that the mobile station moves its state from reception state to transmission state or from transmission state to reception state.

This specification does not apply to the base station, since the base station may operate in full-duplex mode.
The burst transient time may be contained in this transmission / reception switching time.

(2) Specifications
1) The time taken for the mobile station to switch time from reception state to transmission state shall be less than 64 μs.

Note) A channel selection time shall not be included in this transmission / reception switching time.

2) The time taken for the mobile station to switch from transmission state to reception state shall be less than 64 μs.

(3) Description
A transmission / reception switching time shall contain the data processing time in the layer 1 and the layer 2.
The layer 7 or applications (service user) may elapse more time than specified time in this subclause, since the data could not process smoothly by any reason. The layer 2 management entity has a timer (maximum number of frames) for the rapid re-association, when the communication transaction fails. After elapse of this timer, the communication transaction would be cancelled.

If the cancellation is not desired, the mobile station may need temporal data transmission including any idle message.

4.2.11 Wake-up processing of the mobile station

(1) Definition
This processing specifies that the mobile station is able to communicate in a defined radio communication zone, or the transient of the mobile station move state from a standby state (sleep mode state) to an operation state. The latter standby state is the function of an energy management to avoid wasting the battery energy in the mobile station.

(2) Specification

1) The wake-up process shall apply to the normal type of data transaction.
2) The mobile station may not adopt the Wake-up process.

4.2.12 Maximum start-up time of the mobile station

(1) Definition

A maximum start-up time is the time for the mobile station to complete the wake-up process, after receiving the minimum length of downlink data (message) which enables the trigger of transition.

(2) Specifications

Maximum start-up time of the mobile station shall be less than 5 ms.

4.2.13 Test Equipment

4.2.13.1 Conditions for slot transmission

(1) Definition

The communication system specified in this standard uses a wireless communication system in which the base station (test equipment) manages transmission of the wireless communication slot of the mobile station. This standard defines the conditions for slot transmission under which the test equipment can transmit slots (frame control message channels, etc.) to prevent the test equipment from interfering the base station and the mobile station.

(2) Scope

These specifications apply to the test equipment.

(3) Specifications

1) Within 3 seconds prior to the start of communication, carrier sense shall be conducted for the time of 10 frames or more by unit of the maximum frame length described as frame class in Table 4.2.9. Unless the test equipment detects a carrier which equals or exceeds a specified carrier sense level, it shall be able to start slot transmission. Note that the carrier sense shall be conducted at a specified carrier sense frequency.

2) Carrier sense level

The test equipment shall measure the carrier sense level using an antenna for carrier sense that is specified separately. In carrier sense, the equipment shall be capable of detect a carrier which is equal to or below the carrier sense level shown in Table 3.4.5 in front of the carrier sense antenna. If it detects a carrier which equals or exceeds this carrier sense level, it shall not be able to start slot transmission.

Reference:
The method of detection is to conduct average detection for the time of less than half a frame control message channel (FCMC).

Table. 3.4.5 Carrier sense level

Carrier frequency	Carrier sense level
Cannel for radio wave emission	-78 dBm e.i.r.p
Cannel adjacent to the above channel	-78 dBm e.i.r.p

3) Carrier sense frequency
The carrier sense frequency indicates a frequency of a channel at which the test equipment emits radio waves after the completion of carrier sense and a frequency of a channel adjacent to the said frequency.

4) Antenna for carrier sense
When the transceiver antenna of the test equipment is used in carrier sense instead of the antenna dedicated to carrier sense, the differences in the following points must be considered:
- Difference in position
- Difference in gain
- Difference in polarization
- Difference in directivity

4.2.13.2 Avoidance of interference and suspension of transmission
(1) Definition
This is the operation for the test equipment to suspend transmission in order to avoid interference when interference is detected (by carrier sense, etc.).

(2) Scope
These specifications apply to the test equipment.

(3) Specifications
a) Continuous communication time
When communication is conducted continuously, the continuous time length shall be the minimum of the tested item. Carrier senses shall be included during the time and the time interval between carrier senses specified in Subclause 3.4.5 shall be as short as possible.

b) Time interval before resuming communication
When a carrier that equals or exceeds the carrier sense level specified in Subclause 3.4.5.a is detected, the test equipment shall suspend slot (frame) transmission. In such a case, when communication (slot transmission) is resumed at the same channel frequency, there shall be at least a 10-second time interval after the suspension of slot transmission. Then, a carrier sense operation specified in Subclause 3.4.5.a shall be resumed.

c) Suspension of transmission
When a carrier is detected that equals or exceeds the carrier sense level specified in Subclause 3.4.5.a, the test equipment shall suspend slot (frame) transmission immediately.

4.2.13.3 Wireless call number slot (WCNS) transmission
When the test equipment transmits a wireless call number channel (WCNC), it shall do so by assigning a downlink WCNS in such a way that there will be no influence on testing. The method of WCNS assignment is not specified in this standard.

4.2.14 Layer 1 Management service interface.

4.2.14.1 Overview of Interactions

The layer 1 management entity (PLME) provides the following primitives to a MAC sublayer management entity in the layer 2 or a system management entity (SME).

PLME-GET.request
PLME-GET.confirm
PLME-SET.request
PLME-SET.confirm

The management information specific to the layer 1 is represented as a layer 1 (Physical Medium Layer) Management Information Base (MIB). The PLME-GET.request primitive is passed to the layer 1 management entity (PLME) to request from the user entity (the SME or the MAC sublayer management entity (MLME)) to get the value of the MIB attribute. The PLME-GET.confirm is passed from the PLME to convey the results of the previous action associated with the PLME-GET.request primitive. The PLME-SET.request primitive is passed to the PLME to request that the user-entity (the SME or the MLME) set the value of the MIB attribute. The PLME-SET.confirm is passed from the PLME to convey the results of the previous action associated with the PLME-SET.request primitives.
Details of the variable definition of the MIB are shown in Annex A.

4.2.14.2 Service specification

This subclause describes in detail the primitives and parameters associated with the service specified in subclause 4.2.13.1. The parameters are abstractly described, and specified in view of the necessity for the receive entity. A specific implementation is not constrained in the method of making this information available. Figure 4.2.13.2. shows the logical relationship of primitives.

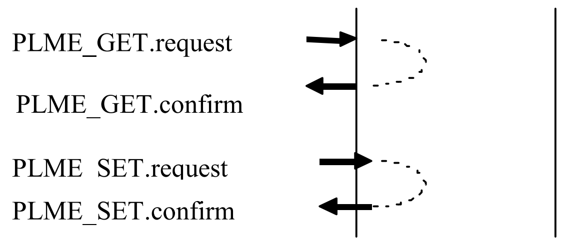


Fig.4.2.13.2 Time-sequence diagram

4.2.14.2.1 PLME-GET.request

(1) Function
This primitive is to request for the MIB access service.

(2) Semantics of Service Primitive
The primitive parameters shall be as follows:

PLME-GET.request (MIB-attribute)

The MIB-attribute parameter is specific to the attribute of the MIB.

(3) When Generated
This primitive is generated by the SME or the MLME to request for getting the MIB attribute of the PLME and is passed to the PLME.

4.2.14.2.2 PLME-GET.confirm

(1) Function
This primitive is to report the results of the action associated with the PLME-GET.request.

(2) Semantics of Service Primitive
The primitive parameters shall be as follows:

PLME-GET.confirm (status, MIB-attribute, MIB-attribute-value)

The status parameter indicates the success or the failure of the MIB-attribute reading requests.
The MIB-attribute parameter is specific to the attribute provided by the PLME-GET.request.
The MIB-attribute-value is specific to the value of the attribute itself.

Note 1) If a type of invalid attribute is specified, the status will indicate the failure.
Note 2) If the status indicates the failure, the MIB-attribute-value will not assure validity.

(3) When Generated
This primitive is generated by the PLME to report the results of the previous action provided by the PLME-GET.request primitives and is passed to the SME or the MLME.

4.2.14.2.3 PLME-SET.request

(1) Function
This primitive is to request for the MIB access service.

(2) Semantics of Service Primitive
The primitive parameters shall be as follows:

PLME-SET.request (MIB-attribute, MIB-attribute-value)

The MIB-attribute parameter specifies the attribute of the MIB.
The MIB-attribute-value is specific to the value.

(3) When Generated
This primitive is generated by the SME or the MLME to request for writing the MIB attribute of the PLME and is passed to the PLME.

4.2.14.2.4 PLME-SET.confirm

(1) Function
This primitive is to report the results of the action associated with the PLME-SET.request.

(2) Semantics of Service Primitive
The primitive parameters shall be as follows:

PLME-SET.confirm (status, MIB-attribute)

The status parameter indicates the success or the failure of the setting MIB-attribute request provided by PLME-SET.request.
The MIB-attribute parameter is specific to the attribute provided by PLME-SET.request.

Note) If a type of invalid attribute is specified, the status will indicate failure.

(3) When Generated
This primitive is generated by the PLME to report the results of the previous action provided by the PLME-SET.request primitives and is passed to the SME or the MLME.

4.3 Layer 2 Standards

4.3.1 Outline of the layer 2

4.3.1.1 Overview

The layer 2 has the same meaning as the data link layer. The layer 2 is further divided into two distinct layers, the logical link control sublayer (LLC sublayer) and medium access control sublayer (MAC sublayer).
The LLC sublayer performs data exchange between LLC sublayers and provides its service for the layer 7.

The MAC sublayer also performs data transmission between MAC sublayers using the bit transmission function of the layer 1 (physical layer). The MAC sublayer manages the bit order data reception/transmission using physical medium channel cooperating with the MAC sublayer management entity (MLME). The MAC subalayer also performs the association (data link connection) cooperating with the functions of the layer1, the layer7 and the system management entity (SME).

This subclause specifies frame structure, elements for procedures and procedures for performing the above operations.

4.3.1.2 Overview of Services

The layer 2 standard is divided in two parts, the MAC sublayer and the LLC subalyer. Each sublayer is specified as below.

4.3.1.2.1 MAC Sublayer

The MAC sublayer is responsible for controlling the physical medium by the MAC entity. The contents of the service are as follows.

(1) Association
Associates with the base station from the mobile station.
(2) Frame control
Manages frames such as slot assignment.
(3) Fragmentation
Fragment a LPDU in MSDUs and defragment MSDUs.
(4) MAC level acknowledgment
Actions regarding error control of the transmission MPDU in MAC sublayer.

(5) Simple encryption
Performs simple encryption to MDCs LPDU and CRC field.

4.3.1.2.2 LLC Sublayer

The LLC sublayer is specified by the identification protocol procedures used for the transfer of information and control between a pair of data link service access points between a base station and a mobile station. Data transfer, retransmission control, etc are performed in accordance with the LLC control field. Operations of two types indicated below are defined in the LLC procedures.

(1) Type l operation: Unacknowledged connectionless-mode services
(2) Type 3 operation: Acknowledged connectionless-mode services.

Note) Type 3 data transfer service is reserved for future systems at this time. The implementation of Type 3 in future systems will be considered

4.3.1.3 Protocol Data Unit

A protocol data unit of the layer 2 is specified in this subclause.

4.3.1.3.1 Protocol Data Unit

The protocol data unit of the layer 2 consists of a MAC control field and a link protocol data unit (LPDU) as shown in Fig. 4.3.1.3.1. The length of LPDU shall be integral multiples of 1 octet. The link address is not contained in the protocol data unit, since the link address is contained within the FCMC.

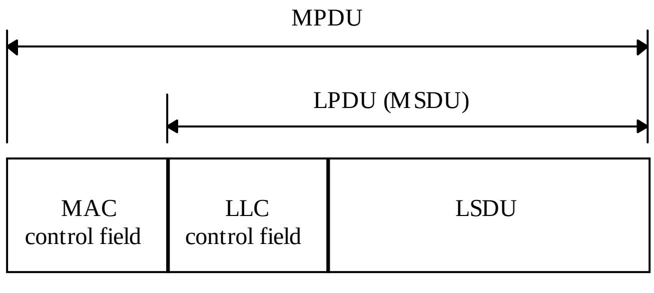


Fig. 4.3.1.3.1 Field format of Protocol Data Unit of the Layer 2

4.3.1.3.2 Relationship between Frame Format and Physical channel

The relationship between the protocol data unit of the layer 2 and frame format of the layer 1 is shown in Fig. 4.3.1.3.2. The protocol data unit of the layer 2 is multiplexed at the position of the MDC in the MDS, with the PR, UW2 and CRC added to it, at the time of delivery to the layer 1.

In the case of the downlink transmission from a base station to a mobile station, the base station registers the link address received from the mobile station at the SCI of the FCMC. The protocol data units of the layer 2 contained the data from the service access point indicated by this link address is previously multiplexed by the procedures stated at the MDS that corresponds to the position of the SCI, and is transmitted to the mobile station. The mobile station compares the link address used at the time of association request with the link address contained in the SCI of the FCMC. When the SCI contained the same address is detected; the data is received from the MDS of the corresponding position, and passes the data to the service access point indicated by the link address, which was held by it.

In the case of the uplink transmission from the mobile station to the base station, the base station registers the link address received from the mobile station at the SCI of the FCMC. The mobile station compares the link address used at the time of link request with the address contained in the SCI of the FCMC and identifies the position of the MDS. The protocol data unit of the layer 2 contained the data from the service access point indicated by this link address is multiplexed at the identified MDS by the procedures described. The base station receives the data from the MDS which corresponds to the SCI, at which link address was registered, and passes the data to the service access point indicated by this link address. Where the LPDU from the LLC sublayer exceeds 65 octets (or 193 octets in QPSK), sequence numbers are added to plural MDSs by LPDUs of 65-octet units (or 193-octet units in QPSK), and thus data is transmitted fragmented.

The MAC sublayer that received the data performs linking processing of these data and then passes the data to the LLC sublayer. The details of these procedures are specified in subclause 4.3.3.4 and 4.3.3.5.

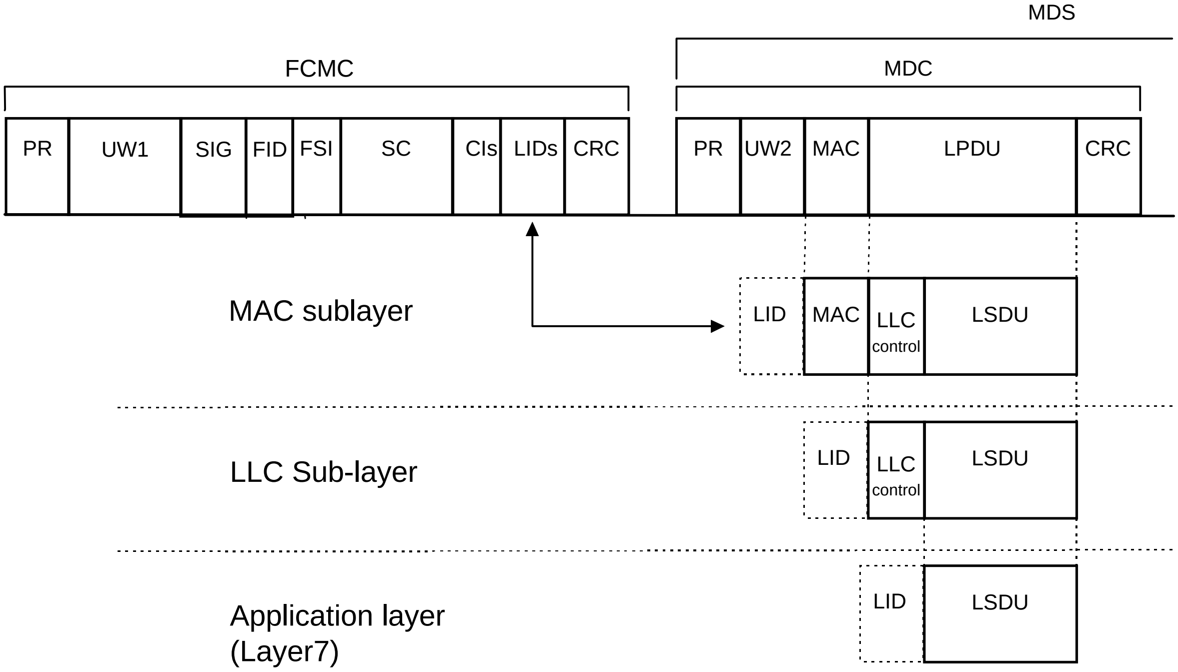


Fig. 4.3.1.3.2 Protocol Data Unit and Frame (the case where the length of LPDU is up to 65 octets [or 193 octets in QPSK])

4.3.2 Link Address (LID)

The link address format is defined in subclause 4.2.4.2.1.8.2. Link address is generated in the layer 7 of the mobile station and used for the association with the base station. This LID shall be a link address that is common to the base station and the mobile station, and the same link address shall be used in the Layer 1, Layer 2 (MAC sublayer and the LLC sublayer), layer 7, each layer management entity and system management entity.
Link address LID is available in three types.

(1) A private link address for the point to point two-way (selective) communication between a mobile station and a base station.
(2) A broadcast link address for the transmission of data, etc., in broadcast type from a base station to plural mobile stations.
(3) A multicast (group) link address for the transmission/reception of data, etc., from a base station to plural groups of mobile stations.

4.3.2.1 Restraint of link address usage

An overview of link addresses is shown in Fig. 4.3.2.1. At the point to point communication, the private link address shall be used. The mobile station should at least be capable of dealing with private link address and broadcast link address. Depending on the type of the mobile station, the multicast (group) link addresses are available. The mobile station should use the private link address at the time of uplink transmission to the base station. The same LID shall be used while the communication is continuously executing.

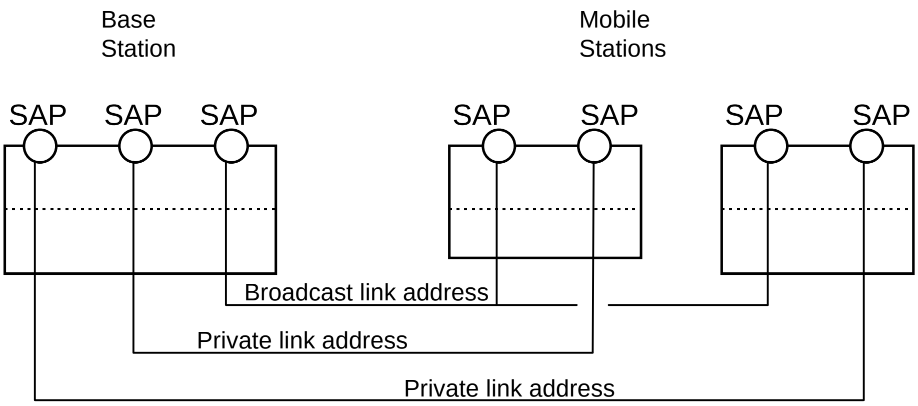


Fig. 4.3.2.1 Overview of Link Addresses

4.3.2.2 Service access point (SAP)

(1) The mobile station shall use a new private link address to associate with the communication link of the base station. This private link address shall be a random address to secure the discrimination among mobile stations.

(2) The base station shall accept the association (data link connection) request from the mobile station, and when it is able to associate with the base station (communication link), it newly opens a service access point (SAP) by the link address reported by an ACTC.
The broadcast link address for the broadcast link and the multicast (group) link address for group link shall be indicated by the base station.

4.3.3 Medium Access Control (MAC) Sublayer

4.3.3.1 Overview of MAC Sublayer

The MAC sublayer is responsible for controlling the use of layer 1 (physical medium channel) by the MAC sublayer entity residing in a base station and a MAC sublayer entity of a mobile station. This subclause specifies the MAC sublayer operations.
The medium access control is unbalanced. The base station always controls access to physical medium channels, granting access to the physical medium to either, including the mobile station, and the principal functions of the MAC sublayer are as follows.

(1) Generation of communication frame
(2) Establishment of association (data link connection)
(3) Transmission/reception of PDU and acknowledgment
(4) Addition and inspection of CRC
(5) Simple encryption/decryption (Scramble/descramble)
(6) MAC level acknowledgment

4.3.3.2 Specification for Interface Service of MAC Sublayer

4.3.3.2.1 MAC Data Service

4.3.3.2.1.1 Overview of Interactions

The MAC sublayer provides the following primitives to the LLC sublayer.

MA-UNITDATA.request
MA-UNITDATA.indication

MA-UNITDATA.request is passed to the MAC sublayer from the LLC sublayer to request transmission of MSDU. MA-UNITDATA.indication is passed to the LLC sublayer from the MAC sublayer to indicate arrival of MSDU.

4.3.3.2.1.2 Service Specification

This subclause describes in detail the primitives and parameters associated to the service specified in subclause 4.3.3.2.1.1. The parameters (excluding "link_address") are described in an abstract way, and the information required on the receiver entity is specified. A specific implementation is not constrained in the method of making this information available.

The “link_address” parameter provides SAPs of the own stations of the MAC sublayer and the LLC sublayer and also SAPs of the remote mobile station. The “link_address” parameter has the format defined in subclause 4.2.4.2.1.8.2. The “data” parameter may be provided by actually passing the MSDU, by passing a pointer, or by other means. The “data” parameter permits use of null characters.
Figure 4.3.3.2.1.2 shows the logical relationship of primitives.

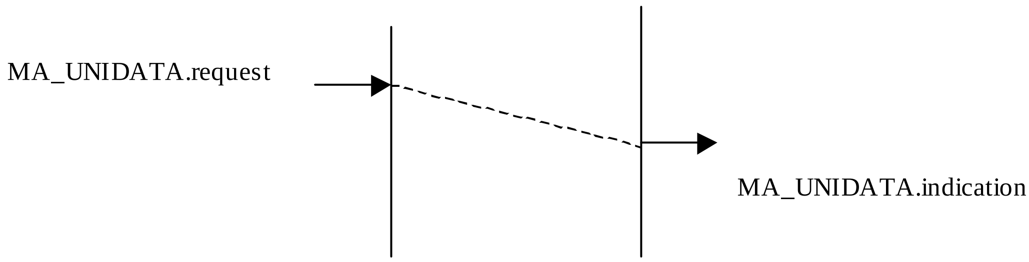


Fig.4.3.3.2.1.2 Time sequence diagram

4.3.3.2.1.2.1 MA-UNITDATA.request

(1) Function
This primitive shall be passed from the LLC sublayer to the MAC sublayer to request that an LPDU be transmitted of the MAC service data unit (MSDU).

(2) Semantics of Service Primitive
The primitive shall provide parameters as follows:

In the MAC sublayer of a mobile station
MA-UNITDATA.request (link_address, data, cr)

The link_address parameter of the mobile station shall be a private link address. The data parameter specifies the MSDU transmitted by the MAC entity. A cr parameter specifies the C/R identifier defined in the LLC sublayer and it shall be set to the same value of the bit number 4 (b4) within the MAC control field.

In the MAC sublayer of a base station
MA-UNITDATA.request (link_address, data, response_request, cr)

The link_address parameter of the base station may be the private, multicast (group) link and broadcast link addresses. The data parameter specifies the MSDU transmitted by the MAC entity. The response_request (RR) indicates that the MAC assigns a MDS in immediate frame. A cr parameter specifies the C/R identifier defined in the LLC sublayer and it shall be set to the same value of the bit number 4 (b4) within the MAC control field.

Note) The parameters of response_request are specified as follows.

(a) The response_request of the base station set to "0" shall indicate that the base station only transmits an MSDU, which is simultaneously passed from the LLC, to the mobile station as indicated by the link_address.
If the PDU is Type 1 and the response_request is set to "0" at the layer 7, the LLC shall set the same value.

(b) The response_request of the base station set to "1" shall indicate that the base station transmits an MSDU, which is simultaneously passed from the LLC, to the mobile station as indicated by the link_address. Hereafter, the base station assigns the uplink MDS with the same link_address.
If the PDU is Type 1 and the response_request is set to "1" at the layer 7, the LLC shall set the same value.

(c) The response_request of the base station set to "2" shall indicate that the MAC sublayer assigns the uplink MDS with the same link_address. The MSDU shall be discarded.
If the PDU is Type 1 and the response_request is set to "2" at the layer 7, the LLC shall set the same value.

(d) The response_request of the base station set to "3" shall indicate that the base station transmits an MSDU, which is simultaneously passed from the LLC, to the mobile station as indicated by the link_address. Hereafter, the base station assigns the uplink MDS with the same link_address
In the case of passing the Type 3 Command PDU to the MAC sublayer, the LLC shall set this value.

(e) The response_request of the base station set to "4" shall indicate that the base station assigns the downlink MDS with the same link_address.
In the case of passing the Type 3 Response PDU to the MAC sublayer, the LLC shall set this value.

(3) When Generated
This primitive is passed to the MAC entity from an LLC entity to request to transmit data.

4.3.3.2.1.2.2 MA-UNITDATA. indication

(1) Function
This primitive shall be passed from the MAC sublayer to the LLC sublayer to indicate the successful reception of a valid LPDU.

(2) Semantics of Service Primitive
The primitive shall provide parameters as follows:

MA-UNITDATA indication (link_address, data, cr)

The link_address parameter of the mobile station shall be a private link address.
The link_address parameters of the base station are private, multicast (group) link and broadcast link addresses. The data parameter specifies the MSDU received by the MAC entity. A cr parameter specifies the C/R identifier defined in the LLC sublayer and it shall be set to the same value of the bit number 4 (b4) within the MAC control field.

(3) When Generated
The MA-UNITDATA primitive is passed from a MAC entity to an LLC entity to indicate that a data has arrived at the MAC entity.

4.3.3.2.2 MAC Management Service Interface

4.3.3.2.2.1 Overview of Interactions

The MAC sublayer layer management entity (MLME) provides the following primitives to a layer 7 or a system management entity (SME).

(1) MIB access service
The primitives associated with the MIB access service are as follows.

MLME-GET.request
MLME-GET.confirm
MLME-SET.request
MLME-SET.confirm

The MLME-GET.request primitive is passed to the MLME to request that the user-entity (the SME or the layer 7) is able to get the value of the MIB attributes that are stored in a Management Information Base (MIB) of the MLME. The MLME-GET.confirm is passed from the MLME to convey the results of the previous action associated with the MLME-GET.request primitive.
The MLME-SET.request primitive is passed to the MLME to request that the user-entity (the SME or the layer 7) is able to set the value of the MIB attribute. The MLME-SET.confirm is passed from the MLME to convey the results of the previous action associated with the MLME-SET.request primitives.

(2) Association service

The primitives related with the association service are as follows.

MLME-SCAN.request
MLME-SACN.confirm
MLME-ASSOCIATE.request
MLME- ASSOCIATE.confirm
MLME- ASSOCIATE.indication
MLME-RLT.request
MLME-RLT.confirm

The MLME-SCAN.request primitive is passed from the layer 7 of a mobile station to request the detection of a communication zone (the detection of the physical medium channel). The MLME-SCAN.confirm is passed to the layer 7 of a mobile station to report the detection of communication zone. The MLME-ASSOCIATE.request primitive is passed from the layer 7 of the mobile station to the MLME to demand an association with a base station. The ASSOCIATE.confirm primitive is passed from the layer 7 of a mobile station to the MLME to convey the results of the previous association with the MLME- ASSOCIATE.request primitive. The MLME- ASSOCIATE.indication is passed from the MLME of the base station to the layer 7 of the base station to indicate the acceptance of an association request from the mobile station.

The MLME-RLT.request primitive is passed from the layer 7 of the mobile station to the MLME to request the detection of an invalid state within a release timer information field (RLT information field). The MLME-RLT.confirm primitive is passed from the MLME of the mobile station to the layer 7 to report the invalid state of the validation bit within a release timer information field (RLT).

4.3.3.2.2.2 Service Specification

This subclause describes in detail the primitives and parameters associated with services specified in subclause 4.3.3.1. The parameters are abstractly described, and specified in view of the necessity for the receive entity. A specific implementation is not constrained in the method of making this information available. Figure 4.3.3.2.2.2-1 and Figure 4.3.3.2.2.2-2 shows the logical relationship of primitives.

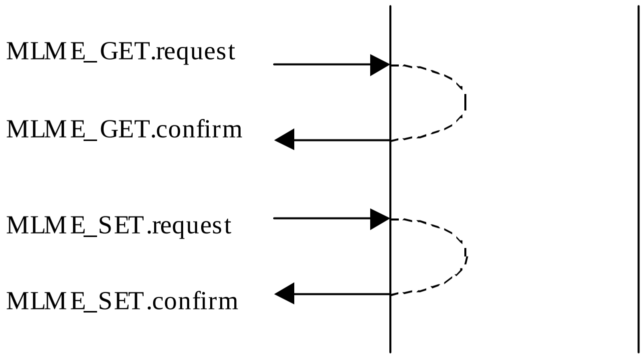


Fig. 4.3.3.2.2.2-1 Time-sequence diagram of the MIB access Service

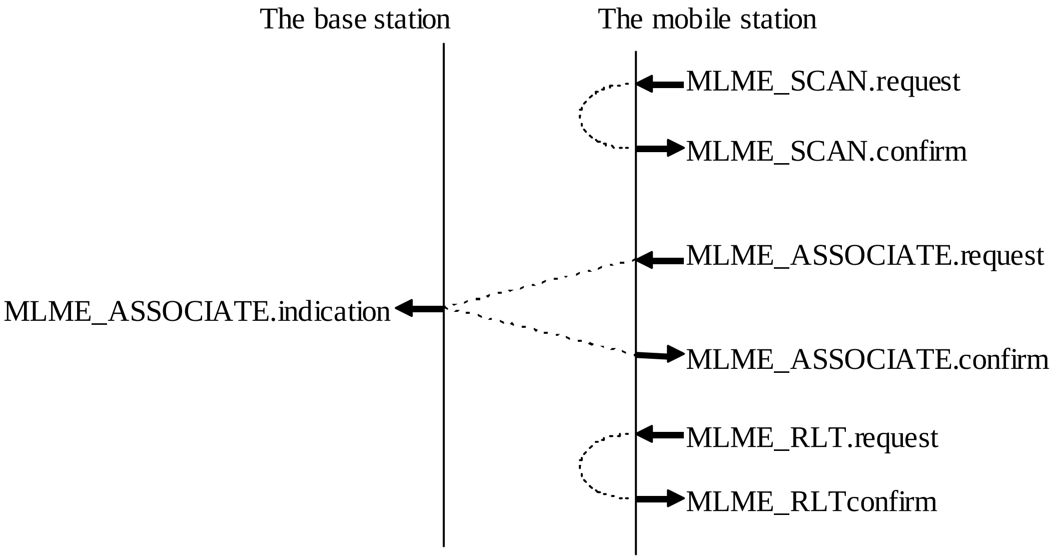


Fig. 4.3.3.2.2.2-2 Time-sequence diagram of the Association Access Service

4.3.3.2.2.2.1 MLME-GET.request

(1) Function
This primitive is to request for the MIB access service.

(2) Semantics of Service Primitive
The primitive parameters are as follows:

MLME-GET.request (MIB-attribute)

The MIB-attribute parameter specifies the attribute of the MIB.

Note) MIB attributes are defined in annex A.

(3) When Generated
This primitive is generated by the SME or the layer 7 to request for getting the MIB attribute of the MLME and is passed to the MLME.

4.3.3.2.2.2.2 MLME-GET.confirm

(1) Function
This primitive is to report the results of the action associated with the MLME-GET.request.

(2) Semantics of Service Primitive
The primitive parameters are as follows:

MLME-GET.confirm (status, MIB-attribute, MIB-attribute-value)

The status parameter indicates the success or the failure of the MIB-attribute reading requests.
The MIB-attribute parameter specifies the attribute provided by the MLME-GET.request.
The MIB-attribute-value specifies the value of the attribute itself.

Note 1) If a type of invalid attribute is specified, the status will indicate failure.
Note 2) If the status indicates failure, the MIB-attribute-value will not be assured valid.
Note 3) MIB attributes are defined in annex A.

(3) When Generated
This primitive is generated by the MLME to report the results of the previous action provided by the MLME-SET.request primitives and is passed to the SME or the layer 7.

4.3.3.2.2.2.3 MLME-SET.request

(1) Function
This primitive is to request for the MIB access service.

(2) Semantics of Service Primitive
The primitive parameters are as follows:

MLME-SET.request (MIB-attribute, MIB-attribute-value)

The MIB-attribute parameter specifies the attribute of the MIB.
The MIB-attribute-value specifies the value.

Note) MIB attributes are defined in annex A.

(3) When Generated
This primitive is generated by the SME or the layer 7 to request for writing the MIB attribute of the MLME and is passed to the MLME.

4.3.3.2.2.2.4 MLME-SET.confirm

(1) Function
This primitive is to report the results of the action provided by the MLME-SET.request.

(2) Semantics of Service Primitive
The primitive parameters are as follows:

MLME-SET.confirm (status, MIB-attribute)

The status parameter indicates the success or failure of the setting MIB-attribute request provided by MLME-SET.request.
The MIB-attribute parameter specifies the attribute provided by MLME-SET.request.

Note1) If a type of invalid attribute is specified, the status will indicate failure.
Note2) MIB attributes are defined in annex A.

(3) When Generated
This primitive is generated by the MLME to report the results of the previous action provided by the MLME-SET.request primitives and is passed to the SME or the layer 7.

4.3.3.2.2.2.5 MLME-SCAN.request

(1) Function
This primitive is to request for the association service in the mobile station.

(2) Semantics of Service Primitive
The primitive parameter has none.

MLME-SCAN.request ()

(3) When Generated
The layer 7 generates this primitive to request for the detection of the communication zone.

Note) this primitive is only used on the mobile station side.

4.3.3.2.2.2.6 MLME-SCAN.confirm

(1) Function
This primitive is to report the results of the action associated with the MLME-SCAN.request.

(2) Semantics of Service Primitive
The primitive parameters are as follows:

MLME-SCAN.confirm (service-code, release-time, ccz-status, tri-status)

The service-code parameter specifies the value of the service application information (SC) field contained within the FCMC. The release-time parameter specifies the value of the release timer information (RLT) field contained within the FCMC. The ccz-status parameter specifies the identifier of the continuous communication zone (CCZ) subfield in the SIG within the FCMC. The tri-status parameter specifies the value of the Transmitter / Receiver Identifier subfield (TRI) in the FSI within the FCMC.

(3) When Generated
This primitive is generated by the MLME to report the detection of the communication zone provided by the MLME-SCAN.request and is passed to the layer 7.

Note) this primitive is only used on the mobile station side.

4.3.3.2.2.2.7 MLME-ASSOCIAITE.request

(1) Function
This primitive is to request for the association service in the mobile station.

(2) Semantics of Service Primitive
The primitive parameters are as follows:

MLME-ASSOCIATE.request (link-address, initialization-mode, application-id, priority)

The link-address parameter specifies the private link address.
The initialization-mode parameter specifies whether the simplified association (initialization) procedure is available in the mobile station. If it is available, the initialization-mode parameter shall be set to “1” and if it is not, its parameter shall be set to “0”. This parameter is the same value of the IMI within the link request information field (LRI).
The application-id parameter specifies the application identification flag within LRI for multiplexing on the ACTC. The priority parameter specifies the assign demand field within the LRI for multiplexing on the ACTC. If the mobile station intends to demand the association request without priority, the priority parameter shall be set to “0” and if the mobile station demand the association request with priority, it shall be set to “1”. The protocol_ver parameter specifies the protocol version response identifier that is multiplexed into the link request data field LRI of the activation channel ACTC, which is available to the mobile station.

(3) When Generated
The layer 7 to demand the association with the base station and be passed to the MLME generates this primitive.

Note) this primitive is only used on the mobile station side.

4.3.3.2.2.2.8 MLME-ASSOCIATE.confirm

(1) Function
This primitive is to report the results of the action provided the ASSOCIATE.request.

(2) Semantics of Service Primitive
The primitive parameter is as follows:

MLME- ASSOCIATE.confirm (status)

The status parameter indicates the success or failure of the action provided by the ASSOCIATE.request.

(3) When Generated
This primitive is generated by the MLME to report the accomplishment of the association procedure and is passed to the layer 7.

Note) this primitive is only used in the mobile station.

4.3.3.2.2.2.9 MLME-ASSOCAITE.indication

(1) Function
This primitive is to indicate the association service in the base station.

(2) Semantics of Service Primitive
The primitive parameters are as follows:

MLME-ASSOCIATE.indication
(link-address, initialization-mode, application-id, priority)

The link-address parameter specifies a private link address within the ACTC.
The initialization-mode parameter specifies the IMI within the link request Information field (LRI).
The application-id parameter specifies the application identification flag within LRI within the ACTC. The priority parameter specifies the assign demand field within the LRI within the ACTC. The protocol_ver parameter specifies the protocol version response identifier that is multiplexed into the LRI of the ACTC.

(3) When Generated
This primitive is generated by the MLME to indicate the acceptance of the association demand from the mobile station and is passed to the layer 7.

Note) this primitive is only used on the base station side.

4.3.3.2.2.2.10 MLME-RLT.request

(1) Function
This primitive is to request for the association service in the mobile station.

(2) Semantics of Service Primitive
The primitive parameter has none.

MLME-RLT.request ()

(3) When Generated
This primitive is generated by the layer 7 to detect the invalid state within a release timer information field (RLT) and is passed to the MLME.

4.3.3.2.2.2.11 MLME-RLT.confirm

(1) Function
This primitive is to report the results of the action associated with the MLME-RLT.request.

(2) Semantics of Service Primitive
The primitive parameters are as follows:

MLME-RLT.confirm (service_code, release_time, ccz_status, tri_status)

The service_code parameter specifies the value of the service code (SC) field contained within the FCMC. The release-time parameter specifies the value of the release timer information (RLT) field contained within the FCMC. The ccz-status parameter specifies the identifier of the continuous communication zone (CCZ) subfield within the SIG contained within the FCMC. The tri-status parameter specifies the value of the Transmitter / Receiver Identifier subfield within the FSI contained within the FCMC.

(3) When Generated
This primitive is generated by the MLME to report the detection of the invalid status of the validation bit of RLT and be passed to the layer 7.

Note) this primitive is only used on the mobile station side.

4.3.3.3 Field Format of Protocol Data Unit (PDU)

4.3.3.3.1 Field Format of Protocol Data Unit

The PDU of the MAC sublayer shall consist of a MAC control field and a link protocol control data unit (LPDU) as shown in Fig. 4.3.3.3.1-1 and Fig. 4.3.3.3.1-2. As the link address is contained in FCMC, it is not attached in the PDU. The LPDU length is different between ASK modulation and QPSK modulation.

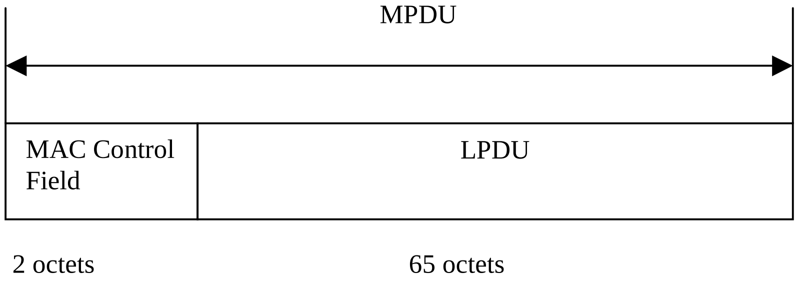


Fig. 4.3.3.3.1-1 MAC Sublayer PDU format (in ASK)

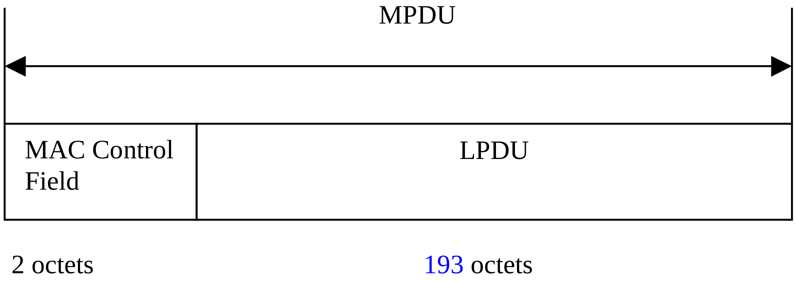


Fig. 4.3.3.3.1-2 MAC Sublayer PDU format (in QPSK)

4.3.3.3.2 PDU Elements of the MAC Sublayer

4.3.3.3.2.1 Format of the MAC control field

The details of the MAC control field are defined in subclause 4.2.4.2.2.1.3. Fig. 4.3.3.3.2.1 shows its format for reference. The MAC control field comprises a set of subfields as follows. The length of field is 2 octets.

(1) Fragmentation information field (FRG): The FRG set to “1” indicates fragmented PDU, the FRG set “0” indicates non-fragmented PDU.
(2) Continuation information (Continuous/Last (C/L)): The C/L set to “0” indicates that the corresponding MDC is the last MDC and The C/L set to “1” indicates that the data (LPDU)

transmission is performed using one MDC or last MDC.

(3) Command/Response (C/R): This field value is set according to the LLC control field of an LPDU.

(4) Sequence number (SEQ): The sequence number of fragmented MPDUs. The sequence number is generated by modulus 16.

(5) Length indicator of LPDU (LI): The valid data length of LPDU. Its length is 2 octets.

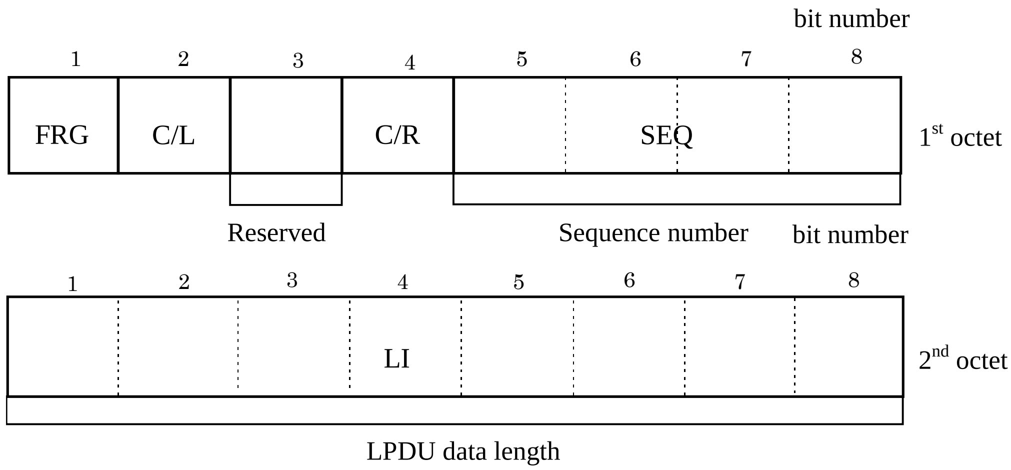


Fig. 4.3.3.3.2.1 Field Format of MAC control field

4.3.3.3.2.2 Field Format of LPDU

The LDPU is 65 octets in ASK and 193 octets in QPSK. The LPDU shall consist of 65 octets. The LPDU is defined by encoding described in clause 4.3.4.2.

4.3.3.3.2.3 Bit Order

Each sub-field shall be transmitted least significant bit (LSB) first, i.e. low order bit first (the first bit of transmitted data has a weight of 2^0.) Furthermore, a LPDU is transmitted in the bit sequence received from the LLC sublayer and is delivered to the LLC sublayer in the received bit sequence.

4.3.3.3.2.4 Transparency

(1) ASK modulation

A LPDU having a length of over 65 octets is fragmented multiple of 65-octet units in the MAC sublayer, and is transmitted using multiple frames (MDSs). Where the data length is less than 65 octets (including the case where it occurred as a result of fragmentation), zeros (“0”) shall be

inserted in the MAC sublayer up to 65 octets, and the data be unit of 65 octets.
The information of fragmentation shall be multiplexed on the MAC control field, and be added to each fragmented data. The fragmented data is defragmented according to the information within the MAC control field.

When the data length is less than 65 octets, the data is taken out in the length that is indicated in the second octet of the MAC control field, and inserted zeros (“0”) shall be removed.

(2) QPSK modulation
A LPDU having a length of over 193 octets is fragmented multiple of 193-octet units in the MAC sublayer, and is transmitted using multiple frames (MDSs). Where the data length is less than 193 octets (including the case where it occurred as a result of fragmentation), zeros (“0”) shall be inserted in the MAC sublayer up to 193 octets, and the data be unit of 193 octets.
The information of fragmentation shall be multiplexed on the MAC control field, and be added to each fragmented data. The fragmented data is defragmented according to the information within the MAC control field.

When the data length is less than 193 octets, the data is taken out in the length that is indicated in the second octet of the MAC control field, and inserted zeros (“0”) shall be removed.

4.3.3.3.2.5 Invalidity of MPDU

The MAC sub-layer shall inspect all received MPDUs to access their validity.
An invalid MPDU shall be defined as one that meets at least one of the following conditions:

(a) The length of MPDU is not 67 octets in ASK or not 197 octets in QPSK.

(b) The FRG of the MAC control field is “0” and the C/L is “1”.

(c) The LI of the MAC control field is “0” (null of the LLC control field) or it is 66 octets or more in ASK or 194 octets or more in QPSK.

(d) The link address of the MPDU received by the base station is a broadcast link address.

If the frame received is invalid MPDU, it shall be discarded.

4.3.3.4 MAC Elements of Procedures

4.3.3.4.1 FCMC variables

This variable manages the frame structure information comprised a set of SIG, FID, FSI, RLT and SCI. The information according to FCMC variable is transmitted using an FCMC. Detail of FCMC variable refers to subclause 4.2.

4.3.3.4.2 Assignment request variables (ASGN)

A variable ASGN for slot assignment request has a form of a structure, and its members consist of an address variable ASGN.LID, a transmission direction variable ASGN.DIR, a response state variable ASGN.RS and a priority variable ASGN.PR.

The ASGN.LID stores the link address assigned to the LID of the SCI. The ASGN.DIR field has “1” and “0” state; and “1” shall be set in the case of uplink transmission, and “0” shall be set in the case of the downlink transmission.

The ASGN.RS field has “1” or “0” state; and “1” shall be set in the transmission with response, and “0” shall be set in the transmission without response.

The ASGN.PR field has “1” or “0” state; and “1” shall be set where the assignment with priority is requested, and “0” shall be set where the normal assignment is requested.
These variables are used on the base station side and shall be generated each time slot assignment is generated.

4.3.3.4.3 Transmission sequence state variable (TSQ, TSQ2)

The MAC sublayer shall be able to maintain a set of transmit sequence state variables TSQ and TSQ2 for each unique SAP which is identified as the destination address with the transmission of an MPDU and shall manage values stored in the sequence number field (SEQ) of the MAC control field. This variable shall take on the values of 0 thorough 7 and shall be incremented by modulo 8 at the time of receiving the MSDU from the service access point (SAP). When a new private link address is established, the TSQ shall be generated and set at initial value “7” at the same time.
TSQ2 shall have an array in a structural format, of which elements consist of a redundancy check state variable TSQ2.DUP and a transmission acknowledgement state variable TSQ2.ACK. TSQ2.DUP shall be generated by modulo 2. TSQ2.ACK shall store the result of receiving acknowledgement. TSQ2 shall be generated at the time of establishment of a new SAP. When it is generated, all elements of TSQ2.DUP shall be set to “0” and TSQ2.ACK shall be initialized into Ack. TSQ2 shall consist of 8 elements.

4.3.3.4.4 Receive sequence state variable (RSQ)

The MAC sublayer shall be able to maintain one receive sequence state variable RSQ for each unique SAP which is identified as the destination address with the transmission of an MPDU. This variable shall be an array that stores the value of the most significant bit in the SEQ within the MAC control field of the MPDU, which is received at an associated link address. (The most significant bit indicates Bit 8 of the 1st octet in the Mac control field, as shown in Fig. 4.3.3.3.2.1). RSQ shall consist of 8 elements. The least significant 3 bits in the SEQ shall indicate the storage location of the most significant bit in the SEQ. The variable insures the MAC sublayer to detect the reception of duplicated MPDU. When a new private link address is established, the RSQ shall be generated with its all elements set to an initial value “1”.

4.3.3.4.5 Retry counters of the base station (NFR1, NFR2, NFR1max, and NFR2max)

These counters are used to set the number of times of retransmission of MDC in the MAC sublayer on the base station side.

A NFR1 is used at the time of the downlink data transmission, and shall be initialized at the time of the first transmission. The NFR1 shall be incremented when the MPDU was transmitted from the base station to the mobile station and an Ack was not received with an ACKC of the corresponding slot.

A NFR2 is used at the time of the uplink data transmission, and shall be initialized at the time of the first transmission. The NFR2 shall be incremented each time when the base station did not correctly receive the MPDU from the mobile station and a Nack was returned. This is the same function as that of the retry counter of the mobile station. It is used for the base station to watch the state of retrying from the mobile station.

The NFR1 and the NFR2 exists by the number of slots assigned as the MDS.
The NFR1max and the NFR2max represent maximum counter values.

4.3.3.4.6 Retry counter of the mobile station (NMR, NMRmax)

A NMR is used to set the number of times of retransmission of the MDC at the MAC sublayer level on the mobile station side.
The NMR is used at the time of the uplink data transmission, and shall be initialized at the time of the first transmission. The NMR shall be incremented when the MPDU was transmitted from the mobile station to the base station and the Ack was not received with the ACKC of the corresponding slot.
A NMRmax represents the maximum number of times of the retransmission.

4.3.3.4.7 Link request counter (NRQ, NRQmax)

This counter (NRQ) is used on the mobile station side. This counter counts the number of times of transmission of the ACTC. The NRQ field shall be set to “1” at the time of first transmission.

The NRQ field shall be incremented each time ACTC is transmitted, until a link address is set at the SCI in the FCMC. The NRQ shall be created when ACTC transmission conditions are satisfied, and shall be deleted at the time of the accomplishment of the association.

NRQmax represents the maximum number of times of transmission.

4.3.3.4.8 Re-link Entry request restriction Counter (NRT)

This counter is used that sets the standby time until a re-association (re-link entry) request is made, where the MDS is not assigned for own private link address, on the mobile station side. The NRT shall be set at the initial value after transmission of the ACTS, and shall be decrement “1” at the time when FCMC is detected. The initial value shall be set according to the STA field in the SCI.
The NRT shall be created when ACTC transmission conditions are satisfied, and shall be deleted at the time of the accomplishment of the association.

4.3.3.4.9 Base station connection variables (NUMLINK, MAXLINK)

The NUMLINK shall be the current number what the base station has accomplished the association with mobile stations.

The MAXLINK shall be the maximum number of the NUMLINK that indicates available number of addresses holding for communication. Comparing the NUMLINK and the MAXLINK, it is able to judge the traffic congestion or the possibility of reception of ACTCs. The number of the NUMLINK shall be incremented by “1” each time the layer 7 has accepted an association request and be decremented by “1” each time the layer 7 has released a communication link. Using services provided by the MLME makes revision of the number of the NUMLINK.

4.3.3.4.10 Base station assignment variable (ASL, ASLmax)

The ASL is the number of ACTSs per frame, which the base station could assign. The number of the ASL is 1 through ASLmax. This variable is used on the base station side.
The ASLmax shall be the maximum available number of assignment slots per frame.

4.3.3.4.11 WCNC transmission counter (WTC, WTCmax)

The WTC is the counter that counts the number of transmission the WCNC. The WTC shall be set to initial value “0” when the mobile station enter the newly communication zone. The WTC shall be incremented by “1” when of the transmission of the WCNC has been accomplished.

The initial value is “0”.
The WTCmax is the maximum number of transmissions.

4.3.3.4.12 Slot assignment state variable (SLT_STATUS)

The SLT_STATUS indicates the state of the slot assignment on the base station side. When there are non-processing ASGN variables, the SLT_STATUS indicates the admission of the transmission immediately (in_time). When there is ASGN variable waiting for processing, the SLT_STATUS indicates the restriction of the transmission immediately (out_time).

Using this variable, the layer 7 performs the data transmission procedures by layer management services provided by the MLME.

4.3.3.4.13 Transmission state variables (TR_STATUS, NUMQ, FQBUSY, MQBUSY)

The TR_STATUS is a variable, which indicates the state of the waiting for transmission.
The NUMQ is a variable, which indicates the number of the MPDUs that are waiting for transmission.

The FQBUSY is threshold value for the judgment of the base station transmission state.

The MQBUSY is threshold value for the judgment of the mobile station transmission state.

On the base station side, when the NUMQ, which indicates the number of the MPDUs that are waiting for transmission, is larger than the FQBUSY, the TR_STATUS shall indicate the busy state, and if it is smaller than the FQBUSY, it shall indicate the idle state.

On the mobile station side, when the NUMQ, which indicates the number of the MPDUs that are waiting for transmission, is larger than the MQBUSY, the TR_STATUS shall indicate the busy state, and if it is smaller than the MQBUSY, it shall indicate the idle state.

Using these variables, the layer 7 performs the data transmission procedures by layer management services provided by the MLME.

4.3.3.4.14 Maximum transmission size variable (MSIZE)

MSIZE is a variable indicating the maximum data length that can be transferred via MDC1 channel. The base station shall set the following value in accordance with its own profile. The mobile station shall set the value according to the profile (signal transmission rate) specified by the base station.

The value of MSIZE shall be 65 octets in ASK and 193 octets in QPSK.

4.3.3.4.15 Management Information Base (MIB)

A MIB is the database constructed for management of layer consisting of variables which determine frame structure such as the FCMC information, control variables, etc. The layer management entity of the MAC sublayer only allows access this MIB directly. Furthermore, another layer management entity allows access to the MIB indirectly using services between layer management entities.

PR, UW1, UW2 (UW2, UW2A, UW2B), CRC specified in the FCMC and the ACTC are not registered in the MIB since they are added at the time of transfer to Layer 1. The details about the MIB are specified in Annex A.

4.3.3.5 Procedures for the MAC Sublayer

The procedures for the MAC sublayer are described as divided into the base station and the mobile station. The state machine that corresponds to these procedures is appended to Annex F for reference.

4.3.3.5.1 Frame Management

4.3.3.5.1.1 Frame Management of the base station

On the base station side, using MIB access services, the frame structure that corresponds to the operation configuration shall be registered in the MIB (management information base) constructed for the layer management entity previously.

4.3.3.5.1.1.1 Generation of Frames

(1) Generation of the FCMS
The parameters of the control field consisting of the SIG, FID, FSI, RLT,SC and SCI are defined as variables in the MIB. The FCMC shall be generated according to the time base of the frame, with reference made to this information.

(2) Generation of the MDS
A MDS is the slot which the SI (b1, b2) of the SCI defined in the MIB is “00”. Reading the

information of the SI in time series according to the transmission sequence of SCIs in slot units, in the case of the half-duplex mode it shall indicate the slot position of generation of the MDS. In the case of the full-duplex mode (the base station), the slot positions of MDSs of downlink and uplink are indicated by sequentially reading odd-numbered SCIs and even-numbered SCIs. Furthermore, referencing the DR control field simultaneously controls the transmission and the reception.

(3) Generation of the ACTS (link request slot)
An activation slot (ACTS) is a slot referenced in which the SI (b1, b2) of the SCI defined in the MIB is “11”. The position of generation of the link request slot shall be indicated by reference information of the SI in time series according to the transmission sequence of SCIs in slot units, in the case of the half-duplex mode. In the case of the full duplex mode, the positions of the ACTS are indicated by sequentially reading SCIs of even numbers. The slot indicated as the link request slot is dedicated to uplink.

(4) Generation of the WCNS
A WCNS is a slot referenced in which the SI (b1, b2) of the SCI defined in the MIB is “10”. The position of generation of the WCNS (Call sign) shall be indicated by reference information of the SI in time series according to the transmission sequence of SCIs in slot units, in the case of the half-duplex mode. In the case of the full duplex mode, the position of WCNS is indicated by sequentially reading SCIs of even numbers. The slot indicated as WCNS is dedicated to uplink.

4.3.3.5.1.1.2 Transmission/Reception Procedures

(1) Transmission of the FCMC
The PR and UW1 are added to the first of the FCMC, which is generated according to the time base of the frame. Furthermore, the 16-bits CRC calculated from the data field except the PR and UW1 is added to the end of the FCMC, before being delivered to the layer 1.

(2) Reception of the ACTC
A comparison shall be made between a unique remainder value and a result, which is calculated, from the serial incoming bits of the data, except the PR and UW2, passed from the layer 1 to the position of the ACTC of the slot indicated by the information of the MIB.

Where it shows equality, portions of the FID, LID and LRI shall be taken out and be passed to the procedure of association, which is described in detail in subclause 4.3.3.5.1.1.3.

Where it shows inequality, the corresponding ACTC shall be discarded, and portions of the FID, LID and LRI shall not transfer to the association procedures.

Note) the CRC procedure is specified in compliance with ITU-R recommendations. However, another procedure may be adopted if it could check errors correctly.

(3) Reception of WCNC
The reception of the WCNC is not specified.

4.3.3.5.1.1.3 Association

4.3.3.5.1.1.3.1 Reception of Association Request

The base station shall receive ACTCs and process these, when the ACPI bits of the SCI in all ACTSs are set to “1”.

Where the LID of the received ACTC is not a private link address, the corresponding ACTC is ignored. The corresponding ACTC is ignored also where the priority assignment bit of the ACTC is “0” (association request without priority) and valid flag is not set in the LRI (application identification flags).

Valid ACTCs are processed in the reception sequence procedures. Where the current connection variable NUMLINK set in the MIB does not exceed the maximum connection variable MAXLINK when an ACTC has been received, the base station shall generate MLME-ASSOCIATE.indication primitive. Hereafter, it shall report the layer 7 reception of ACTC and it is regarded as reception of an association request (acceptance of an ACTC or link request) from a newly arrived mobile station.

However, when the priority assignment bit of the ACTC is set to “1” (association request with priority), an association request shall be received unless all of MDSs are assigned priority assignment (slot in which the ST of the SCI is not “000” exists) and the MLME-ASSOCAITE.indication shall be generated.

Note) The layer 7 judges whether or not the association request passed from the layer 2 accepts.

4.3.3.5.1.1.3.2 Assignment for Normal MDSs

Where data transmission request occurs, the assignment request variable ASGN for requesting slot assignment shall be generated.

(1) Generation of Assignment Request

If an LPDU is received from the LLC sublayer of the base station, its link address shall be set in ASGN.LID field and the ASGN. PR field shall be set to “0” (normal type of assignment). Other parameters are specified as follows.

(a) Where the response-request parameter within the MA-UNITDATA.request passed from the LLC sublayer is “0” or “4”, the ASGN.RS field shall be set to “0” (without response) and the ASGN.RS field shall be set to “0”　(downlink).

(b) Where the response-request parameter within the MA-UNITDATA.request passed from the LLC sublayer is “1” or “3”, the ASGN.RS field shall be set to “1” (with response) and the ASGN.RS field shall be set to “0”　(downlink).

(c) Where the response-request parameter within the MA-UNITDATA.request passed from the LLC sublayer is “2”, the ASGN.RS field shall be set to “0” (without response) and the ASGN.RS field shall be set to “1”　(uplink).

Note) Refer to subclause 4.3.3.2.1.2.1 for parameters of MA-UNITDATA.request.

(2) Assignment Procedures

Assignment procedures of the MDS shall be performed each time the generation of the ASGN is detected. In the MDS assignment procedures, if ASGN.DR is “0” (downlink transmission), an assigned downlink slot (a slot whose ST bit of the SCI is “111” and DR bit is “0”) shall be searched to check the presence of a slot whose LID of the SCI is the same as that of ASGN.LID. If a slot with the same LID is identified, it shall be determined whether the assigned MPDU or the MPDU to be assigned to the concerned slot has already been applied with the fragmentation procedure (refer to Subclause 4.3.3.5.2.1.2.1). Then, if the fragmentation procedure has been applied, the assignment procedure of the concerned ASGN shall be suspended. Whereas, if there is no slot with the same LID of the SCI, or there is such a slot to which the fragmentation procedure is not applied, the assignment procedure of the concerned ASGN shall be conducted.

When ASGN.DR is “1” (uplink transmission), an assigned uplink slot (a slot whose ST bit of the SCI is “111” and DR bit is “1”) is searched to check the presence of a slot whose LID of the SCI is the same as that of ASGN.LID. If a slot with the same LID is identified, the assignment procedure of the concerned ASGN shall be suspended. Whereas, if there is no slot with the same LID of the SCI, the assignment procedure of the concerned ASGN shall be conducted.

Slots able to be assigned are MDSs that the SCI indicate as empty channels or set as a WCNC. When an unassigned SCI (ST (b5, b6, b7) is “011”) exists, the assignment procedures is performed in the following manner.

The ASGN.LID shall be set to the LID of the SCI defined in the MIB. Furthermore, the ASGN.DIR shall be set to the DR bit of the SCI, and ST bit of the SCI shall be set to “111” (normal data channel).

Assignment procedure of the ASGN, the ASGN.PR of which was set at “0”, is kept holding where all the SCIs have been assigned or during FCMS transmission period.

After the accomplishment of the assignment of MDSs, the ASGN shall be deleted if the ASGN.RS is “0”. Furthermore, it shall be not deleted when the ASGN.RS is “1”, but the ASGN.DIR shall be replaced by its complement value, and it is regarded as a new assignment request variable.

In the half duplex-mode, an MDS for the uplink transmission shall be assigned in the same slot.

In the full duplex-mode, it shall set the ASGN.RS to “0” and it is regarded as a newly assigned request variable and it shall find an available slot for assignment. In this case, the slot searching procedure should assign in respect with maintaining slot distance of 1 slot in length from corresponding downlink slot.

4.3.3.5.1.1.3.3 Priority MDS Assignment Procedures

(1) Generation of Assignment Request
Where the priority assignment bit of the ACTC is “1” (association request with priority), the ASGN shall be generated in the following manner.
The link address transmitted by the ACTC shall be set to the ASGN.LID, and the ASGN.DIR shall be set to “1” (uplink transmission), and the ASGN.RS shall be set to “0” (without response), and the ASGN.PR shall be set to “1” (priority assignment).

(2) Assignment procedure
If the ASGN.PR of which was set at “1”, the ASGN shall be set the ASGN.LID at the LID of the SCI, set the ASGN.DIR at the DR bit of the SCI and set “000” (data channel with priority assignment) at the ST bit for assignment. The procedure of assignment shall be performed in the following manner.

(a) If there is any ASGN, assignment of, which was kept suspended, the assignment shall be made with precedence over such an ASGN.
(b) Where no allocable slot was found, the SCI of a slot which is not possessed by priority assignment (the ST bit of the SCI is not “000”) shall be saved and made the assignment. The saved SCI shall be returned with priority when an empty slot becomes available.

Assignment procedure with priority should be accomplished in the frame in which ASGN has been generated.
ASGN shall be deleted after accomplishment of assignment of MDS.

4.3.3.5.1.1.3.4 Termination of Assignment of MDS

The assignment shall terminate under the following conditions.
(1) The link address is a multicast (group) or broadcast address.
The C/L bit of the MAC control field of MPDU for transmission is “0”.
(2) I the case of that the link address is a private address.
(a) The C/L bit of the MAC control field of MPDU for reception is “0” and the Ack was received in the received ACKC, or the NFR1 exceeded the NFR1max.
(b) The C/L bit of the MAC control field of an MPDU for transmission is “0” and the Ack is transmitted in the ACKC, or NFR2 exceeded NFR2max.

The subfield of the ST bit field (b5, b6, b7) shall be set to “011” (empty data channel) after the accomplishment of the assignment. At this time, the LID of the subject SCI shall not change.

4.3.3.5.1.1.4 Traffic flow control

(1) Flow control parameter setting
Traffic control information, state of acceptance of ACTCs (STA) and activation possibility identifier (ACPI), that are multiplexed on an FCMC, are specified using the connection variables (NUMLINK, MAXLINK).

The STA shall have 4 level threshold values in the range of “0” through MAXLINK. The STA shall decide by comparing with these threshold values and the current NUMLINK. However, these threshold values are not defined in these standards, since it is a matter of implementation.

If the current NUMLINK is less than MAXLINK, it shall set the ACPI to “1”. If the current NUMLINK is the same of MAXLINK, the processing ability has reached its limit. Hereafter, the ACPI shall be set to “0” (inhibition of transmission of an ACTC) for avoidance of traffic congestion.

Note 1) refer to subclause 4.3.3.4.8 for connection variables.
Note 2) Threshold values for determining the STA are shown in annex A for reference.
Note 3) if plural ACTSs are assigned in the same frame, the STA value or the ACPI value of each slot shall be set to the same value.

(1) The assignment number of ACTSs
The assignment number of ACTSs (ASLN) per one frame is from “0“ to ASLNmax at will, according to the state of connection variable. The ASLN should be determined as the following manner.
Threshold values have some levels in the range of “0” through MAXLINK and the assignment number of ACTSs is determined by comparing with these threshold values and the current NUMLINK.
However, these threshold values are not defined in this standard, since it is a matter of implementation.

Note) the assignment of ACTSs is performed according to the procedure specified in subclause 4.3.3.5.1.1.6.

4.3.3.5.1.1.5 Management of the trasmission state

The MAC sublayer shall manage the state of transmission for supporting the efficiently transmission procedures in the layer 7. For that, the MAC sublayer of the base station shall manage the slot assignment state variable (SLT_STATUS) and the transmission request state variable (TR_STATUS).

Note) refer to subclause 4.3.3.4.11 for the SLT_STATUS and refer to subclause 4.3.3.4.12 for the TR_STATUS.

4.3.3.5.1.1.6 ACTS and WCNS assignment procedures

The assignment of ACTCs and WCNSs should be performed during a certain period (from the head of FCMS to the end of the SC of the FCMC), since the assignment procedure for MDSs is prohibited during this period.

(1) Assignment of ACTSs
The ACTSs, with numbers previously determined according to the traffic flow control procedures defined in subclause 4.3.3.5.1.1.4, are assigned for slots that the SCI indicates as empty channel MDSs (the SI (b1, b2) is “ 00” and the ST (b5, b6, b7) is “011”).

The slot searching for the empty channel MDSs should be made over SCI fields in due order from the end of SCIs (from a field corresponded to the end of the frame). If an empty channel MDS is available, the SI of SCI of corresponding slot shall set to “11”, hereafter, the ACTS shall be assigned.

If there is assignment for ACTSs in remainder slots, the assignment of subject slots shall be reset. This reset shall set the SCI corresponding slot to an empty channel MDS. In this case, the LID of the subject SCI shall set to a broadcast link address and it shall set the DR to “1” (uplink). (With this, it is able to avoid the assignment for a WCNS.)

Note) the number of assigned ACTSs may be less than the ASLN.

(2) Assignment of WCNSs
The WCNS assignment shall be available for slots that the SCI indicates an empty channel MDS and the LID of it is a private link address. Since the identification of a mobile station for the WCNC is made by using the LID within the empty channel MDS. If an empty channel MDS is available, the SI (b1, b2) of corresponding slot′s SCI shall be set to “10”, hereafter, the WCNS shall be assigned.

4.3.3.5.1.1.7 Assignment of Idle channel MDS

The assignment of an idle channel MDS shall be performed for a slot that indicates an empty channel MDS or a WCNS. Its procedure is not defined in this standard.

4.3.3.5.1.2 Frame Management of the mobile station

The mobile station registers the frame structure information transmitted from the base station at the MIB constructed of the MLME, to maintain the compatibility with communication parameters of the base station.

4.3.3.5.1.2.1 Regeneration of Frames

(1) Judgment of the communication zone and regeneration of the FCMC information
On the receiving the MLME_SCAN.request primitive passed from the layer 7, the MLME of the mobile station shall performs the judgment procedures for a type of communication zone and a frequency type (FTI) of physical medium channel. This judgment procedures is specified in subclause 4.2.8.

After accomplishment of the judgment procedures for communication zone, where the FCMC is acknowledged as a valid frame by the inspection of CRC field, the FCMC information (SIG, FID, FSI, RLT and SC) shall be registered at the MIB. After the registration of these variables, the MLME shall generate MLME-SCAN.confirm primitives of which the parameters are set from the MIB and pass this primitive to the layer 7.

After registration at the MIB, the MLME shall generate the MLME_SCAN.confirm primitive, which is consisted of a set of parameters defined according to that registration information, and pass it to the layer 7.

The information that has been registered once at the MIB shall not be revised until MLME-SCAN.request primitive is passed from the layer 7. (When the layer 7 moves to the state of association (initialization) waiting procedures), it shall pass the MLME-SCAN.request primitive to release the inhibiting state for revision of the MIB information. The subfield of SCI in FCMC shall not adopted these procedure defined above.

Where the FCMC is acknowledged as a valid frame by the inspection of the CRC field and the FID of corresponding FCMC is the same FID that is previously registered at the MIB, the subfields of SCI shall be registered at the MIB one by one.

(2) Generation of the MDS

A valid MDS of the mobile station shall be a slot referenced as follows. The SI bit of the SCI is “00”, and the ST bit (b5, b6, b7) is not “011” (empty data channel), and the address indicated by LID is a private link address which has passed from the layer 7 to the MLME, link address broadcast or multicast (group) link address.

Reading out of the MIB the LIDs of the SCI, in which the SI (b1, b2) is “00” and the ST bit (b5, b6, b7) is not “011”, in slot units corresponding with the SCI transmission sequence, the MDS positions shall be indicated by comparing them with that addresses in the case of half-duplex mode.

In the case of full-duplex mode, the positions of MDSs of downlink and uplink shall be indicated by sequentially reading odd-numbered SCIs and even-numbered SCIs and by comparing them with those addresses. Furthermore, reading the DR bit simultaneously shall control transmission and reception.

(3) Generation of the ACTS

An ACTS shall be a slot referenced in which the SI bit of the SCI registered in the MIB is “11”. The positions of assignment of link request slots shall be indicated by reading the information of the SI bit (b1, b2) in time series corresponding with the SCI transmission sequence in slot units, in the case of half-duplex mode. In the case of full-duplex mode, the positions shall be indicated by sequentially reading even-numbered SCIs. The slots indicated as link request slots should be dedicated to transmission.

(4) Generation of the WCNS (Call sign)

A WCNS is a slot referenced in which the SI (b1, b2) of the SCI registered at the MIB is "10". The position of generation of the WCNS shall be indicated by referencing the information of the SI in time series corresponding with the transmission sequence of SCIs in slot units, in the case of the half-duplex mode. In the case of the full duplex mode, the position of WCNS is indicated by sequentially reading SCIs of even numbers.

4.3.3.5.1.2.2 Transmission/Reception Procedures

(1) Reception of FCM

The mobile station shall interpret slot positions from FCMS beginning at UW1 of FCMC, and reproduces the time base of the frame. A comparison shall be made between a unique remainder value and a result which is calculated from the serial incoming bits of the data, except the PR and UW1, passed from the layer 1 to the position of the FCMS indicated by the time base of the frame.

The FCMC shall transfer to the layer management if the comparison shows equality.

If the comparison shows inequality, the corresponding frame is regarded as an invalid frame and shall be not processed.

(2) Transmission of ACTC

PR and UW2 shall add FID, LID and LRI generated according to an association (initialization) request specified in subclause 4.3.3.5.1.2.3 at the head. Furthermore, the 16 bits CRC calculated from data codes except PR and UW2 shall be added to the end and delivery is made to the layer 1.

(3) Transmission of WCNC (Call sign)

Where a WCNS indicated by its own link address is assigned, it shall inspect whether the current WTC value is less than the WTCmax registered at the MIB or not. If it is less than the WTCmax, the WCNC shall be generated in the format (refer to annex C) in compliance with the registered information at the MIB in the position of the WCNC window, which is specified in subclause 4.2.4.2.4. This WCNC is delivered to the layer 1 as it is.

If the current WTC exceeds the WTCmax, it shall be not made the WCNC transmission.

The value of WTC shall be incremented by "1" each time of a WCNC transmission.

4.3.3.5.1.2.3 Normal Association

The normal association (initialization) procedure is performed when the MLME has received the MLME-ASSOCIATE.request primitive and the priority parameter indicated the normal association procedure.

(1) The generation of the MLME-ASSOCIATE.request
On the generating the MLME-ASSOCIATE.request primitive, the layer 7 of a mobile station shall meet the following conditions,

(a) The layer 7 has received the MLME-SCAN.confirm primitive from the MLME.
(b) One of applications registered in the layer 7 is available for an application notified from the base station using the SC field.

(2) FID field
The FID specifies the value of the MIB, which has been registered after the justification procedures of the communication zone.

(3) LID field
The MLME shall use a private link address within the MLME-ASSOCIATE.request primitive passed from the layer 7 for the association request.
If it is a private link address, the MLME shall register it the LID field for the ACTC of the MIB. If it is a broadcast address or multicast address, the MLME shall not register it and ignore the MLME-ASSOCIATE.request primitive.

(4) Link request information (LRI) field
The LRI parameter shall use the parameter contained within the MLME-ASSOCIATE.request primitive passed from the layer 7. This parameter shall be registered in the LRI field within the ACTC of the MIB and the ACTC shall be transmitted using this LRI parameter.

The initialization_mode parameter within the MLME_ASSOCIATE.request primitives shall correspond to the IMI (the initialization mode identifier). The application-id parameter shall correspond to the API (the application identifier).
The protocol version identifier (PV I) specifies the value previously registered in the MIB.

(5) Transmission of ACTC
The transfer of an ACTC is allowed using one of ACTSs that are referenced where the SI bit (b1, b2) of the SCI registered in the MIB is “11”. However, if one of ACTSs in the same fame set the ACPI “ 0 “, the transmission of the ACTC shall be suspended.
One ACTC could be transmitted using an arbitrary position (window) out of ACTC positions (windows) illustrated in Fig. 4.2.4. This position shall be selected at random for each transmission.

On receiving the MLME-ASSOCIATE.request primitive, link request counter NRQ and re-link entry request constraint counter NRT shall be generated, and the NRQ shall be set at initial value “1” at this time. The NRQ shall be incremented by “1” and the NRT shall be set at the initial value after accomplishment of transfer of the ACTC. (The NRT shall be decremented by “1” at the time when the FCMS is indicated.)

Where a transmitted link address was detected out of SCI in the next frame or subsequent of the ACTC transfer frame, the transmission of the ACTC shall terminate. At the same time, the NRQ and the NRT shall be deleted and the MLME_ASSOCIATE.confirm primitive with status parameter indicating “success” shall be generated and be passed to the layer 7.
Where a transmitted link address was not detected out of SCI in the next frame or subsequent of the ACTC transfer frame, an ACTC shall be transferred again at the time when the value of NRQ becomes “0”.

Transmission of ACTC shall be stopped when NRQ exceeds NRQmax as a result of retransmission and the MLME_ASSOCIATE.confirm primitive with status parameter “ failure” shall be created and be passed to the layer 7.

The initial value of the NRT shall be determined according to the traffic flow control information set at the STA of the FCMC.

Note) the conditions for the determination of the NRT value are shown in annex A for reference.

4.3.3.5.1.2.4 Association request with Priority

Only when the priority parameter of the MLME-ASSOCIATE.request primitive passed from the layer 7 is “1”, which means demanding the MDS assignment with priority, the priority assignment bit of the ACTC may be set to “1”. In this case, if the communication is in progress, the communication should be quickly interrupted and the ACTC should be transmitted. The transmitting operation is performed for each frame until the MDS is assigned. (The initial value of the NRT is “1”.) Furthermore, repeating transmission operation shall not be constrained by the NRQmax.

Note) The condition for the priority assignment, further definition is required elsewhere. However, it is outside of the scope of this standard.

4.3.3.5.1.2.5 Management of transmission state

Giving support to the efficient transmission procedure in the Layer 7, the MAC sublayer should manage the transmission state. On the mobile station side the MAC sublayer should manage transmission state variables.

4.3.3.5.2 Procedures for Transfer PDUs

4.3.3.5.2.1 Transfer Procedures at the base station

4.3.3.5.2.1.1 MAC Data Service Procedures

On receiving the MA-UNITDATA.request primitive of the base station from the LLC sublayer, the MAC control field shall be generated and the state variable TSQ shall be incremented by "1".

The element of TSQ2 is referred to by the value of TSQ to check the state of the element's TSQ2.ACK. If the state of TSQ2.ACK is Nack, TSQ shall be incremented by "1" and made to refer to TSQ2 repeatedly until any element is identified which indicates that the state of the concerned element's TSQ2.ACK is Ack. If the state of TSQ2.ACK is Ack, the value of the sequence number field (SEQ) in the MAC control field shall be generated out of both the value of the concerned element's TSQ2.DUP and the value of TSQ. The value of SEQ shall be determined by the following generating function:

$$SEQ = TSQ2.DUP \times 8 + TSQ$$

After the value of SEQ is generated, the concerned element's TSQ2.DUP shall be incremented by 1 to be updated. If the link address is a private link address, the state of the concerned element's TSQ2.ACK shall be set Nack. If the link address is a broadcast link address or a group broadcast link address, the state of the concerned element's TSQ2.ACK shall be set Ack. (The state of TSQ2.ACK is updated by the result of reception of acknowledgement described in Subclause 4.3.3.5.2.1.2.1 (3) and the result of retransmission described in Subclause 4.3.3.5.2.1.2.1 (4).)

Also, the variable ASGN shall be created according to the received MA-UNITDATA.request primitive and be passed to the MLME. This MAC control field and an LPDU shall be once held and the transfer procedure defined in detail in subclause 4.3.3.5.2.1.2 shall be performed. However, the response parameter is "2", the LPDU shall be discarded.

The data received from the mobile station shall be processed according to transfer procedure defined in detail in subclause 4.3.3.5.2.1.2. After accomplishment of this transfer procedure, the MLME shall generate the MA-UNITDATA.indication primitive, and pass the link address and the LPDU to the LLC sublayer.
At this time, the comparison will be made between the value of the most significant bit of the SEQ field within the MAC control field and the value of the element of the variables RSQ, which will be referred to by the least 3 significant bits of the concerned SEQ. If it shows

equality, the corresponding LPDU shall not pass to the LLC sublayer and be discarded, since the LPDU is duplicated. After the comparison of the RSQ and the TSQ values has completed, the most significant bit of the concerned SEQ shall be stored in the element of the RSQ to be referred to by the least 3 significant bits of the concerned SEQ for a duplication inspection next time.

If a duplicated reception is identified, a slot for uplink transmission shall be reassigned to the concerned mobile station. This is just as in the case of receiving a MA-UNITDATA request primitive in which the parameter "response_request" is set to "2" from the base station.

Note1) The inspection of the continuance, defined in subclause 4.3.3.5.2.1.2, for the sequence number SEQ within the receiving PDU passed after the accomplishment of the transfer procedures shall not be performed.
Note2) The relationship between the TSQ, the RSQ, and MAC control subfields is shown table 4.3.3.5.2.1.1 for reference.

Table. 4.3.3.5.2.1.1 The relationship between the TSQ, the RSQ, and MAC control subfields

Frame Numbers	1	2	3	4	5	6	7	8	9	10	11	12
TSQ (transmission side)	0	1	2			3	4	5		6	7	8
TSQ2.DUP (transmission side)	0	0	0			0	0	0		0	0	1
FRG	0	0	1	1	1	0	0	1	1	0	0	0
C/L	0	0	1	1	0	0	0	1	0	0	0	0
SEQ	0	1	2	3	4	3	4	5	6	6	7	8
SEQ (reception side) comparison with the RSQ	0	1			2	3	4		5	6	7	8

Fragmentation within frames. Fragmentation within frames.

4.3.3.5.2.1.2 MAC Transfer Control Procedures

4.3.3.5.2.1.2.1 Transmission Control

(1) Fragmentation LPDU

The fragmentation procedure is adopted when the length of an LPDU received from the LLC sublayer exceeds the maximum transmission size MSIZE.

The fragmentation procedure at first shall generate an MPDU with a MAC control field added to the data of MSIZE from the head. At this time, “1” shall be set at both the FRG and the C/L of the MAC control field, and MSIZE (“10000010” in ASK [65] and “10000011” in QPSK [193]) shall be set at the LI, and the NFR1 shall be initialized. The initial value of the SEQ shall be set at the same value defined in the MAC data service procedure (subclause 4.3.3.5.2.1.1).

When the MPDU was sent to the mobile station and reception has been acknowledged, the length of the remaining the LPDU shall be inspected. If it exceeds MSIZE, the data of MSIZE shall be further taken out from the head, and a next MPDU shall be generated with a MAC control field added to it. Both the FRG and the C/L of the MAC control field shall be set to “1”, and the LI shall be set to MSIZE (“10000010” in ASK [65] and “10000011” in QPSK [193]), and the SEQ shall be incremented by “1”. At this time, the TSQ shall not be incremented. Furthermore, the NFR1 shall be initialized in the same manner.

Identical procedure shall repeated until the length of the remaining the LPDU becomes MSIZE or less, and then accomplishment of fragmentation procedure shall be indicated with “0” set at the C/L. Furthermore, the number of octets of the length of the remaining the LPDU shall be set at the LI, and “0” shall be inserted to the LPDU until the number of octets becomes MSIZE.

When all of the MPDUs generated as fragmented were transferred to the mobile station and their reception was acknowledged, the transmission control for the subject LPDU shall terminates.

(2) Non-fragmentation LPDU

In case LPDU received from LLC sublayer is short of MSIZE, it is added directly with a MAC control field to make up an MPDU. In this case, both FRG and C/L of the MAC control field are set to "0", and LI is set to the number of octets equivalent to the length of LPDU, and NFR1 is initialized. If LPDU is short of MSIZE, it is padded with 0s until made up to MSIZE.

When MPDUs are forwarded to and accepted by a mobile station, the transmission control of the LPDU is put to an end.

(3) Reception of an acknowledgement

When the MPDU generated by the procedure mentioned above was sent, it should wait for reception of the ACKC during the certain period indicated by a transfer slot.

If the AI was not obtained from the ACKC during this period or if the Nack was received at the AI, the NFR1 shall be incremented and the retransmission procedure indicated below shall be executed.

Where the Ack was received at the AI, transfer of the subject MPDU shall terminate, and the subject MPDU shall be discarded.

In this case, the element of the transmission state variable, TSQ2, is looked up using the three least significant bits of the sequence number field (SEQ) of the MAC control field for the MPDU, and the status of the transmission confirmation state variable, TSQ2.ACK, which is one of the members of its element, is turned Ack. Provided that if the MPDU in question has been fragmented as aforesaid, the processing is carried out for the sequence number affixed to the first of the segments into which the MPDU is fragmented. The status will be changed when the Ack for the last fragment has been received.

This acknowledgement transmission procedure shall only be applied to the transmission of MPDU indicated by a private link address, and not to the transmission of MPDU indicated by multi-group or broadcast link addresses.

(4) Retransmission

Retransmission procedure is performed when the transfer slot of the MPDU could not receive the Ack at the AI obtained from the ACKC (the AI was not obtained from the ACKC or the Nack was received at the AI) during a certain period indicated by a transfer slot.

Where the Ack could not be received, the MPDU shall not be discarded, but be retransmitted by the slot assigned to the next frame, and it shall wait for reception of the AI of that slot.

Retransmission procedure shall be repeated until the Ack is received or until the NFR1 exceeds the NFR1max.

The LPDU shall be discarded when the NFR1max is exceeded.

In this case, the element of the transmission state variable, TSQ2, is looked up using the three least significant bits of the sequence number field (SEQ) of the MAC control field for the MPDU, and the status of the transmission confirmation state variable, TSQ2.ACK, which is one of the members of its element, is turned Ack. Provided that if the MPDU in question has been fragmented as aforesaid, the processing is carried out for the sequence number affixed to the first of the fragments into which the MPDU is split. The status will be changed when the Ack for the last fragment has been received.

This retransmission procedure shall only be applied to the transmission of MPDUs indicated by a private link address, and not to the transmission of MPDU indicated by multi-group or broadcast link addresses.

(5) Generation of Idle channel signal

If the MLME detects an MDS that it is an idle channel with the downlink, it shall generate an MPDU of which LPDU fields are all "0".

In this case, FRG ,C/Land C/R of the MAC control field shall both be set to all "0"; LI shall be set to the MSIZE value ("10000010" (65) in ASK system or "10000011"(193) in the π /4-shift QPSK system); and NFR1 shall be initialized.

If there are MPDUs waiting for transmission or LPDUs in process, the generation of the idle channel signal shall not destroy the contents of these MPDUs and LPDUs.

4.3.3.5.2.1.2.2 Reception control

(1) Reception of MPDU

If the ST of the SCI identifies a normal data channel or a data channel assigned with priority, the MPDU to be transferred by the uplink MDS shall be accepted, and the MLME shall execute the acknowledgement transmission procedures and the defragmentation procedures specified below.

If the ST of the SCI identifies another type of channel (an idle signal channel, a empty data channel etc.), the MPDU to be transferred by the uplink MDS shall be discarded, and the MLME shall terminate the reception control procedures.

(2) Transmission of acknowledgement

When the reception of the MPDU is indicated, the NFR2 shall be initialized, and the AI shall be transferred by that reception slot. At this time, where the MPDU was correctly received, it shall set the AI to the Ack with the AK set to "1". If it was not correctly received, it shall set the AI to the Nack with the AK set to "0".

The conditions for setup of the Nack are as follows. The Ack is set unless these conditions are satisfied.

(a) The length of MPDU is not MSIZE+2.
(b) The subfield FRG of the MAC control field is "0" and the C/L is "1".
(c) The LI of the MAC control field is "0" (null LLC control field), or shows a value in excess of MSIZE + 1.
(d) The result of CRC inspection is incorrect.

The NFR2 shall be counted each time the Nack is sent or when MPDU is not received correctly, and retransmission of the MPDU from the mobile station shall be waited for.

Queue for retransmission of the MPDU shall be continued until an MPDU, which is identified as the Ack, is received or until the NFR2 exceeds the NFR2max.

When the NFR2 exceeds the NFR2max, the assignment for the corresponding slot shall terminate.

The MPDU, which transmitted Nack, shall be discarded.

(3) Defragmentation MPDU

When previous defragmentation procedure has been completed and an MPDU in which the FRG of the MAC control field is "1" is received, a new defragmentation procedure starts. Hereafter, the defragmentation procedure shall be continued while receiving MPDUs of which both the FRG and the C/L of the MAC control field is "1", and it shall be terminated when an MPDU in which the FRG is "1" and the C/L is "0" is received. The defragmentation procedure shall terminate when the LPDU to be delivered to the LLC sublayer is generated. The procedures indicated below are performed with MPDUs that returned Ack.

(a) If the C/L within first MPDU passed to the defragmentation procedure is "1", the MAC control field of the corresponding MPDU shall be held until the completion of the defragmentation procedure and the MPDU shall be the first data of the LPDU.

(b) If the C/L within first MPDU passed to the defragmentation procedure is "0", the corresponding MPDU shall be discarded and the defragmentation procedure shall be terminated.

(c) If the increment of the SEQ is "1" (the SEQ is continuous, but change from "1111" to "0000" is included), data of the length indicated by the LI shall be taken out from the beginning of the MSDU, and shall be defragmented sequentially.

(d) If the increment of the SEQ is "0" (the MPDU was duplicated), the corresponding MPDU shall be discarded.

(e) If the increment of the SEQ is not "1" or "0" (The SEQ is not continuous; but change from "1111" to "0000" is excluded), the MPDUs received thereafter and defragmented data of up to this time shall be discarded. After deleting the last MPDU (the FRG was "1" and the C/L was "0"), it shall be regarded as the completion of the defragmentation procedure.

(f) After the completion of the defragmentation of MPDUs and the generation of a valid LPDU, it shall be regarded as the termination of the defragmentation procedure, the LPDU with the MAC control field which has been held shall pass to the MAC data service procedure specified in subclause 4.3.3.5.2.2.1.

The receive control procedures shall terminate after the completion of this defragmentation procedure.

(4) Non-defragmentation MPDU

On receiving an MPDU, both FRG and C/L of the MAC control field of which is "0", is indicated, the defragmentation procedure shall not be executed. But data of the length indicated by LI shall be taken out from the beginning of the MSDU, and LPDU to be passed to the LLC sublayer shall be generated and reception control procedures shall terminate.

4.3.3.5.2.1.3 Transmission/Reception procedures

4.3.3.5.2.1.3.1 Transmission

(1) Transmission of MDC

The MPDU generated by transmission control is preceded by a ramp bit (for $\pi/4$ shift QPSK system only), preamble and unique word in accordance with the modulation system, and is followed by a 16-bit CRC figured out from the data codes other than ramp bit (for $\pi/4$ shift QPSK system only), preamble and unique word. Then, the range from the header of LPDU just after the MAC control field to the end of CRC is scrambled by the key generated from

LID (see 4.2.6 for details). The scrambled result is multiplexed to the MDC position in the slot indicated by the MIB information and transferred to layer-1.

(2) Transmission of ACKC

The AI generated by transmission control is preceded by a ramp bit (for $\pi/4$ shift QPSK system only), preamble and unique word in accordance with the modulation system, and is followed by a 16-bit CRC figured out from the data codes other than ramp bit (for $\pi/4$ shift QPSK system only), preamble and unique word. Finally, it is multiplied to the ACKC position in the slot indicated by the MIB information, and is delivered to layer-1.

4.3.3.5.2.1.3.2 Reception

(1) Reception of MDC

The key generated from the LID shall descramble the data passed from the layer 1 at the position of the MDC of the slot indicated by the information of the MIB. The range of data for descrambling (details are defined in subclause 4.2.6) shall be from the beginning of the LPDU field to the end of CRC. A 16-bits CRC shall be calculated from the descrambled data codes other than ramp bit (for $\pi/4$ shift QPSK system only), preamble (PR) and unique word (UW2), and shall be compared with a reference value.

If the comparison shows equality, the corresponding MPDU shall be taken out and be passed to the reception control procedures specified previously.

(2) Reception of ACKC

The signal transferred from layer-1 to the ACKC position in the slot indicated by the MIB information is subjected to 16-bit CRC calculation based on data codes other than ramp bit (for the $\pi/4$ shift QPSK system only), preamble and unique word and compared with a reference value.

If the comparison shows equality, the AI shall be taken out and be passed to the reception control procedures.

If the comparison shows inequality, the corresponding ACKC shall be discarded, and the AI shall not be passed to the reception control.

4.3.3.5.2.2 Transfer Procedures at the mobile station

4.3.3.5.2.2.1 MAC Data Service Procedures

On receiving the MA-UNITDATA, request primitive of the mobile station from the LLC sublayer, the MAC control field shall be generated and the transmission sequence state variable, TSQ, shall be incremented by "1". In this case, the element of the transmission state variable, TSQ2, shall be looked up using the value of TSQ, and the status of the transmission confirmation state variable, TSQ2.ACK, which is one of the members of its element, shall be confirmed. If the status of TSQ2.ACK is NACK, TSQ shall be incremented so as to look up TSQ2. This process shall be repeated until said element is found to have the ACK status of TSQ2.ACK. If the status of TSQ2.ACK is ACK, the value of the element member redundancy check state variable TSQ2.DUP shall be combined with the value of TSQ to generate the value of the MAC control field sequence number field (SEQ). The value of the SEQ shall be determined using the following generation formula.

$$SEQ = TSQ2.DUP \times 8 + TSQ$$

After generation of the SEQ value, the TSQ2.DUP value of the element shall be incremented to turn the status of the TSQ2.ACK of the element to NACK. (The status of TSQ2.ACK is updated by the result of the reception of acknowledgement specified in 4.3.3.5.2.2.2.1 (3) and the result of the retransmission procedure specified in 4.3.3.5.2.2.2.1 (4).)
This MAC control field information and an LPDU shall be once held and the transfer procedures defined in detail in subclause 4.3.3.5.2.2.2 shall be performed.

The data received from the base station shall be processed according to transfer procedure defined in detail in subclause 4.3.3.5.2.2.2. After completion of this transfer procedure, the MLME shall generate the MA-UNITDATA.indication primitive, and pass the link address and the LPDU to the LLC sublayer. At this time, the comparison shall be made between the value of the SEQ field within the MAC control field and the value of the reception sequence state variable RSQ. If it shows equality, the corresponding LPDU shall not pass to the LLC sublayer and be discarded, since the LPDU was duplicated. After completion of the comparison with the RSQ and the TSQ, the value of the SEQ within the MAC control field shall be held in the RSQ field for the duplication inspection next time.
Upon completion of the comparison above, the most significant bit of the SEQ shall be stored in the element of the reception sequence state variable RSQ which is looked up using the three least significant bits of the SEQ in preparation for the next redundancy check of reception.

(Note 1) The SEQ continuity check of the received data passed after completion of the transfer procedure specified in subclause 4.3.3.5.2.2.2 shall not be performed.

(Note 2) The relationship between the TSQ, the RSQ, and MAC control subfields is shown in Figure 4.3.3.5.2.1.1 for reference.

4.3.3.5.2.2.2 MAC Transfer Control Procedures

4.3.3.5.2.2.2.1 Transmission Control

(1) Fragmentation LPDU

In case the length of LPDU received from LLC sublayer is in excess of the maximum transfer size variable, MSIZE, it must be fragmented.
For the purpose of fragmentation, The MSIZE data taken from the leading end shall be added with a MAC control field to form an MPDU. In this case, FRG and C/L of the MAC control field shall both be set to "1"; LI shall be set to the MSIZE value ("10000010" (65) in ASK system or "10000011"(193) in the π/4-shift QPSK system); and NFR1 shall be initialized. The initial value of the SEQ shall be set at the same value as defined in the MAC data service procedure (subclause 4.3.3.5.2.2.1).

When the MPDU was sent to the base station and reception has been acknowledged, the length of the remaining LPDU shall be inspected. If it exceeds MSIZE, the data of MSIZE shall be further taken off from the beginning, and an MPDU shall be generated with a MAC control field added to it. In this case, FRG and C/L of the MAC control field shall both be set to "1"; LI shall be set to the MSIZE value ("10000010" (65) in ASK system or "10000011"(193) in the π/4-shift QPSK system); SEQ shall be incremented; TSQ shall not be incremented; and NMR shall be initialized.

The process shall be repeated until the remaining part of LPDU becomes smaller than MSIZE. When the remaining part gets smaller than MSIZE, C/L shall be set to "0" to signify the end of fragmentation. The number of octets equivalent to the remaining length of LPDU shall be set to LI, and LPDU shall be padded with 0s until MSIZE is reached.

When all of the MPDUs generated as fragmented were transferred to the base station and their reception was acknowledged, the transmission control for the LPDU shall terminate.

(2) Non-fragmentation LPDU

In case LPDU received from LLC sublayer is short of MSIZE, it shall be added directly with a MAC control field to make up an MPDU. In this case, both of the FRG and the C/L of the MAC control field shall be set to "0", the number of octets of its length shall be set at the LI, and the NMR shall be initialized. If LPDU is short of MSIZE, it shall be padded with 0s until an MSIZE is reached.

When the MPDU was sent to the mobile station and its reception was acknowledged, the transmission control for the LPDU shall terminate.

(3) Reception of acknowledgement

When the MPDUs prepared in the above process are transmitted, the system shall wait for ACKC while the transfer slots for MPDUs are on display.

If the AI was not obtained from the ACKC during this period or if the Nack was received at the AI, the NMR shall be incremented and the retransmission procedure indicated below shall be executed.

Where the Ack was received at the AI, transfer of the MPDU shall terminate, and the MPDU shall be discarded.

In this case, the element of the transmission state variable, TSQ2, shall be looked up using the three least significant bits of the sequence number field (SEQ) of the MAC control field for the MPDU, and the status of the transmission confirmation state variable, TSQ2.ACK, which is one of the members of its element, shall be turned Ack. Provided that if the MPDU in question has been fragmented as aforesaid, the processing shall be carried out for the sequence number affixed to the first of the segments into which the MPDU is fragmented. The status will be changed when the Ack for the last segment has been received.

(4) Retransmission

Retransmission procedure shall be performed when the transfer slot of the MPDU could not receive the Ack at the AI obtained from the ACKC (the AI was not obtained from the ACKC or the Nack was received at the AI) while the transfer slot for MPDU is displayed.

Where the Ack could not be received, the subject MPDU shall not be discarded, but be retransmitted by the slot assigned to the next frame, and it shall wait for reception of the AI in the corresponding slot.

Retransmission procedure shall be repeated until the Ack is received or until the NMR exceeds the NMRmax.

When NMRmax is exceeded, the LPDU shall be dicarded, and the re-transmission procedures shall be terminated. In case the version of the protocol selected for communication with the base station is "0", the retransmission shall be terminated if an MPDU is received from the base station while the retransmission is in progress.

In this case, the element of the transmission state variable, TSQ2, shall be looked up using the three least significant bits of the sequence number field (SEQ) of the MAC control field for the MPDU, and the status of the transmission confirmation state variable, TSQ2.ACK, which is one of the members of its element, shall be turned Ack. Provided that if the MPDU in question has been fragmented as aforesaid, the processing shall be carried out for the sequence number affixed to the first of the segments into which the MPDU is fragmented. The status shall be changed when the Ack for the last segment has been received.

(5) Generation of idle channel signal

If the MLME detects an MDS indicating that it is an idle channel with the uplink, it shall generate an MPDU in which LPDU fields are all "0".
In this case, FRG , C/L and C/R of the MAC control field shall both be set to "0"; LI shall be set to the MSIZE value ("10000010" (65) in ASK system or "10000011"(193) in the π /4-shift QPSK system).
If there are MPDUs waiting for transmission or LPDUs in process, the generation of the idle channel signal shall not destroy the contents of these MPDUs and LPDUs.

4.3.3.5.2.2.2.2 Reception control

(1) Reception of MPDU

If the ST of the SCI has identified normal data channel or a data channel assigned with priority, the MPDU to be transferred by the downlink MDS shall be accepted, and the MLME shall execute the acknowledgement transmission procedure and the defragmentation procedure specified below.

If the ST of the SCI has identified another type of channel (an idle signal channel, an empty data channel etc.), the MPDU to be transferred by the downlink MDS shall be discarded, and the MLME shall terminate the reception control procedures.

(2) Acknowledgement transmission

When the reception of the MPDU is indicated, the AI shall be sent within the ACKC in the reception slot. If the MPDU was correctly received, it shall set the AI to the Ack with the AK set to "1". If it was not correctly received, the AI shall be set to the Nack with the AK set to "0".

The conditions that set the Nack are as follows. The Ack shall be set unless these conditions are satisfied.

(a) The length of MPDU is not equal to MSIZE+2.
(b) In the MAC control field, FRG is "0", whereas C/L is "1".
(c) In the MAC control field, LI is "0" (i.e., absence of LLC control field), or shows a value in excess of MSIZE+1.
(d) CRC check result is not correct.

The MPDU that has dispatched NACK is discarded.

This acknowledgement transmission procedure shall only be applied to a private link address, not to multi-group or broadcast link addresses.

(3) Defragmentation MPDU

When the previous defragmentation procedure has been completed and an MPDU in which the FRG of the MAC control field is "1" is received, a new defragmentation procedure starts. Hereafter, the defragmentation procedure shall be continued while receiving MPDUs of which the both of the FRG and the C/L of the MAC control field is "1", and it shall be terminated when an MPDU in which the FRG is "1" and the C/L is "0" is received. The defragmentation procedure shall terminate when the LPDU to be delivered to the LLC sublayer is generated. The procedures indicated below shall be performed with respect to the MPDUs that returned Ack.

(a) If the C/L within the first MPDU passed to the defragmentation procedure is "1", the MAC control field of the corresponding MPDU shall be held until the completion of the defragmentation procedure and the MPDU shall be the first data of the LPDU.

(b) If the C/L within the first MPDU passed to the defragmentation procedure is "0", that MPDU shall be discarded and the defragmentation procedure shall terminate.

(c) If the increment of the SEQ is "1" (the SEQ is continuous, but change from "1111" to "0000" is included), data of the length indicated by the LI shall be taken out from the beginning of the MSDU, and shall be defragmented sequentially.

(d) If the increment of the SEQ is "0" (the MPDU was duplicated), the corresponding MPDU shall be discarded.

(e) If the increment of the SEQ is not "1" or "0" (The SEQ is not continuous; but change from "1111" to "0000" is excluded), the MPDUs received thereafter and the data defragmented theretofore shall be discarded. After deleting the last MPDU (the FRG was "1" and the C/L was "0"), it shall be regarded as the completion of the defragmentation procedures.

(f) After the completion of the defragmentation of MPDUs and the generation of a valid LPDU, it shall be regarded as the termination of the defragmentation procedure, and the LPDU together with the MAC control field which has been held shall pass to the MAC data service procedure specified in subclause 4.3.3.5.2.2.1.

The reception control procedure shall terminate after the completion of this defragmentation procedures.

(4) Non-defragmentation MPDU

In case the MPDU having returned an Ack is indicated in which MAC control field has its FRG and C/L set to "0", the defragmentation procedure shall not be executed. But data of the length indicated by LI shall be taken out from the beginning of the MSDU, an LPDU to be passed to the LLC sublayer shall be generated and reception control procedures shall terminate.

4.3.3.5.2.2.3 Transmission/Reception procedure

In this transmission/reception procedures, the source address of the base station shall be identified as the FID by way of the SCI registration procedure specified in subclause 4.3.3.5.1.2.1(1).

4.3.3.5.2.2.3.1 Transmission

(1) Transmission of MDC

The MPDU generated by transmission control shall be preceded by a ramp bit (for $\pi/4$ shift QPSK system only), preamble and unique word in accordance with the modulation system, and shall be followed by a 16-bit CRC figured out from the data codes other than ramp bit (for $\pi/4$ shift QPSK system only), preamble and unique word. Then, the range from the header of LPDU just after the MAC control field to the end of CRC shall be scrambled by the key generated from LID (see 4.2.6 for details). The scrambled result shall be multiplexed to the MDC position in the slot indicated by the MIB information and shall be passed to layer-1.

(2) Transmission of ACKC

The AI generated by transmission control is preceded by a ramp bit (for $\pi/4$ shift QPSK system only), preamble and unique word in accordance with the modulation system, and is followed by a 16-bit CRC figured out from the data codes other than ramp bit (for $\pi/4$ shift QPSK system only), preamble and unique word. Finally, it shall be multiplied to the ACKC position in the slot indicated by the MIB information, and is delivered to layer-1.

4.3.3.5.2.2.3.2 Reception

(1) Reception of MDC

The data passed from the layer-1 at the position of the MDC of the slot indicated by the information of the MIB shall be de-scrambled by the key generated from the LID. The range of data for descrambling (details are defined in subclause 4.2.6) shall be from the beginning of the LPDU field to the end of CRC. A 16-bits CRC shall be calculated from the descrambled data less the preamble (PR) and unique word (UW2), and shall be compared with a reference value.

If the comparison shows equality, the corresponding MPDU shall be taken out and be passed to the reception control procedure specified previously.

(2) Reception of ACKC

The signal transferred from layer-1 to the ACKC position in the slot indicated by the MIB information shall be subjected to 16-bit CRC calculation based on data codes other than ramp bit (for the $\pi/4$ shift QPSK system only), preamble and unique word and shall be compared with a reference value.

If the comparison shows equality, the AI shall be taken out and be passed to the reception control procedure. If the comparison shows inequality, the corresponding ACKC shall be discarded, and the AI shall not be passed to the reception control procedure.

4.3.4 Logical Link Control (LLC) Sublayer

The LLC generates command PDU and response PDU for transmission and interprets received command PDUs and response PDUs.

LLC provides the following functions.

(1) Initialization of PDU transmit/receive.
(2) Control of data flow.
(3) Interpretation of received command PDUs and generation of appropriate response PDUs.
(4) Action regarding error control and error recovery functions in LLC sublayer.

The LLC sublayer provides a description of the peer-to-peer protocol procedures that are defined for the transfer of information and control between a pair of data link service access points (LSAPs) in this radio communication system environment.

For a broad range of DSRC applications, two types of data link control operation are contained.

(See subclause 4.3.4.3)

The first (referred to as Type 1) of operation provides unacknowledged connectionless-mode service across the data link with a minimum protocol. This type of operation may be useful when the layer-7 or applications provide any error recovery and sequencing service so that these do not need replicating in the layer-2. In addition, this type of operation may prove useful in applications where it is not essential to acknowledge the delivery of the data link layer (layer-2) data unit.

The second (referred to as Type 3) of operation provides an acknowledged connection-less mode data unit exchange service, which permits a station to both transmit data and request the return of the data at the same time. Although exchange service is connectionless, in-sequence data transfer is guaranteed by the initiating station.

(Note 1) Definition of this LLC sublayer is based on ISO/IEC 8802-2:1994 (Information technology -- Telecommunication and information exchange between systems -- Local and metropolitan area networks - Specific requirements -- Part 2: Logical link control).

(Note 2) Type 3 data transfer service is reserved for future systems at this time. The implementation of Type 3 in future systems will be considered.

Type 2 is not adopted because of an unwanted overhead for connection and disconnection in the real-time environment of this radio communication system.

4.3.4.1 LLC Sublayer Service Specification

This subclause specifies the services required of the LLC sublayer by the superordinate entities for the purpose of packet exchange between the layer-7 entities using LLC sublayer. The service is described in an abstract way and does not imply any particular implementation or any exposed interface.

Two forms of service are provided.

(a) Unacknowledged connectionless-mode service
(b) Acknowledged connection-less mode service

(1) Unacknowledged connection-mode service

The data transfer service that provides the means by which data link user entities can exchange link service data units (LSDUs) without the establishment of data link level connection on an unacknowledged base. The data transfer can be point-to-point, multicast (group cast), or broadcast.

(2) Acknowledged connectionless-mode service

The Acknowledged connection-less mode data unit exchange service provides the means by which data link user entities can exchange link service data units (LSDUs) which are acknowledged at the LLC sublayer, without establishment of data link connection. The service provides a means by which a layer-7 at one station can transmit a data unit to another station, request a previously prepared data unit from another station, or exchange data unit from another station. The data unit transfer is point-to-point.

4.3.4.1.1 Overview of Interaction

(1) Unacknowledged connectionless-mode service

(a) Data unit transmission service

The primitives associated with unacknowledged connectionless mode data transfer are:

DL-UNITDATA.request
DL-UNITDATA.indication

The DL-UNITDATA.request primitive is passed from the layer-7 to the LLC sublayer to request that an LSDU be transmitted using unacknowledged connectionless-mode procedures.

A DL-UNITDATA.indication primitive is passed from the LLC sublayer to the layer-7 to indicate arrival of an LSDU.

(2) Acknowledged connectionless-mode service

(a) Acknowledged connectionless-mode data unit transmission service

The primitives associated with the acknowledged connectionless-mode data unit transmission service are:

DL-DATA-ACK. request
DL-DATA-ACK. indication
DL-DATA-ACK-STATUS.indication

The DL-DATA-ACK.request primitive is passed from the layer-7 to the LLC sublayer to request that an LSDU be transmitted to a remote LLC using acknowledged connectionless-mode data transmission procedures. The DL-DATA-ACK.indication primitive is passed from to the layer-7 the LLC sublayer to indicate the arrival of a common PDU except in the case where this PDU is used only for resynchronization. The DL-DATA-ACK-STATUS.indication is passed from the LLC sublayer to the layer-7 to convey the results of previous associated DL-DATA-ACK.request primitive.

(b) Data unit exchange service

The primitives associated with the acknowledged connectionless-mode data unit exchange services are:

DL-REPLY.request
DL-REPLY.indication
DL-REPLY-STATUS.indication

The DL-DATA-REPLY.request primitive is passed from the layer-7 to the LLC sublayer to request that an LSDU be returned from a remote station or that LSDUs be exchanged between stations using acknowledged connectionless-mode data unit exchange procedures.

The DL-DATA-REPLY.indication primitive is passed from the LLC sublayer to the layer-7 to indicate the arrival of a common PDU. The DL-DATA-REPLY-STATUS.indication is passed from the LLC sublayer to the layer-7 to convey the results (success/failure and reply data) of previous associated DL-REPLY.request primitive.

(c) Reply data unit preparation service

The primitives associated with reply data unit preparation are:

DL-REPLY-UPDATE.request
DL-REPLY-UPDATE-STATUS.indication

The DL-REPLY-UPDATE.request primitive is passed from the layer-7 to the LLC sublayer to request that an LSDU to be held by LLC and transmitted at later time when requested to do so by some other station. The DL-DATA-REPLY-UPDATE-STATUS.indication is passed from the LLC sublayer to the layer-7 to convey the results of previous associated DL-REPLY-UPDATE.request primitive.

4.3.4.1.2 Detailed Service Specification

This subclause describes in detail the primitives and parameters associated with the identified services (specified in 4.3.4.1.1). The parameters (except "link addresses") are defined in abstract sense. The parameters specify the information that must be available to the receiving end. No restraint shall be imposed upon the implementation method of providing this information.

The link_address parameter identifies remote SAP and remote SAP of both MAC and the LLC. The link_address parameter shall have the format defined in subclause 4.2.4.2.1.8.2.

The data parameter may be provided by actually passing the data link service data unit by passing a pointer or other means. The parameter may be null.

The status parameter indicates success or failure of a previous associated request.

(Note) Different from ISO/IEC 8802-2:1994, MAC and LLC shall have one common address.

Possible logical sequences of successful data unit transmission are illustrated in Fig. 4.3.4.1.2. (Primitive types that occur earlier in time and connected by dotted lines in the diagrams are the logical antecedents of subsequent primitive types.)

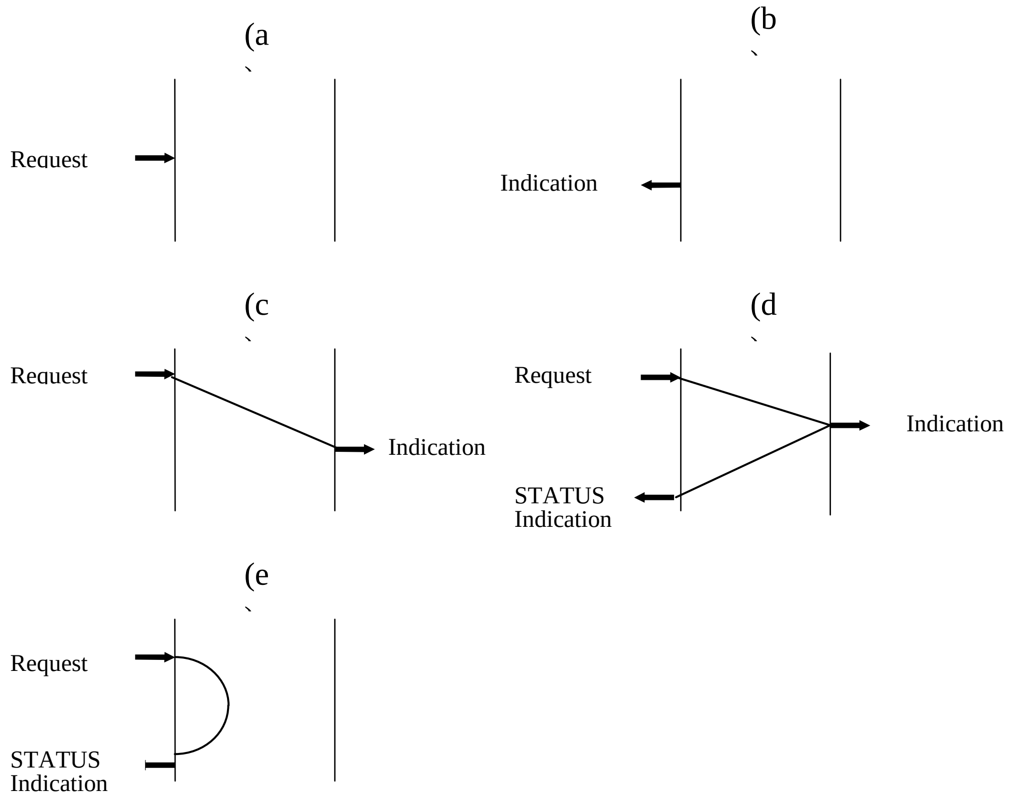


Figure 4.3.4.1.2 Time series diagram

4.3.4.1.2.1 DL-UNITDATA request

(1) Function

This primitive is the service request primitive for the unacknowledged connectionless-mode data transfer service.

(2) Parameter

This primitive shall provide parameters as follows.

On the mobile station side
DL-UNITDATA.request (link_address, data)

The link_address parameter of the mobile station shall be a private link address. The data parameter specifies the LSDU to be transmitted by the data link entity.

On the base station side
DL-UNITDATA.request (link_address, data, response_request)

The link_address parameter of the base station may be the private, multicast (groupcast) link and broadcast link addresses. The data parameter specifies the MSDU to be transmitted by the data link entity. The response_request parameter is passed to the MAC sublayer directly.

(Note) The parameters of response_request are specified as follows. The response_request set to "1" indicates that the MAC sublayer only transmits data, which is simultaneously passed from the LLC, to the mobile station as indicated by link_address.

The response_request set to "2" indicates that the MAC sublayer assigns the uplink MDS with the same link_address. In this case, data is discarded by the MAC sublayer.
The response_request set to "0" indicates that the MAC sublayer assigns the uplink MDS with the same link_address. At that time, the MAC sublayer discards the corresponding data.
the MAC sublayer transmits data, which is simultaneously passed from the LLC, to the mobile station as indicated by link_address.

(3) When generated

This primitive is passed from the layer-7 to the LLC sublayer to request that an LSDU be transmitted to one or more remote LSAP(s) using unacknowledged connectionless-mode procedures.

4.3.4.1.2.2 DL-UNITDATA.indication

(1) Function

This primitive is a service indication primitive for the unacknowledged connectionless-mode data transfer service.

(2) Parameter

This primitive shall provide parameters as follows.

DL-UNITDATA.indication (link_address, data)

The link_address parameter of the base station shall specify a private link address. The link_address parameter of the mobile station shall specify a private link address, multi (group) link and broadcast link addresses. The data parameter shall specify the LSDU that is to be transferred by the data link entity.

(3) When generated

This primitive is passed from the LLC sublayer to the layer-7 to indicate arrival of LSDU from a specified remote station entity.

4.3.4.1.2.3 DL-DATA-ACK.request

(1) Function

This primitive is a service request primitive for the acknowledged connectionless-mode data unit transfer service.

(2) Parameter

This primitive shall provide parameters as follows.

DL-DATA-ACK.request (link_address, data)

The link_address parameter indicates a private link address. The data parameter specifies the LSDU to be transferred by the data link entity.

(3) When generated

This primitive is passed from the layer-7 to the LLC sublayer to request that an LSDU be transmitted to remote LSAP using acknowledged connectionless-mode data unit transfer procedures.

4.3.4.1.2.4 DL-DATA-ACK.indication

(1) Function

This primitive is the service request primitive for the acknowledged connectionless-mode data unit transmission service.

(2) Parameter

This primitive shall provide parameters as follows.

DL-DATA-ACK.indication (link_address, data)

The link_address parameter specifies a private link address. The data parameter specifies the LSDU to be transferred by the data link entity.

(3) When generated

This primitive is passed from the LLC sublayer to the layer-7 to indicate arrival of non-null, nonduplicate LSDU from a specified remote station entity.

4.3.4.1.2.5 DL-DATA-ACK-STATUS indication

(1) Function

This primitive is a status indication primitive for the acknowledged connectionless-mode data unit transfer service.

(2) Parameter

This primitive shall provide parameters as follows.

DL-DATA-ACK-STATUS.indication (link_address, status)

The link_address parameter specifies a private link address. The status parameter indicates success or failure of the previous associated acknowledged connectionless-mode data unit transfer request.

(3) When generated

This primitive is passed from the LLC sublayer to the layer-7 to indicate success or failure of the previous associated acknowledged connectionless-mode data unit transfer request.

4.3.4.1.2.6 DL-REPLY.request

(1) Function

This primitive is the service request primitive for the acknowledged connectionless-mode data unit exchange service. This primitive can be used to request a previously prepared data unit from another station, or to exchange data unit with another station.

(2) Parameter

This primitive shall provide parameters as follows.

DL-REPLY.request (link_address, data)

The link_address parameter shall specify a private link address. The data parameter specifies the LSDU transferred by the data link entity.

(3) When generated

This primitive is passed from the layer-7 to the LLC sublayer to exchange an LSDU with a remote station or to obtain an LSDU prepared at a remote station.

(Note) The primitive can be passed with a null (having zero length) data parameter for the purpose of requesting data only (without transmitting data).

4.3.4.1.2.7 DL-REPLY.indication

(1) Function

This primitive is a service indication primitive for the acknowledged connectionless-mode data unit exchange service.

(2) Parameter

This primitive shall provide parameters as follows.

DL-REPLY.indication (link_address, data)

The link_address parameter indicates a private link address. The data parameter specifies the LSDU to be transferred by the data link entity.

(3) When generated

This primitive is passed from the LLC sublayer to the layer-7 to indicate either a successful acquisition of an LSDU from a remote station entity or exchange of LSDUs with a remote station entity.

The transfer of previously prepared LSDU to the requesting station shall not destroy the original copy of LSDU. Subsequent requests for data by any station shall cause the transfer of the same LSDU, until the DL-REPLY-UPDATE.request primitive is used to replace the LSDU with new information.

4.3.4.1.2.8 DL-REPLY-STATUS.indication

(1) Function

This primitive is a service status indication primitive for the acknowledged connectionless-mode data unit exchange service.

(2) Parameter

This primitive shall provide parameters as follows.

DL-REPLY-STATUS.indication (link_address, data, status)

The link_address parameter indicates a private link address. The status parameter indicates the success or failure of the previously associated acknowledged connectionless-mode data unit exchange request.

(3) When generated

This primitive is passed from the LLC sublayer to the layer-7 entity to indicate the success or failure of previous associated acknowledged connectionless-mode data unit exchange request and to pass data available.

4.3.4.1.2.9 DL-REPLY-UPDATE.request

(1) Function

This primitive is a service request primitive for response data unit preparation service.

(2) Parameter

This primitive shall provide parameters as follows.

DL-REPLY-UPDATE.request (link_address, data)

The link_address parameter indicates a private link address. The data parameter specifies the LSDU held by the data link entity at the request of the response data unit preparation request.

(3) When generated

This primitive is passed from the layer-7 to the LLC sublayer to request that an LSDU be associated with a local SAP and held by LLC for future access.

Once LSDU has been associated with a local SAP, that LSDU shall be transferred to the other stations using acknowledged connectionless-mode response PDU as often as requested by other stations (without need for additional DL-REPLY-UPDATE.request primitives from the layer-7).

A subsequent DL-REPLY-UPDATE.request primitives from the layer-7 for the specified SAP serves to replace the currently associated LSDU with a new LSDU.

4.3.4.1.2.10 DL-REPLY-UPDATE-STATUS.indication

(1) Function

This primitive is a service confirmation primitive for the reply data unit preparation service.

(2) Parameter

This primitive shall provide parameters as follows.

DL-REPLY-UPDATE-STATUS.indication (link_address, status)

The link_address parameter shall specify a private link address. The status parameter indicates success or failure of the previous associated data unit preparation request.

(3) When generated

This primitive is passed from the LLC sublayer to the layer-7 to indicate success or failure of the previous associated data unit preparation request.

The effect on reception of this primitive by the layer-7 is unspecified.

If the status is successful, this primitive indicates that the LLC sublayer has associated LSDU with a local SAP.

4.3.4.2 LLC PDU Structure

This subclause defines in detail the LPDU structure. It defines the relative positions of the various components of the PDU.

4.3.4.2.1 LPDU format

All LLC PDUs shall conform to the format shown in Fig. 4.3.4.2.1.

Control field	Information field
8 bit	8×M bit

(Note 1) Control=Control field: Refer to subclause 4.3.4.4.1
(Note 2) M=Number of octets: an integer value equal to or greater than "0" (Upper bound of M depends on media access methodology used.)

Fig. 4.3.4.2.1 LLC PDU Format

4.3.4.2.2 Elements of the LLC PDU

4.3.4.2.2.1 Address Field

The link address is used for the MAC sublayer and LLC sublayer and is therefore not contained in the LPDU.

The link address of downlink shall make a clear distinction between one (private) SAP or more (multi (group) link, broadcast link) SAP(s) for which the LLC information field is intended and the SAP from which the data transfer was initiated. The link address of uplink shall make a clear distinction between the specific (private) SAP for which the LLC information field is intended and the SAP from which the LLC information field was initiated.

The format of a link address is defined in subclause 4.2.4.2.1.8.2. A link address shall be generated as described in subclause 4.3.2.

4.3.4.2.2.2 Command/Response

The Command/Response bit shall be located at bit 4 (b4) in the MAC control field. If this bit is "0", it shall indicate that the LPDU is a command. If this bit is "1", it shall indicate that the LPDU is a response.

4.3.4.2.2.3 LLC Control Field

The control field shall consist of one octet that shall be used to designate commands and responses. The contents of these fields shall be described in subclause 4.3.4.4.

4.3.4.2.2.4 Information field

An information field shall consist of a multiple (including zero) of octets.

4.3.4.2.2.5 Bit order

Command and Response shall be delivered to / received from the MAC sublayer with the least significant bit first (i.e., the first bit of an octet that is delivered / received shall have the weight of 2^0.).

This information field shall be delivered to the MAC sublayer in the same bit order as received from the layer-7. The information field shall be delivered to the layer-7 in the same bit order as received from the MAC sublayer.

4.3.4.2.2.6 Invalid LPDU

Invalid LPDU shall be ignored. An invalid LPDU shall be defined as one that meets at least one of following conditions:

(1) LPDU judged by the MAC sublayer or the layer-1 entity to be invalid.
(2) LPDU whose length is not a multiple of octets.
(3) LPDU whose length is 0 (no control field).
(4) LPDU that has no valid command or response control field specified in this standard.

(5) LPDU which contains a Type 3 command or response control field, and whose link address is multi (group) link address or a broadcast link address.
(6) LPDU which contains a Type 3 response control field, but contains no ACn response status subfield in its information field.

4.3.4.3 Types of LLC Procedure

LLC defines two types of operation for data communication between service access points (SAPs).

(1) Type 1 operation

With Type 1 operation, PDUs shall be exchanged between LLCs without the need for the establishment of data link connection. In the LLC sublayer these PDUs shall not be acknowledged, nor shall there be any flow control or error recovery in the Type 1 procedures.

(2) Type 3 operation

With Type 3 operation, PDUs shall be exchanged between LLC entities without the need for the establishment of data link connection. In the LLC sublayer, PDUs that may or may not bear information shall be acknowledged. The acknowledgment function shall be completed by destination LLC returning to those LLCs a specific response in a separate PDU that contains status information and may or may not bear user information.

In the normal operation, each command PDU in Type 3 operation shall receive an acknowledgment PDU, and though the source LLC may transmit a Type 3 command for recovery purposes, it shall not transmit a new Type 3 command PDU while waiting for acknowledgment of a previous PDU with the same link address. The LLC entity shall not accept a new request primitive from the layer-7 until receipt of the preceding "request" primitive LSDU has been acknowledged by the remote LLC entity. This restriction is necessary to allow higher layers to perform recovery operation before resuming normal data transmission in case LLC is unsuccessful in transmitting a PDU (even after retransmission).

The mechanism alternating LLC control field code in successive PDUs provides a one-bit sequence number functionality which allows the LLC receiving a command PDU to differentiate between a new and second copy of a previously received PDU. Further, the LLC receiving an acknowledgment PDU can insure that acknowledgment refers to the last transmit information PDU. A previously received acknowledgment that incurred excessive delay is thus ignored.

The Type 3 operation defines the status information that must be maintained at the stations involved in the information exchange.   Each station shall maintain for each SAP, a one-bit sequence number for transmitting and another for receiving. Therefore, the mobile station has to maintain one pair of transmit / receive sequence numbers, if using Type 3 operation. The base station has to maintain, for each mobile station using Type 3 operation in the communication zone, one pair of transmit / receive sequence numbers.

Type 3 operation shall only be used in a point to point (private) communication.

4.3.4.4 Elements of LLC Procedures

This sabclause specifies the elements of the LLC procedures for code-independent data communication using LPDU structure (see subclause 4.3.4.2).

4.3.4.4.1 Format of Control Field

The format defined for the control field is illustrated in Fig. 4.3.4.4.1.

1	2	3	4	5	6	7	8
1	1	M	M	P/F	M	M	M

M : Modifier function bit
P/F : Poll bit (P bit) - command LPDU transmission
Final bit (F bit)- response LPDU transmission
"1" = Poll/Final

The two least significant bits are set to "1".

Fig. 4.3.4.4.1 LPDU Control Field

The PDU shall be used to provide data link control functions and information transfer. The PDUs shall contain a P/F bit set in accordance to subclause 4.3.4.5.2.

4.3.4.4.2 Control Field Parameters

4.3.4.4.2.1 Type 3 Operation Parameters

(1) Transmit sequence state variable V (SI)

The LLC shall be able to maintain one transmit sequence state variable V (SI) for each unique SAP used for transmitting Type 3 command. This variable shall assume a value of 0 and 1 and shall be set equal to the bit eight of the LLC control field code used for the last Type 3 response PDU received with the link address. The V (SI) variable permits the LLC to insure that received acknowledgment applies to the currently transmission and allows the receiver to detect duplicate frames. The V (SI) shall be created with establishment of a new private link address.

(2) Receive sequence state variable V (RI)

The LLC shall be able to maintain one receive sequence state variable V (RI) for each unique SAP associated with received Type 3 command PDUs. This variable contains the complement of the bit eight of AC0 or AC1 LLC control field code of the last received Type 3 command PDU with the associated link address. The V (RI) variable allows the LLC to differentiate between a Type 3 received for the first time, and a received PDU which is retransmission of previously received PDU. The V (RI) shall be created with establishment of a new private link address.

(3) Reception status state variable V (RB)

The LLC shall be able to maintain one reception status state variable V (RB) for each unique SAP associated with received Type 3 command PDUs. This variable contains an indication of success or failure of the reception of the information field from the last received Type 3 command with the associated link address. The V (RB) variable insures that the response to the duplicate command PDU contains the same reception status code as the response to the original command PDU. The reception status state variable V (RB) shall be changed if the last reception was successful, but previous not.

4.3.4.4.3 Commands and Responses

This subclause defines the commands and associated responses. Subclause 4.3.4.4.3.1 and 4.3.4.4.3.2 contain definition of the set of commands and response (listed below) for each the control fields format for Type 1 and Type 3 operation, respectively.

The C/R bit located in bit four of the MAC control field, is used to make a clear distinction between command and response. Table 4.3.4.4.3 shows the command and response.

Table 4.3.4.4.3 Commands and Responses of Type 1 Operation and Type 3 Operation

Command		Response	
UI -	Unnumbered Information		
AC0 -	Acknowledged Connectionless Information, Seq. 0	AC1 -	Acknowledged Connectionless Acknowledge, Seq. 1
AC1 -	Acknowledged Connectionless Information, Seq. 1	AC0 -	Acknowledged Connectionless Acknowledge, Seq. 0

4.3.4.4.3.1 Commands of Type 1 Operation

The LLC control field of the PDU command for Type 1 operation is illustrated in Fig. 4.3.4.4.3.1.

1	2	3	4	5	6	7	8	
1	1	0	0	P	0	0	0	UI command

Fig. 4.3.4.4.3.1 Type 1 Operation Command, Control Field Bit assignment

(1) Unnumbered Information (UI) command

On the downlink, the UI command PDU shall be used to transmit information to one or more Mobile station SAP(s) (private, multi (group), broadcast link addresses).

On the uplink, the UI command PDU shall be used to transmit information to the base station SAP (private link address).

The use of UI command PDU does not depend on the existence of the data link connection between the destination and source LLCs, and its use will not affect the V (SI) or V (RI) variables of Type 3 operation. There is no LLC response PDU to the UI command PDU.

The data contained in an UI command PDU may be lost if logical data link exception (e.g. a transmission error or the busy state of the destination) occurs during the transmitting of the command PDU.

4.3.4.4.3.2 Type 3 Operation Commands and Responses

The Type 3 command and response PDU LLC control field is illustrated in Fig. 4.3.4.4.3.2.

1	2	3	4	5	6	7	8	
1	1	1	0	P	1	1	0	AC0 command
1	1	1	0	P	1	1	1	AC1 command
1	1	1	0	F	1	1	0	AC0 response
1	1	1	0	F	1	1	1	AC1 response

Fig. 4.3.4.4.3.2 Type 3 Operation Command and Response, Control Field Bit Assignment

(1) Acknowledged Connectionless Information (ACn) command

In Type 3 operation the ACn command PDU shall be used to transmit information to request information, without prior establishment of a data link connection. Use of the ACn command PDU does not depend upon the existence of the data link connection between the destination LLC and source LLC. Reception of ACn command PDU shall be acknowledged by ACn response PDU at the earliest opportunity. The ACn command PDU shall have a private link address. The information field in an ACn command PDU may be either null (having zero length) or non- null, and if non-null, shall contain.

(Note) The use of ACn command with a multi (group) link address is not allowed.

(2) Acknowledged Connectionless (ACn) Response

In Type 3 operation the ACn response PDU shall be used to reply to an ACn command PDU. Response shall be made at the earliest opportunity. The ACn response PDU shall confirm the responding LLC and transmit an acknowledgement to the originating LLC. The ACn response PDU shall contain a status subfield in its information field. (See subclause 4.3.4.4.3)

Table 4.3.4.4.3.2 summarizes the functions performed by ACn command and response PDUs according to the state of the P/F bit and non-null LSDU.

Table 4.3.4.4.3.2 Summary of ACn Command and Response PDU Functionality

Command:

P	LSDU	Function
0	null	Resynchronization
0	non-null	Transmitting data
1	null	Requesting data
1	non-null	Exchanging data

Response:

F	LSDU	Function
0	null	Acknowledgment of resynchronization or Acknowledgment of received data
0	non-null	(not allowed)
1	null	Acknowledgment, request data unavailable
1	non-null	Acknowledgment with request data

4.3.4.4.3.3 Type 3 Operation Response information field

Every ACn response PDU shall contain a status subfield in its information field. The remainder of the information field may be either null or non-null, and if non-null shall contain a link service data as shown in Fig. 4.3.4.4.3.3.

	← ACn Response information field →								
	Status sub-field (1 octet)								LSDU sub-field (0 or more octet)
Control	C	C	C	C	R	R	R	R	Link Service Data Unit
	1	2	3	4	5	6	7	8	

Fig. 4.3.4.4.3.3 ACn Response PDU Information Field

The code returned by CCCC part of the status subfield indicates success or failure of information transfer in the command PDU (from initiating LLC to responding LLC). Possible values of CCCC are given in Table 4.3.4.4.3.3-1.

Table 4.3.4.4.3.3-1 ACn Response Status Subfield CCCC Values

C	C	C	C	MNEMONIC	CATEGORY	DECSCRIPTION
0	0	0	0	OK	Success	Command received
1	0	0	0	RS	Perm Err	Unimplemented or inactivated service
1	0	1	0	UE	Perm Err	LLC user interface error
0	1	1	0	PE	Perm Err	Protocol error
1	1	1	0	IP	Perm Err	Permanent implementation dependent error
1	0	0	1	UN	Temp Err	Resources temporarily unavailable
1	1	1	1	IT	Temp Err	Temporary implementation dependent error

↑:Least significant bit of CCCC subfield delivered to/ received from the MAC sublayer

(Note) All other CCCC codes are reserved.

The code returned by RRRR part of the status subfield indicates success or failure information transfer in the command PDU (from the responding LLC to the initiating LLC). Possible values of RRRR are given in Table 4.3.4.4.3.3-2.

Table 4.3.4.4.3.3-2 ACn Response Status Subfield RRRR Values

R	R	R	R	MNEMONIC	CATEGORY	DECSCRIPTION
0	0	0	0	OK	Success	Success Response LSDU is pretransmitted
1	0	0	0	RS	Perm Err	Unimplemented or inactivated service
1	1	0	0	NE	Perm Err	Response LSDU never submitted
0	0	1	0	NR	Success	Success Response LSDU not requested
1	0	1	0	UE	Perm Err	LLC user interface error
1	1	1	0	IP	Perm Err	Permanent implementation dependent error
1	0	0	1	UN	Temp Err	Resources temporarily unavailable
1	1	1	1	IT	Temp Err	Temporary implementation dependent error

↑:First RRRR subfield bit delivered to / received from the MAC sublayer

(Note) All other RRRR codes are reserved.

In response PDU with final bit set to 0, the RRRR shall be set to "NR".

(Note)The response status field into which the status of layer-7 (resource) of the receiver (sender) is set is passed to the layer-7 (resource) of the sender (receiver). These actions in the layer-7 (parameter setting and action procedures) are not specified in this specification.

4.3.4.5 LLC Description of the Procedures

4.3.4.5.1 Procedures for Addressing

The address field of the frame shall be used to indicate the link address of PDU.

4.3.4.5.1.1 Type 1 Procedures

Private link addressing shall be supported by the mobile station on uplink and by the base station in downlink. Private, multicast (group) and broadcast link addressing shall be supported in downlink.

4.3.4.5.1.2 Type 3 Procedures

Link addresses shall be private. The mobile station shall be able to handle one pair of transmitting and receiving access points with private link address. The base station shall be able to handle one pair of transmitting and receiving access points with private link address, for each mobile station in the communication zone at one time.

4.3.4.5.2 Procedures of the use of P/F bit

4.3.4.5.2.1 Type 1 Procedures

An UI command PDU shall only transmitted with P bit set to "0". If a UI command PDU is received with the P bit set to "1", the LLC sublayer shall optionally discard it or pass it to the layer-7 with an identifying flag showing that the P bit was set to "1". Since a UI PDU shall not be transmitted as a response PDU, procedure regarding the use of the F bit does not apply.

4.3.4.5.2.2 Type 3 Procedures

The LLC sublayer shall set P bit in an ACn command PDU to "0" if the command PDU is not a request for the remote LLC to return an LSDU in its acknowledgment. Thus the P bit is set to "0" when data is to be passed only from the transmitting station to receiving station.

LLC shall set P bit in an ACn command PDU to "1" if the command PDU is a request for the remote LLC to return an LSDU in its acknowledgment. If it is only necessary to request data from the responding LLC to the transmitting LLC, a null information field may be placed in the command PDU. When transmitting an ACn response PDU, the LLC sublayer sets the F bit equal to the P bit in the received ACn command PDU and includes a non-null LSDU subfield only if F bit is a "1".

4.3.4.5.3 Procedures for Logic Data Link Set-up

The transmit sequence state variable V (SI), receive sequence state variable V (RI) and reception status state variable V (RB) shall be generated and deleted together with the generation and deletion of corresponding SAP. The transmit sequence state variable V (SI) shall be set to a "0" at the time of the generation.

(Note) No sequence number resynchronization is defined since it is assumed that status variables are not deleted (due to power down, reset or the like) in one communication zone.

4.3.4.5.4 Procedures for Information Transfer

4.3.4.5.4.1 Type 1 Procedures

Information transfer shall be completed by transmitting the UI command PDU with the P bit set to "0". If the P bit is set to "1", the transmitting UI PDUs or as response PDUs is prohibited. The C/R bits in the MAC control field is used to identify that command is contained in PDU. Reception of the UI command PDU shall not be acknowledged by the layer-2 LLC procedures.

(Note) Since the reception of an UI command PDU is not acknowledged by the layer-2 LLC procedures, the UI command PDU may be lost if the LLC trouble occurs during the transmitting of the command PDU.

4.3.4.5.4.2 Type 3 Procedures

4.3.4.5.4.2.1 Transmission of ACn commands

Information transfer from an initiating LLC to a responding PDU shall be completed by the transmitting of an ACn command. It shall be possible to transmit such a command PDU at any time, to any receiving LLC provided the transmitting LLC is not currently awaiting an ACn response PDU from that LLC for the same local service access points.

Upon being passed a DL-DATA-ACK.request primitive from the layer-7, the LLC shall transmit an ACn command PDU containing the specified LSDU with the P bit in the ACn command PDU set to "0".

Upon being passed a DL-REPLAY.request primitive from the layer-7, the LLC shall transmit an ACn command PDU containing the specified LSDU with the P bit in the ACn command PDU set to "1".

When an ACn command PDU is constructed the value of V (SI) shall be used to select the LLC control field code of the PDU. When V (SI) is "0", the code of the LLC control field code shall be AC0, and when V (SI) is "1", the LLC control field code shall be AC1.

When the LLC transmits a command PDU, it shall start an acknowledgment timer for the transmission and increment an internal transmission count variable. If no ACn response PDU is received before the acknowledgment timer expires, the transmitting LLC shall retransmit the ACn command, increment the internal transmission count variable, and reset and restart the acknowledgment timer.

If an ACn response PDU is not still received, the retransmitting procedures shall be repeated until the value of the internal transmission count variable is found to equal the value of the logical link parameter N11 (see 4.3.4.5.5.3), at which time an unsuccessful status shall be reported to the layer-7.

The acknowledgment timer and internal transmission count variable shall be maintained separately for each Type 3 information exchange between a pair of transmitting and receiving LLCs.

Type 3 information exchange shall not interfere with any Type 1 operation.

The maximum value for the acknowledgment timer is N13.

The maximum value for the acknowledgment timer is N11.

4.3.4.5.4.2.2 Receiving ACn Commands

Upon receipt of an ACn command, the LLC shall compare the V (SI) received status variable with the bit eight of the LLC control field of the received PDU ("0" in AC0, "1" in AC1) from that SAP.

If the comparison shows equality, the received PDU is recognized to be a non-duplicate, otherwise, the received PDU is recognized to be a duplicate of most recently received ACn command PDU.

4.3.4.5.4.2.2.1 Non-duplicate ACn Command

If the received LPDU is valid, not null, the P bit is "0", the LSDU shall be passed to the layer-7 in a DL-DATA-ACK.indication primitive.

2If the P bit is "1" and the requested reply LSDU can be accessed, the DL-REPLY.indication primitive shall be passed to the layer-7. If the LSDU is non-null, it shall be passed in the indication primitive.

If the P bit is "1", the requested reply LSDU can not be accessed and the received LSDU was non null, the received LSDU shall be passed to the layer-7 in the DL-DATA-ACK.indication primitive.

The state variable V (RI) of the SAP associated with the received command PDU shall be set equal to the complement of the bit eight of the LLC control field in the received PDU.

LLC shall acknowledge the receipt of a non-duplicate ACn command PDU by transmitting to the originator of an ACn response PDU having the bit eight of the LLC control field set to the (new) value of V (RI).

If the P bit in the received command PDU is "0", the response PDU shall be transmitted with the F bit set to "0" and with only a status subfield in the information field.

If the P bit of the received command PDU is "1", the response PDU shall be transmitted with the F bit set to "1", and with the information field including the LSDU previously associated with the SAP, if it was available.

4.3.4.5.4.2.2.2 Duplicated ACn Command

The LLC procedures for reception of a duplicate ACn command PDU are the same as those for the non-duplicate PDU with the following exceptions.

The V (RI) and V (RB) status variable are not affected by reception of a duplicate command PDU.

The DL-DATA-ACK.indication primitive is not issued, regardless of the P bit in the command PDU.

If an LSDU is received in a command PDU, it is discarded.

4.3.4.5.4.3 Transmission of Acn response

AC0 response PDU shall be transmitted only upon the reception of an AC1 command.

ACn response PDU shall be transmitted only upon the reception of an AC0 command.

The response shall be transmitted to the transmitter of the associated command PDU.

The status subfield in the response PDU shall indicate whether or not resources were available to successfully receive the information field in the associated command PDU and, in the case of the F bit equal to "1", whether or not an LSDU was available for return in the response PDU.

The status code in the CCCC portion of the status subfield of an ACn response PDU is set according to the reception status stored previously in the appropriate V (RB) state variable.

4.3.4.5.4.4 Receiving Acknowledgment

After transmitting an ACn command PDU to some remote LLC, the transmitting LLC shall expect to receive an acknowledgment in the form of ACn PDU from the LLC to which the command PDU was transmitted.

An AC0 command shall receive AC1 acknowledgment and vice versa.

Upon receiving such a response PDU, the LLC shall compare bit eight of the LLC control field code in the response PDU with the current value of transmit sequence state variable V (SI).

If comparison shows inequality, the response is considered valid and the LLC shall stop the acknowledgment timer associated with the transmission for which the acknowledgment was received, and reset the internal transmission count to "0". The V (SI) state variable shall be complemented.

The LLC shall pass a DL-DATA-ACK-STATUS.indication primitive or a DL-REPLAY-STATUS.indication primitive to the layer-7, depending on which request primitive is being confirmed. In the case that response data was returned in the ACn response PDU, the LSDU shall be passed to the layer-7.

The LLC shall pass the status to the layer-7 based on the status subfield in the response PDU. If the comparison of the bit eight of the code of the LLC control field in the response PDU with the current value of transmit sequence state variable V (SI) shows equality, the ACn response PDU shall be considered invalid. The LLC shall take no further action, and shall continue to expect to receive a valid ACn response PDU. The acknowledgment timer (maximum value is N13) shall not be affected.

4.3.4.5.5 List of logical Data Link Parameters

4.3.4.5.5.1 Maximum Number of Octets in a PDU (N10)

N10 is a logical link parameter that denotes the maximum number of octets in a PDU.

4.3.4.5.5.2 Minimum Number of Octets in a PDU

A minimum length of a valid command PDU shall contain the control field. Thus, the minimum number of octets in a valid command PDU shall be 1.

The minimum length of a valid response PDU shall contain the control field and a status subfield in that order. Thus, the minimum number of octets in a valid response PDU shall be 2.

4.3.4.5.5.3 Maximum Number of Transmission (N11)

N11 is a logical link parameter that indicates the maximum number of times of ACn command PDU transmitted by LLC trying to complete successful information exchange. Normally, N11 is set large enough to overcome the loss of a PDU due to link error condition. The value of N11 may be set to 1 so that LLC does not itself request a PDU to the MAC sublayer, but retransmission may be initiated by the layer-7.

4.3.4.5.5.4 Acknowledgment Time, N13

The acknowledgment time is a logical link parameter that determines the period of the acknowledgment timers, and as such shall define the time interval during which the LLC shall expect to receive an ACn response PDU from specific a LLC from which the LLC is awaiting a response PDU. The acknowledgment time shall take into account any delay-introduced time by the MAC sublayer and whether the timer is started at the beginning or the end of the transmission of ACn command PDU by the LLC. The proper operation of the procedures shall require that the acknowledgment time shall be greater than the normal time between the transmission of an ACn command PDU and the reception of the corresponding ACn response PDU.

The specific MAC defines the unit of acknowledgment time. The value may be different for the base station and a mobile station, and therefore two parameters values are defined N13FE for a base station and N13ME for a mobile station are defined.

4.3.4.5.6 Detailed description of procedures

This subclause contains a precise description of the LLC procedures. The LLC operations is described using following three types of components:

(1) Type 1 Component

This component is responsible for transmitting a Type 1 commands upon request of the layer-7 and for processing Type 1 commands as they are received from the MAC sublayer and putting it forward to the layer-7.

(2) Type 3 receiver Component

This component is responsible for processing Type 3 commands as they are received from the MAC sublayer, and returning Type 3 responses to the originators of the commands. At the base station LLC is separate Type 3 Receiver Component for each private link address (for each mobile station in the communication zone). At mobile station LLCs there is only one Type 3 Receiver Component at one time.

(3) Type 3 Sender Component

This component is responsible for transmitting Type 3 commands upon request of the layer-7, and for the processing of Type 3 responses when they are received from the MAC sublayer. At the base station LLC is potentially a separate Type 3 Sender Component for each private link address (for each mobile station in the communication zone). At mobile station LLCs there is only one Type 3 Sender Component at one time.

The operation of the component is described using a state machine description.

4.3.4.5.6.1 Type 1 Component

The Type 1 component handles all LLC Type 1 PDU traffic for particular link address in the LLC. An UI PDU is transmitted to one or more (downlink only) remote SAPs in response to a user request, to transmit a service data unit. The Type 1 Component shall process Type 1 LPDUs addressed for a particular link address.

Table 4.3.4.5.6.1 is showing the Type 1 Component state transition table.

Table 4.3.4.5.6.1 Type 1 Component State Transition Table

Current status	Event	Action(s)	Next state
Activated status	RECEIVE_UI	UNIDATA_indication ()	READY
	UNIDATA_REQUEST	TRANSMIT_UI	READY

4.3.4.5.6.1.1 State Description

(1) READY

This is the only state. SAP is capable of receiving and transmitting Type 1 command PDU.

4.3.4.5.6.1.2 Event Description

(1) RECEIVE_UI

The MAC sublayer has passed to LLC an MA-UNITDATA.indication primitive including UI command PDU.

(2) UNITDATA_REQUEST

The layer-7 has passed a DL-UNITDATA.request primitive to the LLC.

4.3.4.5.6.1.3 Action Description

(1) UNITDATA_INDICATION

Pass to the layer-7 a DL-UNITDATA.indication primitive containing an LSDU equal to the information field from the associated received command PDU.

(2) TRANSMIT_UI

Transmit an MA-UNITDATA.request primitive including UI command PDU to the MAC sublayer.

4.3.4.5.6.2 Type 3 Receiver Component Overview

The Type 3 Receiver Component is responsible for receiving ACn commands from the remote LLCs and returning the appropriate ACn response. There is one Type 3 Receiver Component for each private link address associated with received Type 3 command PDUs and this component has only one state. All state information is contained in the state variables. All operations at the responding LLC necessary for the handling of a single transaction are terminated at one time interval. Each Receiver Component uses its own V (RI) state variable and V (RB) state variable when checking for a duplicate command PDU and when checking of the status of a previous reception.

At a mobile station there shall be one receiver component communicating with Type 3 operation. At a base station there shall be as many receiver components as mobile stations communicating with Type 3 operation in the communication zone.

Table 4.3.4.5.6.2 is showing Type 3 Receiver Component state transition table.

4.3.4.5.6.2.1 State Description

(1) READY

LLC is capable of receiving and acknowledging Type 3 PDUs.

4.3.4.5.6.2.2 Functions description

The following function return values are used both for qualifying and for supplying values used in action.

(1) RECEIVE STATUS()

Returns an indication of the success or failure of processing of the information field of the received command PDU. (It is assumed, however, that the LLC header was successfully received any time a DL-UNITDATA.indication primitive is passed to the LLC.) The possible returned values are:

OK Information field successfully processed.
UN Resources temporarily unavailable for information field.
RS Reception of information is unimplemented or inactivated.
UE Hardware failure prevents information passage from user.
IT Temporary implementation dependent error.
IP Permanent implementation dependent error.

(2) ACCESS()

Return an indication of whether or not an LSDU associated with remote LLC specified in received command PDU is available for inclusion in a response PDU. The possible returned values are as follows.

OK LSDU exists and it can be accessed quickly enough to include it in the response PDU.
UN Resources temporarily unavailable to access the LSDU.
RS The return of LSDU is unimplemented or inactivated.
NE Response LSDU was never submitted by user.
UE Hardware failure prevents information passage from user.
IT Temporary implementation dependent error.
IP Permanent implementation dependent error.

Table 4.3.4.5.6.2 Type 3 Receiver Component Status Transition Table

Current State	Event	Action(s)	Next State
READY	REPLY_UPDATE_REQUEST	SAVE:=GIVEN_LSDU REPLY_UPDATE_STATUS_INDICATION	READY
	RECEIVE_ACn_CMD(SQC=V(RI), P=0,INFO<>NULL) and RECEIVE_STATUS()=OK	TRANSMIT_ACn_RSP(SQR=1-SQC,F=0,C=OK,R=NR,LSDU=NULL) DATA_ACK_INDICATION V(RI):=1-SQC V(RB):=OK	READY
	RECEIVE_ACn_CMD(SQC=V(RI), P=0,INFO=NULL) and RECEIVE_STATUS()=OK	TRANSMIT_ACn_RSP(SQR=1-SQC,F=0,C=OK,R=NR,LSDU=NULL) V(RI):=1-SQC V(RB):=OK	READY
	RECEIVE_ACn_CMD(SQC=V(RI), P=0) and RECEIVE_STATUS()<>OK	TRANSMIT_ACn_RSP(SQR=1-SQC,F=0,C=RECEIVE_STATUS(),R=NR,LSDU=NULL) V(RI):=1-SQC V(RB):=RECEIVE_STATUS()	READY
	RECEIVE_ACn_CMD(SQC=V(RI), P=1) and RECEIVE_STATUS()=OK and ACCESS()=OK	TRANSMIT_ACn_RSP(SQR=1-SQC,F=1,C=OK,R=OK,LSDU=SAVE) REPLY_INDICATION(LSDU=INFO) V(RI):=1-SQC V(RB):=OK	READY
	RECEIVE_ACn_CMD(SQC=V(RI), P=1) and RECEIVE_STATUS()<>OK and ACCESS()=OK	TRANSMIT_ACn_RSP(SQR=1-SQC,F=1,C=RECEIVE_STATUS(),R=OK,LSDU=SAVE) REPLY_INDICATION(LSDU=NULL) V(RI):=1-SQC V(RB):=RECEIVE_STATUS()	READY
	RECEIVE_ACn_CMD(SQC=V(RI), P=1,INFO<>NULL) and RECEIVE_STATUS()=OK and ACCESS()<>OK	TRANSMIT_ACn_RSP(SQR=1-SQC,F=1,C=OK,R=ACCESS(),LSDU=NULL) DATA_ACK_INDICATION V(RI):=1-SQC V(RB):=OK	READY
	RECEIVE_ACn_CMD(SQC=V(RI), P=1,INFO=NULL) and RECEIVE_STATUS()=OK and ACCESS()<>OK	TRANSMIT_ACn_RSP(SQR=1-SQC,F=1,C=OK,R=ACCESS(),LSDU=NULL) V(RI):=1-SQC V(RB):=OK	READY
	RECEIVE_ACn_CMD(SQC=V(RI), P=1) and RECEIVE_STATUS()<>OK and ACCESS()<>OK	TRANSMIT_ACn_RSP(SQR=1-SQC,F=1,C=RECEIVE_STATUS(),R=ACCESS(),LSDU=NULL) V(RI):=1-SQC V(RB):=RECEIVE_STATUS()	READY
	RECEIVE_ACn_CMD(SQC<>V(RI),P=0)	TRANSMIT_ACn_RSP(SQR=1-SQC,F=0,C=V(RB),R=NR,LSDU=NULL)	READY
	RECEIVE_ACn_CMD(SQC<>V(RI),P=1) and ACCESS()=OK	TRANSMIT_ACn_RSP(SQR=1-SQC,F=1,C=V(RB),R=OK,LSDU=SAVE) REPLY_INDICATION(LSDU=NULL)	READY
	RECEIVE_ACn_CMD(SQC<>V(RI),P=1) and ACCESS()<>OK	TRANSMIT_ACn_RSP(SQR=1-SQC,F=1,C=V(RB),R=ACCESS(),LSDU=NULL)	READY

4.3.4.5.6.2.3 Event Description

(1) REPLY-UPDATE_REQUEST

The layer-7 has passed a DL-REPLY-UPDATE.request primitive to LLC.

(2) RECEIVE_ACn_CMD(SQC,P,INFO)

The MAC sublayer has passed to LLC an MA-UNITDATA.indication primitive including AC0 or AC1 command PDU, where the command sequence bit SQC (bit eight of LLC control field) is "0" for AC0 command or "1" for AC1 command. The following parameter values exists for this action:

SQC=V (RI)	Either the command sequence bit is equal to the V (RI) state variable for this Receiver Component, or that a state variable does not exist.
SQC<>V(RI)	There exists V (RI) state variable for this Receiver Component and the command sequence bit is not equal to this state variable.
P=0	The P bit is "0" in the command.
P=1	The P bit is "1" in the command.
INFO=NULL	The information field of the command is null (of zero length).
INFO<>NULL	The information field of the command is not null.

In the state transition table, some of the events are qualified by the following conditions. The event is recognized only when the condition is true.

(3) RECEIVE_STATUS()=OK

The information field in the received command PDU was successfully received or can be passed to the user.

(4) RECEIVE_STATUS()<>OK

The information field in the received command PDU was not successfully received or cannot be passed to the user.

(5) ACCESS()=OK

A response LSDU associated with the SAP does exist and it can be accessed quickly enough to include it in the response PDU.

(6) ACCESS<>OK

Either a response LSDU associated with the SAP does not exist or the LSDU does exist but it cannot be accessed quickly enough to include it in the response PDU.

4.3.4.5.6.2.4 Action Description

(1) SAVE:=GIVEN_LSDU

The LSDU is given in the associated DL-REPLY-UPDATE.request primitive held in readiness for transmission by being placed in the abstract location, SAVE. The SAVE location used is specifically associated with the SAP given in the primitive and the new LSDU replaces any previously held for that SAP.

(2) TRANSMIT_ACn_RSP(SQR,F,C,R,LSDU)

Pass an MA-UNITDATA.request primitive to the MAC sublayer including an AC0 or AC1 response PDU. The following parameter values exists for this action:

SQR=1-SQC	The response sequence bit (bit eight of LLC control field code) is set to the complement of the sequence bit from the received command.
F=0	The F bit of the response is set to "0".
F=1	The F bit of the response is set to "1".
C=OK	The CCCC portion of the status subfield is set to OK code (successful reception).
C=RECEIVE_STATUS()	The CCCC portion of the status subfield is set to the value returned by the RECEIVE_STATUS function.
C=V(RB)	The CCCC portion of the status subfield is set equal to the V (RB) state variable associated with the link address of the received command PDU.
R=NR	The RRRR portion of the status subfield is set to NR code. (Response data not requested.)
R=OK	The RRRR portion of the status subfield is set to OK code. (Response data included.)

R=ACCESS() The RRRR portion of the status subfield is set to the value returned from the ACCESS function.

LSDU=NULL The LSDU subfield of the response is null (having zero length).

LSDU=SAVE The LSDU subfield of the response contains the LSDU held in readiness the SAVE location for this SAP.

(Note) at the base station, the medium for the response of the mobile station shall be assigned immediate upon connection to the ACn command.

(3) DATA_ACK_INDICATION

Pass the layer-7 a DL-DATA-ACK.indication primitive including an LSDU equal to the information field of associated received command PDU.

(4) REPLY_INDICATION(LSDU)

Pass to the layer-7 a DL-REPLY.indication primitive. The following parameter values exists for this action:

LSDU=INFO The user is passed an LSDU equal to the information field from associated received command PDU. (This field may be null.)

LSDU=NULL The user is passed a null LSDU.

(5) REPLY_UPDATE_STATUS_INDICATION

Pass the layer-7 a DL-REPLY-UPDATE-STATUS.indication primitive.

(6) V(RI):=1-SQC

The V (RI) state variable for this Receiver Component is set to the complement of the sequence bit (bit eight of LLC control field code) in the received command PDU.

(7) V(RB):=OK

The V (RB) state variable for this Receiver Component is set to the "OK" code (successful reception).

(8) V(RB):=RECEIVE_STATUS()

The V (RB) state variable for this Receiver Component is set to the value returned by the RECEIVE_STATUS function.

4.3.4.5.6.3 Type 3 Sender Component

The Type 3 Sender Component is responsible for transmitting ACn command PDUs to a remote LLC. The Sender Component also receives response PDUs and retransmits the command PDUs if no response is received. Type 3 protocol allows one outstanding (not yet acknowledged) command PDU for each private SAP. Each Transmitter uses its own V (SI) state variable when selecting the LLC control field code for a new transmission and when checking for valid response LLC control field code.

There shall be one Sender Component at each mobile station, communicating with Type 3 operation.

There shall be as many receiver components as mobile station, communicating with Type 3 operation, in the communication zone.

Each Sender Component has three states. In the IDLE state, it is capable of processing the request from the layer-7 to transmit a new command PDU. In the WAIT_A and WAIT_R states, the component is only capable of receiving a response from the remote LLC, or of timing out and performing a retransmission. The WAIT_A state is used when the expected response is data less acknowledgment. The WAIT_R state is used when the expected response is a data bearing reply.

Table 4.3.4.5.6.3 shows Type 3 Sender Component state transition table.

Table 4.3.4.5.6.3 Type 3 Sender Component State Transition Table

Current State	Event	Action(s)	Next State
IDLE	RECEIVE_ACn_RSP	(No action)	IDLE
	DATA_ACK_REQUEST	TRANSMIT_ACn_CMD(SQC=V(SI), P=0) START_ACK_TIMER RETRY_COUNT:=RETRY_COUNT +1	WAIT_A
	REPLY_REQUEST	TRANSMIT_ACn_CMD(SQC=V(SI), P=1) START_ACK_TIMER RETRY_COUNT:=RETRY_COUNT +1	WAIT_R
WAIT_A	RECEIVE_ACn_RSP(SQR<>V(SI), LSDU=NULL)	DATA_ACK_STATUS_INDICATION(STATUS=STATUS_SUBFIELD) CANCEL_ACK_TIMER RETRY_COUNT:=0 V(SI):=1-V(SI)	IDLE
	RECEIVE_ACn_RSP(SQR<>V(SI), LSDU<>NULL)	DATA_ACK_STATUS_INDICATION(STATUS=PE) CANCEL_ACK_TIMER RETRY_COUNT:=0 V(SI):=1-V(SI) REPORT_STATUS(ILLEGAL_LSDU)	IDLE
	RECEIVE_ACn_RSP(SQR=V(SI))	(No action)	WAIT_A
	ACK_TIMER_EXPIRED and RETRY_COUNT<N11	RETRANSMIT_OLD_CMD START_ACK_TIMER RETRY_COUNT:=RETRY_COUNT +1	WAIT_A
	ACK_TIMER_EXPIRED and RETRY_COUNT>=N11	DATA_ACK_STATUS_INDICATION(STATUS=UNSUCCESFUL) RETRY_COUNT:=0	IDLE
WAIT_R	RECEIVE_ACn_RSP(SQR<>V(SI), R=OK)	REPLY_STATUS_INDICATION(STATUS=STATUS_SUBFIELD,LSDU=GIVEN_LSDU) CANCEL_ACK_TIMER RETRY_COUNT:=0 V(SI):=1-V(SI)	IDLE
	RECEIVE_ACn_RSP(SQR<>V(SI), R<>OK)	REPLY_STATUS_INDICATION(STATUS=STATUS_SUBFIELD,LSDU=NULL) CANCEL_ACK_TIMER RETRY_COUNT:=0 V(SI):=1-V(SI)	IDLE
	RECEIVE_ACn_RSP(SQR=V(SI))	(No action)	WAIT_R
	ACK_TIMER_EXPIRED and RETRY_COUNT<N11	RETRANSMIT_OLD_CMD START_ACK_TIMER RETRY_COUNT:=RETRY_COUNT +1	WAIT_R
	ACK_TIMER_EXPIRED and RETRY_COUNT>=N11	DATA_ACK_STATUS_INDICATION(STATUS=UNSUCCESFUL,LSDU=NULL) RETRY_COUNT:=0	IDLE

4.3.4.5.6.3.1 State Description

(1) IDLE

In this state, LLC is capable of executing a request from the layer-7 to transmit a Type 3 command PDU.

(2) WAIT_A

In this state, LLC is waiting for an acknowledgment previously transmitted Type 3 command PDU that was invoked by a DL-DATA-ACK.request primitive.

(3) WAIT_R

In this state, LLC is waiting for an acknowledgment previously transmitted Type 3 command PDU that was invoked by a DL-REPLY.request primitive.

4.3.4.5.6.3.2 Event description

(1) DATA_ACK_REQUEST

The layer-7 has passed a DL-DATA-ACK.request primitive to the LLC.

(2) REPLY_REQUEST

The layer-7 has passed a DL-REPLY.request primitive to the LLC.

(3) RECEIVE_ACn_RSP(SQR,R,LSDU)

The MAC sublayer has passed to LLC an MA-UNITDATA.indication primitive including the AC0 or AC1 response of which contains PDU, where the response sequence bit SQR (bit eight of the LLC control field) is 0 for an AC0 response or 1 for an AC1 response. The following parameter values exist for this action.

SQR=V(SI)	The response sequence bit is equal to the V (SI) status variable for this Sender Component.
SQR<>V(SI)	The response sequence bit is not equal to the V (SI) status variable for this Sender Component.
R=OK	The RRRR portion of the status subfield of the received response PDU shows OK status. (Indicating that LSDU is included.)

R<>OK The RRRR portion of the status subfield of the received response PDU shows a status other than OK. (Indicating that an LSDU is not included.)

LSDU=NULL The LSDU subfield of the response is null (having zero length).

LSDU<>NULL The LSDU subfield of the response is not null.

(4) ACK_TIMER_EXPIRED

The acknowledgment timer associated with this Sender Component (i.e., timer for a specific private link address) has terminated.

In the state transmission table, some events are qualified by the following conditions. The event is recognized only when the condition is true.

(5) RETRY_COUNT<N11

The retry count for this Sender Component is less than the logical link parameter N11.

(6) RETRY_COUNT>=N11

The retry counts for this Sender Component is greater than or equal to the logical link parameter N11.

4.3.4.5.6.3.3 Action Description

(1) TRANSMIT_ACn_CMD(SQC,P)

Pass an MA-UNITDATA request primitive including an AC0 or AC1 command PDU to the MAC sublayer. The following parameter values exist for this action.

SQC=V(SI) The command sequence bit (8th bit of LLC control field) is made equal to the status variable V (SI) for this Receiver Component. If no status variable V (SI) exists, it is generated by value "0". Otherwise, the current value is used.

P=0 The P bit of the response is set to "0".

P=1 The P bit of the response is set to "1".

(2) RETRANSMIT_OLD_CMD

Pass an MA-DATA.request primitive including the ACn command PDU most recently transmitted by this Sender Component to the MAC sublayer.

(3) START_ACK_TIMER

Start the acknowledgment timer for this Sender Component.

(4) CANCEL_ACK_TIMER

Cancel the acknowledgment timer for this Sender Component.

(5) DATA_ACK_STATUS_INDICATION(STATUS)

Pass to the layer-7 a DL_DATA_ACK_STATUS.indication primitive. The following parameter values exist for this action.

STATUS=UNSUCCESSFUL	This status parameter is set to indicate failure receive an acknowledgment.
STATUS=STATUS_SUBFIELD	This status parameter is set according to the status returned by the received response PDU.

(6) REPLY_STATUS_INDICATION(STATUS,LSDU)

Pass to the layer-7 a DL-REPLY-STATUS.indication primitive. The following parameter values exist for this action.

STATUS=UNSUCCESSFUL	This status parameter is set to indicate failure to receive an acknowledgment.
STATUS=STATUS_SUBFIELD	The status parameter is set according to the status returned in the received response PDU.
STATUS=PE	This status parameter is set at PE status (protocol error).
LSDU=NULL	The data parameter is null.
LSDU=GIVEN_LSDU	The data parameter contains the LSDU given in the associated MA-DATA.indication primitive.

(7) V(SI):=1-V(SI)

Complement of V (SI) state variable for this Sender Component

(8) RETRY_COUNT:=0

Set the retry counter for this Sender Component to "0".

(9) RETRY_COUNT:=RETRY_COUNT+1

Increment the retry counter for this Sender Component.

(10) REPORT_STATUS(ILLEGAL_LSDU)

Report to layer management that an LSDU was received in violation of the Type3 LLC protocol.

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4.4 Layer 7 standards

4.4.1 Scope

This subclause specifies the architecture and service items. Furthermore, considering the layer 7 structure, the application service elements that are constructed by the application protocol data unit (APDU), the application service data unit (ASDU) and operations relating to the ASDU are also specified. The operation specified regarding the ASDU is performed by the invocation from service primitives (SP).
Services for applications provided by the layer 7 have a wide range, from simple service to complex, and are able to perform the process simultaneously for multiple applications by selecting necessary elements.

4.4.1.1 Outline of services

The purpose of the layer 7 is to provide communication tools for the application whilst the scope of the application oriented working groups is to build the application using the tools provided by the layer 7. These tools consist of elements that can be used by application processes.
The following subjects are covered by this standard:

(1) The layer 7 structure and framework.
(2) Services to enable data transfer and remote operations.
(3) Common encoding rules to translate data in local syntax with an abstract syntax defined by ASN.1 (Abstract Syntax Notation One) into transfer syntax and vice versa.
(4) Communication negotiation and association (initialization) procedures.
(5) Broadcast service support.
(6) Communication system management support including communication profile handling.

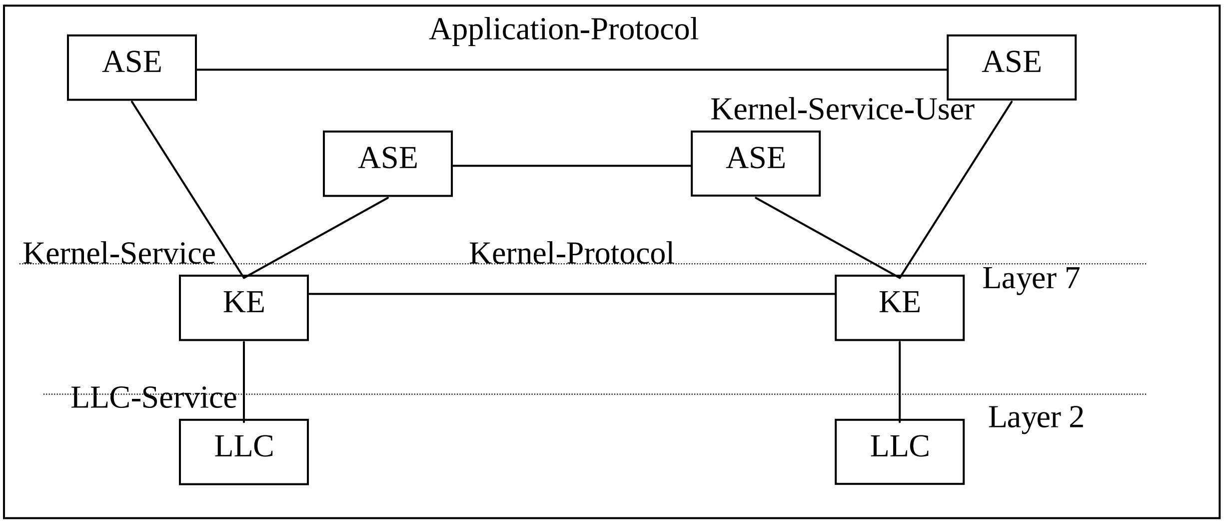
Note) Although, this standard does not cover application multiplexing procedure, fragmentation procedure, concatenation and chaining procedure, etc. , shall specify and explain the requirements on the layer 7 operation.

4.4.1 .2 Structure

The layer 7 shall consist of the layer 7 Kernel Element(s) (KE(s)). The layer 7 may consist of additional Application Service Elements. The services are provided service users by means of service primitives. These services are realized by means of protocols.

The fig. 4.4.1.2.1 shows the layer 7 structure for the basic data transfer service. This kernel element for the data transfer service is the transfer kernel element (T-KE). The layer 7 also shall composed of the initialization kernel element (I-KE) for the initialization (association) control and the broadcast pool kernel element (B-KE) for the broadcast services.

The fig. 4.4.1.2.2 shows the entire layer 7 structure that is constructed by 3-kernel element.



Kernel-Service-Provider=LLC-Service-User

Figure 4.4.1.2.1 The layer 7 Structure (data transfer service)

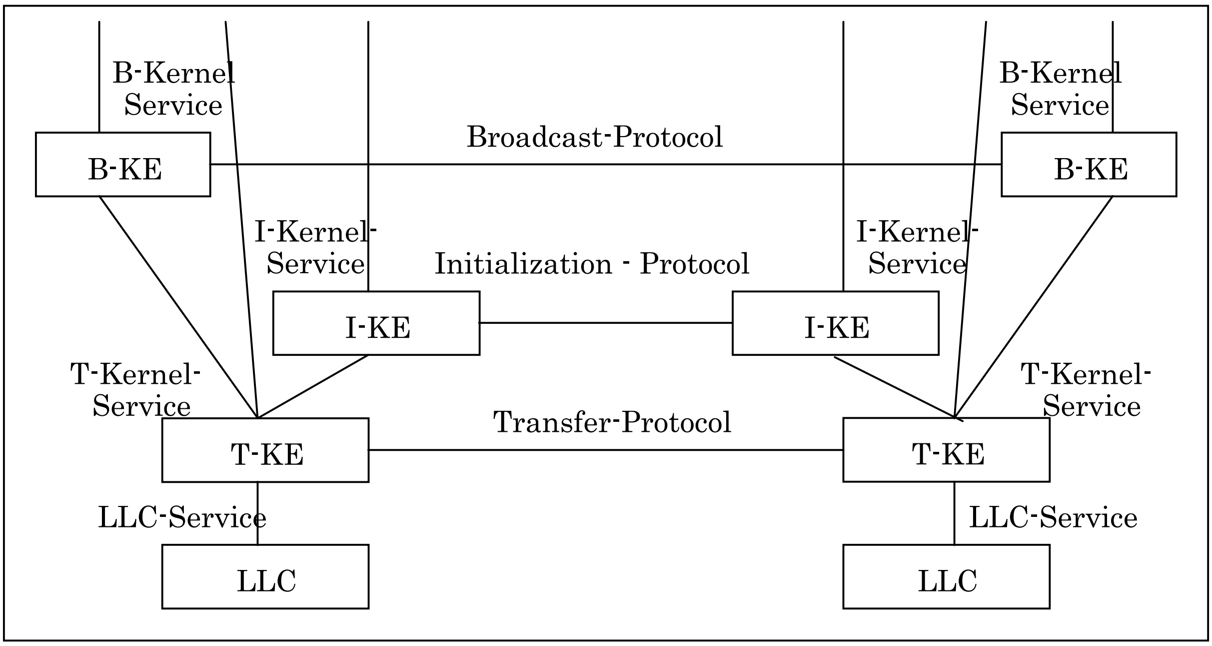


Figure 4.4.1.2.2 the layer 7 kernel Structure

The layer 7 kernel provides the minimum set of services realized by the kernel elements needed to support several applications in parallel. This requires the means for dialogue initialization (association) control, offered by the Initialization KE (I-KE), cyclic broadcast transmission, offered by the Broadcast pool KE (B-KE), and generic transfer of data structures, offered by the Transfer-KE (T-KE). To permit simultaneous independent access to these elements from the user elements, the requirements on elements that may access the layer 7 kernel are defined. The layer 7-kernel elements always exist as single instances and are allocated outside the application processes, whereas several instances of these elements that access the kernel may exist in the application processes.

The outline of function of each KE is described below.

(1) Transfer Kernel Element (T-KE)
T-KE shall transfer information between two peer service users and shall abstract from the realization of this transfer. The T-KE is responsible for the transfer of an APDU to the peer entity. It includes the needed, but extremely reduced, functionality from the Network Layer (the layer 3) to the Presentation Layer (the layer 6). These are (de-) coding to transfer syntax, and (de-) Multiplexing with priority handling.

(2) Initialization Kernel Element (I-KE)
The I-KE is responsible for the association (initialization) of the communication on the level of the layer 7.

(3) Broadcast Kernel Element (B-KE)
The B-KE is responsible for the collection, broadcast and retrieval of data for multiple applications and/or multiple mobile stations.

The KE of the layer 7 shall consist of at least two Kernel Elements, the T-KE, and the I-KE or the B-KE. The Kernel may consist in addition of a B-KE or an I-KE.

4.4.1.3 Definition of Function

The functionalities, architectures and terminologies of the layer 7 are defined in this subclause.

4.4.1.3.1 Term

(1) Application
The User who uses the service provided by DSRC communication protocol stack.

(2) Attributes
Elements may have attributes. An attribute has an associated value, which can exhibit structure; i.e. it can consist of a set or sequence of sequence of data elements.

Note) The value of an attribute is observed or modified by sending a request to an element to read (GET) or write (SET) the value.

(3) Attribute identifier
An identifier used to distinguish an attribute of an element from all other attributes.

(4) Beacon Service Table (BST)
The BST is the data structure which showed service which the base station provides, and is sent from the base station. On the base station side the I-KE collects application identifiers, etc. relevant for the communication. The application identifiers are stored in the BST as a priority list defining the order in which applications are served. The reception of the BST on the mobile station side is the initiator of each data transfer from applications on mobile station side. The mobile station's I-KE evaluates a received BST and indicates the availability (including parameter) of services to the corresponding application and application service elements.

(5) Broadcast Pool
File, cyclically broadcast from the base station to the mobile stations. Records may be independent by inserted from several service users.

(6) Chaining
A function performed by the transfer kernel element (T-KE) to concatenate multiple application protocol data units (APDUs) or APDU fragment into one ASDU and to process simultaneously. It is called Chaining to perform multiple application operation (data transfer) in one APDU using one Chain (Chain : Consists of the concatenated multiple T-APDU fragments with the fixed sequentiality in the same PDU number) .

(7) Concatenation
A function performed by the transfer kernel element (T-KE) to concatenate multiple application protocol data units (APDUs) or divided APDU into one application service data unit (ASDU).

(8) Element
An application element with data and function became the set, and abstract expression of the resource required for data processing and data communications.

(9) Element Identifier (EID)
An identifier used to distinguish the element within the mobile station.

(10) Encoding
A function performed by the transfer-service-provider that transfers the data from a special local syntax into transfer syntax common for all communication systems (with the same applications on them). The peer transfer-service-provider decodes this data from transfer syntax into its own local syntax. The common abstract description of this data is the abstract syntax (defined by means ASN.1 [ISO 8824]). The common rules for the encoding and decoding are the Packed Encoding Rules (PER [ISO 8825-2]).

(11) Fragmentation
A function performed by the transfer kernel element (T-KE) to divide encoded PDU into T-APDU.

(12) Head of the line
Queuing discipline (also: strict priority queuing or fixed priority queuing), a number of queues are served in priority order, i.e. a lower priority queue is served if all higher priority queues are empty, each queue is served in First-Come-First-Served order, and each customer goes to the head of the line of the customers of lower priorities but behind all customers of equal or higher priority.

(13) Management
The layer management is the part of the layer 7 that supports the communication system management. This management consists of providing the layer 7, the layer 2 or the layer 1 in both entities with values for the communication parameters and the collection and distribution of other information necessary for controlling the communication system.

(14) Operation
An operation is the means to access a functionality or information of an element or to change its state.

(15) Profile
Information about capabilities and/or settings in the different layers and/or application processes. A profile is identified by an INTEGER.

(16) Time
The initialization kernel element (I-KE) shall interpret Time as the number of seconds up from the 1/1/1970 00:00.

(17) Vehicle Service Table (VST)
The VST is the answer of the I-KE inside the mobile station (vehicle) on the BST. It contains

the identifiers of all application present in the BST and registered in the mobile station (vehicle) and the profile used for further communication.

4.4.1.3.2 Data units in the data transfer services

Data units in the data transfer services in the layer 7 are defined as below.

(1) Application Data Unit (ADU)
Data unit specified in an application and transferred between two application entities.

(2) Application Protocol Data Unit (APDU)
Data Units exchanged between peer application service elements.

(3) Application Service Data Unit (ASDU)
Data associated to a SP invocation of an application service element.

(4) LLC Protocol Data Unit (LPDU)
Data Unit transmitted between two LLC protocol instances.

(5) LLC Service Data Unit (LSDU)
Vertically transmitted data unit between the layer 7 and the LLC.

(6) Transfer Application Protocol Data Unit (T-APDU)
Data Unit of APDU transferred between transfer kernel elements (T-KEs)

4.4.2 Kernel Elements

The functionalities of each kernel of the layer 7 are specified in detail.

4.4.2.1 Transfer-KE (Transfer-service-provider)

4.4.2.1.1 Function

The T-KE shall transfer information between two service users by translating a defined service primitive(s) to T-APDU and shall provide its function.

4.4.2.1.2 Outline of Services

The T-KE shall offer its services by means of service primitives defined as follows.

(1) GET
(2) SET
(3) ACTION
(4) EVENT-REPORT
(5) INITIALIZATION

4.4.2.1.3 Protocol

The transfer protocol shall consist of the following sequence of steps.

(1) Translate SDU to PDU
(2) Encoding of PDU
(3) Octet alignment
(4) Multiplexing, Concatenation, and Access to LLC
(5) Demultiplexing and Deconcatenation
(6) Removing of inserted bits
(7) Decoding of PDU
(8) Translate PDU to SDU and Distribution to addressee

The sequence of these functionalities is shown in fig. 4.4.2.1.

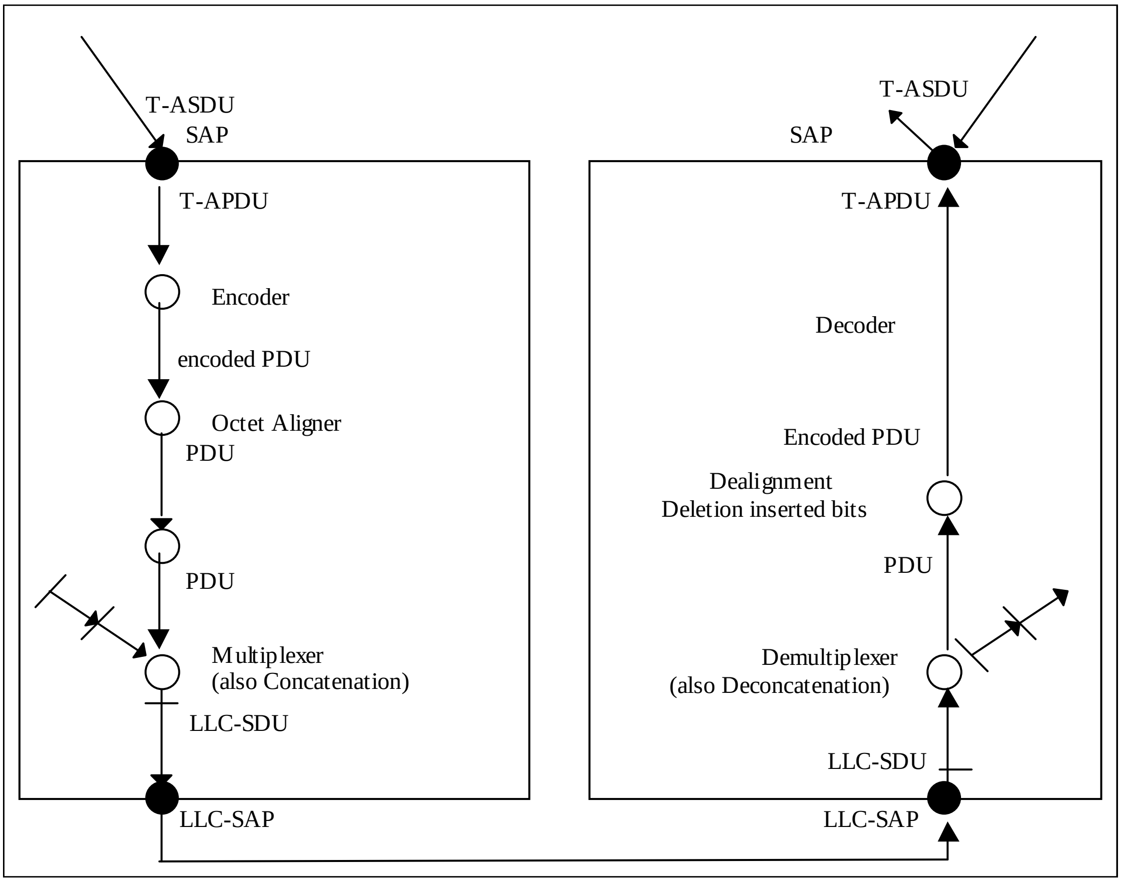


Figure 4.4.2.1 Functionalities of the T-KE

4.4.2.2 Initialization-KE (Initialization-service-provider: I-KE)

4.4.2.2.1 Function

The I-KE shall realize the initialization of the communication between a mobile station and a base station by exchanging information concerning profiles or applications with its peer entity. It shall inform the applications inside the mobile station about the presence of a peer application inside the base station. It shall handle the LID of the mobile station.

4.4.2.2.2 Outline of Services

The I-KE shall provide the following services to other elements (Initialization-service-users) as follows.

(1) RegisterApplicationRSU(Beacon)
(2) RegisterApplicationOBU(Vehicle)
(3) DeregisterApplication
(4) NotifyApplicationRSU(Beacon)
(5) NotifyApplicationOBU(Vehicle)
(6) End(Ready)Application

4.4.2.3 Broadcast-KE (Broadcast-service-provider: B-KE)

4.4.2.3.1 Function

The B-KE shall realize the collection, broadcast and distribution of information for different applications in the mobile station and the base station by exchanging the Broadcast Pool.

4.4.2.3.2 Outline of Services

The B-KE shall provide the following services to other elements (Broadcast-service-users).
(1) BroadcastData
(2) GetBroadcastData

4.4.3 Layer 7 service interface

4.4.3.1 Scope

The communication between the layer 7 and service users (applications) using service primitives provided by the layer 7.

4.4.3.2 List of service primitives

The name of the primitive is specific to the operation that should be performed. A Service primitive defined in this standard is shown in Table. 4.4.3.1.

4.4.3.3 Relationship of primitives

In this standard, primitives are 4 generic types as follows. The relationship between the layer 7 and application entity and their associated peer protocol entities is shown in Fig. 4.4.3.3.
These service primitives are abstraction in that they specify only the service provided rather than means by which the service is provided. This definition of services is independent of any particular interface implementation.

(1) request
The request primitive is passed from the application (kernel service user) to the layer 7 to request that a service be initiated.
(2) indication
The indication primitive is passed from the layer 7 to the application (kernel service user) to indicate a service from the peer application (peer kernel service user).
(3) response
The response primitive is passed from the application (kernel service user) to the layer 7 to response for a service from the peer application (peer kernel service user) invoked by an indication primitive.
(4) confirm
The confirm primitive is passed from the layer 7 to the application (kernel service user) to convey the results of one or more associated previous service request(s).

Table. 4.4.3.1. Service primitives

Primitives	request	indication	response	confirm	Notice
GET	√	√	√	√	T-KE
SET	√	√	√	√	T-KE
ACTION	√	√	√	√	T-KE
EVENT-REPORT	√	√	√	√	T-KE
RegisterApplicationRSU(Beacon)					I-KE
RegisterApplicationOBU(Vehicle)					I-KE
DeregisterApplication					I-KE
NotifyApplicationRSU(Beacon)					I-KE
NotifyApplicationOBU(Vehicle)					I-KE
End(Ready)Application					I-KE
BroadcastData	√				B-KE
GetBroadcastData	√			√	B-KE

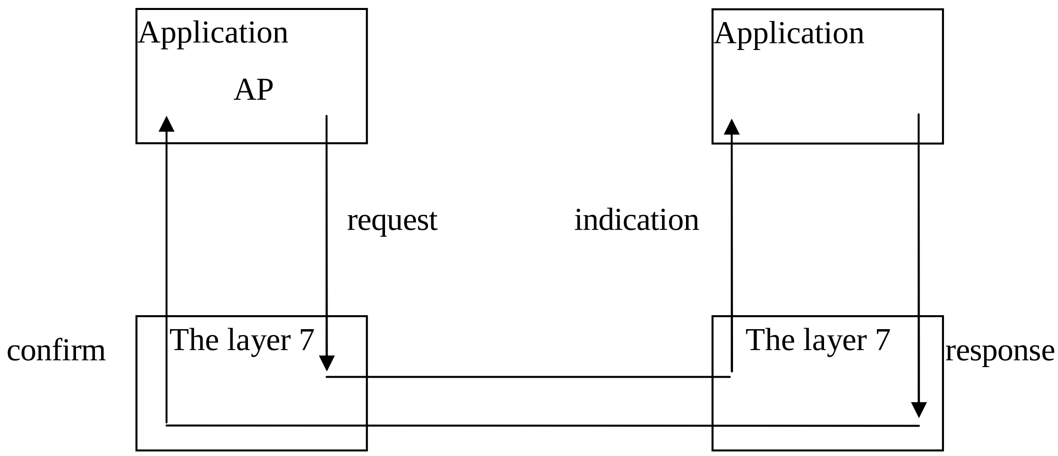


Fig. 4.4.3.3 Relationship between primitives and entities

4.4.3.4 Service specification

4.4.3.4.1 Get primitives

(1) Function and When Generated
The invocation of the GET service by an application (kernel service user) shall result in the retrieval of information from a peer application (kernel service user) on the base station / mobile station side. The service shall only be requested in a confirmed mode, and a reply is expected.

(2) Format
These primitives shall provide parameters as follows.

GET.request ([IID], LID, Chaining, EID, [Access Credentials], [AttrIdList], Flow Control)
GET.indication ([IID], LID, Chaining, EID, [Access Credentials], [AttrIdList], Flow Control)
GET.response ([IID], LID, Chaining, EID, Flow Control, [AttrList], [Ret])
GET.confirm ([IID], LID, Chaining, EID, [Flow Control], [AttrList], [Ret])

Note) parameter "xx" within the [xx] is optional. This note shall apply to the following definitions.

4.4.3.4.2 SET primitives

(1) Function and When Generated
The invocation of the SET service by an application (kernel service user) shall result in the modification of information by a peer application (kernel service user) on the base station / the mobile station side. The service may be requested in a confirmed or non-confirmed mode. In the confirmed mode a reply is expected.

(2) Format
These primitives shall provide parameters as follows.

SET.request ([IID], LID, Chaining, EID, [Access Credentials], AttrList, Mode, Flow Control)
SET.indication ([IID], LID, Chaining, EID, [Access Credentials], AttrList, Mode, Flow Control)
SET.response ([IID], LID, Chaining, EID, Flow Control, [Ret])
SET.confirm ([IID], LID, Chaining, EID, [Flow Control], [Ret])

4.4.3.4.3 ACTION primitives

(1) Function and When Generated
The invocation of the ACTION service by an application (kernel service user) shall result in the performance of an action by a peer application (kernel service user) on the base station / the mobile station side. The service may be requested in a confirmed or non-confirmed mode. In the confirmed mode a reply is expected.

(2) Format
These primitives shall provide parameters as follows.

ACTION.request ([IID], LID, Chaining, EID, Action Type, [Access Credentials],
[Action Parameter], Mode, Flow Control)
ACTION.indication ([IID], LID, Chaining, EID, Action Type, [Access Credentials],
[Action Parameter], Mode, Flow Control)
ACTION.response ([IID], LID, Chaining, EID, Flow Control,
[Response Parameter], [Ret])
ACTION.confirm ([IID], LID, Chaining, EID, [Flow Control],
[Response Parameter], [Ret])

4.4.3.4.4 EVENT-REPORT primitives

(1) Function and When Generated
The invocation of the EVENT-REPORT service by an application (kernel service user) shall result in the report of an event about an element to a peer application (kernel service user) on the base station / the mobile station side. The service may be requested in a confirmed or non-confirmed mode. In the confirmed mode a reply is expected.

(2) Format
These primitives shall provide parameters as follows.

EVENT-REPORT.request ([IID], LID, Chaining, EID, Event Type, [Access Credentials],
[Event Parameter], Mode, Flow Control)
EVENT-REPORT.indication ([IID], LID, Chaining, EID, Event Type,
[Access Credentials], [Event Parameter], Mode, Flow Control)
EVENT-REPORT.response ([IID], LID, Chaining, EID, Flow Control, [Ret])
EVENT-REPORT.confirm ([IID], LID, Chaining, EID, [Flow Control], [Ret])

4.4.3.4.5 RegisterApplicationRSU(Beacon) primitive

(1) Function and When Generated
The invocation of the RegisterApplicationRSU(Beacon) service to by an application (kernel service user) on the base station side shall result in the registration of the application to the application list of I-KE.

Note) Refer to the parameter of Profiles for Annex P.

(2) Format
These primitives shall provide parameters as follows.

RegisterApplicationRSU(Beacon) (AID, Mandatory, Priority, [EID], [Profiles],
[Parameter])

4.4.3.4.6 RegisterApplicationOBU(Vehicle) primitive

(1) Function and When Generated
The invocation of the RegisterApplicationOBU(Vehicle) service by an application (kernel service user) on the mobile station side shall result in the registration of the application to the application list of I-KE.

(2) Format
This primitive shall provide parameters as follows.

RegisterApplicationOBU(Vehicle) (AID, Priority, EID, [Profiles], [Parameter])

Note) Refer to the parameter of Profiles for Annex P.

4.4.3.4.7 DeregisterApplication primitive

(1) Function and When Generated
The invocation of the DeregisterApplication service by an application (kernel service user) on the base station / the mobile station side shall result in the deregistration of the associated entry in an application list.
In addition, if DeregisterApplication is invoked from the corresponding application in the state managed by only its application, it shall release the association (link) at the time.

(2) Format
This primitive shall provide parameters as follows.

DeregisterApplication (AID, [EID])

4.4.3.4.8 NotifyApplicationRSU(Beacon) primitive

(1) Function and When Generated
The invocation of the NotifyApplicationRSU(Beacon) by the I-KE in the layer 7 shall result in the notification of the application (kernel service user) on the base station about the presence of a potential communication application and the LID of the associated mobile station.

(2) Format
This primitive shall have the following format.

NotifyApplicationRSU (Priority, [EID], LID, [Parameter], obe Configuration)

Note) The obeConfiguration parameter of NotifyApplicationRSU(Beacon) to the simplified association (initialization) procedures specified with subclause 4.4.5.2 is considering as empty.

4.4.3.4.9 NotifyApplicationOBU(Vehicle) primitive

(1) Function and When Generated
The invocation of the NotifyApplicationOBU(Vehicle) by the I-KE in the layer 7 shall result in the notification of the application (kernel service user) on the mobile station side about the presence of a potential communication application and the LID generated by the mobile station.

(2) Format
This primitive shall provide parameters as follows.

NotifyApplicationOBU (RSU(Beacon), Priority, [EID], LID, [Parameter])

4.4.3.4.10 End(Ready)Application primitive

(1) Function and When Generated
The invocation of the End(Ready)Application service by the application (kernel service user) shall result in the notification of the I-KE that the LID is not longer needed for this application.
In addition, if End(Ready)Application is invoked from the corresponding application in the state managed by only its application, it shall release the association (link) at the time.

(2) Format
This primitive shall have the following format.

End(Ready)Application (EID, LID, [Norm_end])

Note) Norm_end is an option, has a meaning only the mobile station and is not necessary to use it on the base station.

4.4.3.4.11 BroadcastData primitive

(1) Function and When Generated
The invocation of the BroadcastData service by the application (kernel service user) on the base station side shall result in the broadcast of information to other Broadcast applications on the mobile station side or in the update of this information.

(2) Format
This primitive shall provide parameters as follows.

BroadcastData.request (File)

4.4.3.4.12 GetBroadcastData primitives

(1) Function and When Generated
The invocation of the GetBroadcastData-service by a Broadcast application shall result in the retrieval of the broadcasted data.

(2) Format
These primitives shall provide parameters as follows.

GetBroadcastData.request (Name, EID)
GetBroadcastData.confirm (File)

4.4.3.4.13 NotifyApplicationOBU_Release primitives

(1) Function and When Generated
The invocation of the NotifyApplicationOBU_Release service by the application (kernel service user) shall result in the notification to the layer 7 from the application that the application received the release by the EVENT_REPORT.request from the base station.

(2) Format
These primitives shall provide parameters as follows.

NotifyApplicationOBU_Release ()

A variable does not specify.
Note) That primitives is an option.

4.4.3.5 Parameters

Parameters defined in service primitives are specified as follows. It is assumed the bit number 8 (b8) is the MSB, if no modification notices are attached. Furthermore, the data which has the structure described below is passed to the T-KE and will perform the encoding process.

(1) IID (Invoker Identifier)
IID shall be the EID of the element initiating the request or the response. It shall give the EID for a response to this primitive. In the case where the EID are the same identifier on the base station side or the mobile station side for the same application (the same context), the IID shall not be used. This parameter is not needed if an answer shall be sent to a default invoker.
The IID shall have the format as shown in Fig. 4.4.3.5.1.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	IID							

Fig. 4.4.3.5.1 IID format

Note) IID uses presently the default value(divided by 0..127) of ASN.1 abstract syntax in Annex H.

(2) LID (Link Identifier)
LID shall be the LLC ID chosen by the I-KE on the mobile station side as specified in 4.3.2. The LID format shall be the LID format defined in subclause 4.2.4.2.1.8.2. That is, the 1 bit of each octet is an extender. If the following octet is valid, the b1 shall be set to “0” and if the following octet is invalid, it shall be set to “1”. Actually, the valid field is 28 bits length.
The LID shall have the format as shown in Fig. 4.4.3.5.2.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1 extension
1	(MSB) LID							
2	LID							
3	LID							
4	LID (LSB)							

Fig. 4.4.3.5.2 LID format

(3) EID (Element Identifier)
EID shall be the EID of the element, which receives the indication or confirmation related to a request or response. The EID shall have the format as shown in Fig. 4.4.3.5.3. A definition of the EID is shown in Annex I.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	EID							

Fig. 4.4.3.5.3 EID format

Note1) Where the EID parameter is or not the same as the IID, the setting values of these parameters are shown in the table below for reference.

		Primitives			
EID of the Application	Parameter	request Base→Mobile	indication Base→Mobile	response Base←Mobile	confirm Base←Mobile
Base side : 6 Mobile side : 7	IID	6	6	7	7
	EID	7		6	

(a) The case of the different parameter

		Primitives			
EID of the Application	Parameter	request Base→Mobile	indication Base→Mobile	response Base←Mobile	confirm Base←Mobile
Base side : 8 Mobile side : 8	IID	No use	No use	No use	No use
	EID	8		8	

(b) The case of the same parameter

Note2) EID uses presently the default value(divided by 0..127) of ASN.1 abstract syntax in Annex H.

Note3) EID=0 is reserved as the identifier of ETC application (AID=14), EID=1 is reserved as the identifier of emergency warning application, EID=2 is reserved as the identifier of broadcast application for AHS, EID=3 is reserved as the identifier of broadcast application for multimedia information system.

(4) AccessCredential

It shall be octet string ASN.1 type and carry the information needed to fulfill access conditions in order to perform the operation on the addressed element.

The AccessCredential shall have the format as shown in Fig. 4.4.3.5.4.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	AccessCredential length							
2	AccessCredential [0]							
3	AccessCredential [1]							
:	:							
:	:							

Note) The length =“0” shall indicate that following octets are not used.

Fig. 4.4.3.5.4 AccessCredential format

(5) AttrIdList (Attribute Identifier List)

It shall be a list of IDs of attributes of the element receiving a GET.indication.

The AttrIDList shall have the format as shown in Fig. 4.4.3.5.5.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	AttrIdList count							
2	AttrIdList [0]							
3	AttrIdList [1]							
:	:							
:	:							

Note) The count =“0” shall indicate that following octets are not used.

Fig. 4.4.3.5.5 AttrIdList format

(6) Flow Control

Flow Control shall be a parameter that represents the behavior of the underlying communication service to LLC service primitives. The Flow Control parameter shall have the format and value as shown in Fig. 4.4.3.5.6.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	Flow Control							

Flow Control parameter	LLC service
1	DL-UNITDATA.request without response request
2	DL-UNITDATA.request with response request
3	DL-UNITDATA.indication
4	DL-DATA-ACK.request
5	DL-DATA-ACK.indication
6	DL-DATA-ACK-STATUS.indication
7	DL-PERLY.request
8	DL-PERLY.indication
9	DL-PERLY-STATUS.indication
10	DL-REPLY-UPDATE.request
11	DL-REPLY-UPDATE-STATUS.indication
12	DL-UNITDATA.request wait response request

Fig. 4.4.3.5.6 Flow Control parameters

(7) AttrList (Attribute List)

It shall be a sequence of attribute values of one element sent by the SET.request, the SET.indication or the GET.response or GET.confirm.

The AttrList shall have the format as shown in Fig. 4.4.3.5.7.

However, the structure of attribute value is not defined in this standard.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	Attribute count							
2	attributeId (Attribute [0])							
3 : :	attributevalue (Attribute [0]) :							
:	Attribute [1]							
:	Attribute [2]							
:	:							
:	:							

Note) The Attribute count =“0” shall indicate that following octets are not used.

Fig. 4.4.3.5.7 AttrList format

(8) Ret (Return Code)

It shall be a special return code issued by an element as an answer to a service indication.

The Ret shall have the format and be coded as shown in Fig. 4.4.3.5.8.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	Ret							

(a) RET format

Value	Definition
-1	No use
0	Successfully Processed
1	The requested operation was not performed for reasons pertinent to the security of the system.
2	One or more attribute values were not accessed because the identifier for the specified attribute was not recognized or the attribute value specified was out of range, etc.
3	The requested operation was not performed because a parameter was too complex.
4	A general failure in processing the operation was encountered.
5	The request operation is processing.
6	Chaining Error (Note1)
7-99	Reserve
100	Specified component (ChannelID) does not exist.
101	The request operation can't access specified component (ChannelID).
102	Nonsupport ActionType/EventType
103-127	Reserve in application

Note) the value shall be described using the 2's complementary values. The value "-1" shall be regarded as the request was successfully processed.

Fig. 4.4.3.5.8 Ret formats and values definition

Note1) It is called Chaining to perform multiple application operation (data transfer) in one APDU using one Chain (Chain : Consists of the concatenated multiple T-APDU fragments with the fixed sequentiality in the same PDU number). The operation of next T-APDU fragments in Chain limited by the processing status of the previous T-APDU fragments in same Chain. When Ret (Return status) of response T-APDU to the corresponding T-APDU fragments is expect no error, the operation by the next T-APDU fragments belonging to same Chain is not perform, the request response is retuned to Chaining error. It is determined by communication profile, whether Concatenation can be used or not. There is no Chaining function because communication profile does not use Concatenation in this standard.

(9) Mode

It shall be a Boolean parameter indicating whether there shall be a service response to a service indication.

The Mode shall have the format and be coded as shown in Fig. 4.4.3.5.9.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	Mode							

Note) Only the bit number 1 shall be valid. Other bit-field shall not be used.

(a) Mode format

Value	Definition
0	Not need for response.
1	Need for response.

(b) Definition of Mode value

Fig. 4.4.3.5.9 Mode formats and values definition

(10) Action Type

It shall identify an operation of the element which receives as ACTION.indication and which shall be invoked.

The Action Type shall have the format as shown in Fig. 4.4.3.5.10.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	ActionType							

Fig. 4.4.3.5.10 ActionType format

(11) Action Parameter

Action Parameter shall be the information needed for the invocation of an operation identified in an ACTION.indication. The Action Parameter is not defined in this standard, since their data structures have some types according to the Action Types.

(12) Response Parameter

It may be information resulting from the execution of the operation invoked by ACTION.indication. The Response Parameters are not defined in this standard, since their data structures have some types according to the Action Types.

(13) Event Type

It shall identify the message that shall be delivered to an element that receives an EVENT-REPORT.indication.

The Event Type shall have the format and be coded as shown in Fig. 4.4.3.5.11.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	EventType							

(a) EventType format

Value	Definition
0	The release of the association (link)

Note) Values of 1, 2 and 3 are reserved for future systems.

(b) Definition of EventType value

Fig. 4.4.3.5.11 EventType format and value definition

(14) Event Parameter

It shall be the additional information needed for the message sent via an EVENT-REPORT.request or EVENT-REPORT.indication, respectively. The Event Parameter is not defined, since the Event Type is defined only for the release and the Event Parameter for this release does not exist.

(15) AID

It shall be the Application Entity ID of the Initialization service user (application).

The AID values are defined in annex I.

The AID shall have the format as shown in Fig. 4.4.3.5.12.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	AID							

Fig. 4.4.3.5.12 AID format

Note) AID uses presently the default value(divided by 0..31) of ASN.1 abstract syntax in Annex H.

(16) Mandatory

It shall be the BOOLEAN status of the Initialization service user (application). It shall be true if the Initialization service user (application) is a mandatory application and false if the Initialization service user (application) is a non-mandatory application.

The Mandatory shall have the format and be coded as shown in Fig. 4.4.3.5.13.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	Mandatory							

Note) Only the bit number 1 shall be valid. Other bit-field shall not be used.

(a) Mandatory format

Value	Definition
0	Non-mandatory
1	Mandatory

(b) Definition of Mandatory values

Fig. 4.4.3.5.13 Mandatory formats and values definition

(17) Priority

It shall be the priority of the Initialization service user (application) in relation to the other Initialization service user (application). A small INTEGER shall represent a high priority, a high INTEGER shall represent a low priority.

The Priority shall have the format as shown in Fig. 4.4.3.5.14.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	Priority							

Fig. 4.4.3.5.14 Priority format

(18) Profiles

It may be a SEQUENCE of Profile related to the application.

The Profiles shall have the format as shown in Fig. 4.4.3.5.15.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	Profiles count							
2	Profiles [0]							
3	Profiles [1]							
:	:							
:	:							

Note) The count="0" shall indicate that following octets are not used.

Fig. 4.4.3.5.15 Profiles format

(19) Parameter (I-KE)

Parameter (I-KE) may be additional information related to the association (initialization) with the initialization service user (application). The Parameter (I-KE) is not defined in this standard.

(20) ObeConfiguration

It shall be an obeConfiguration describing the configuration and status of the mobile station related to the LID given in the NotifyApplicationRSU(Beacon).

The obeConfiguration shall have the format as shown in Fig. 4.4.3.5.16.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	(MSB) equipment class							
2	Equipment class (LSB)							
3	(MSB) manufucturerID							
4	manufucturerID (LSB)							
5	(MSB) obe Status							
6	obe Status (LSB)							
:	:							

Fig. 4.4.3.5.16 obeConfiguration format

Note) Equipment Class is 15 bits data structure, 8^{th} bit of 1^{st} octets is invalid bit. It is better to set it as "0" etc.

(21) RSU(Beacon)
It may be the beaconID (base station ID provided the initialization service user (application)) which offers the service.
The RSU(Beacon) shall have the format as shown in Fig. 4.4.3.5.17.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	(MSB) Manufacturer ID							
2	Manufacturer ID (LSB)							
3	(MSB) Individual ID							
4	Individual ID							
5	Individual ID							
6	Individual ID (LSB)							

Fig. 4.4.3.5.17 Beacon format

Note) Individual Id is 27 bits data structure, 4^{th} bit to 8^{th} bit of 3^{rd} octets are invalid bits. It is better to set it as "0" etc.

(22) Norm_end

It shall be the notification whether an application of the initialization service user was normally accomplished or not.

The Norm_end shall have the format and be coded as shown in Fig. 4.4.3.5.18

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	Norm_end							

Note) Only the bit number 1 shall be valid. Other bit-field shall not be used.

(a) Norm_end format

Value	Definition
0	The desired operation was not performed for any reasons and the initialization service user decided to discontinue the subject application processing.
1	The desired operation was successfully processed and the initialization service user decided to discontinue the subject application processing.

(b) Definition of Norm_end value

Fig. 4.4.3.5.18 Norm_end format and value definition

(23) File (B-KE)

It shall be the NamedFile that contains the information that shall be broadcast or retrieved from the Broadcast Pool.

The File (B-KE) shall have the format as shown in Fig. 4.4.3.5.19.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	ase ID							
2	file ID							
3	Record count							
4	Record value length--Record[0]							
5	Record value [0] --Record[0]							
:	Record value [1] --Record[0]							
:	:							
:	: --Record[0]							
:	Record [1]							
:	Record [2]							
:	:							

Note) The Record count="0" shall indicate that following octets are not used.

Fig. 4.4.3.5.19 File (B-KE) format

(24) Name (B-KE)

It shall be the FileName of the file that shall be retrieved from the Broadcast Pool.

The Name (B-KE) shall have the format as shown in Fig. 4.4.3.5.20.

	Bit number							
Octet Number	8	7	6	5	4	3	2	1
1	ase ID							
2	file ID							

Fig. 4.4.3.5.20 Name (B-KE) format

4.4.4 Layer Management

4.4.4.1 Scope

This layer 7 management entity (ALME: application layer management entity) consists of providing the layer 7 and the layer 2 in both entities with values for the communication parameters and communication control information necessary for communication and administration of the communication system.

The communication control information and service interface to access to that information are defined for the layer 7 management entity. But, the functionalities of the layer 7 management entity are not specified in detail, since the function of the layer 7 management entity can be realized by the I-KE of the layer 7.

The communication parameters and the communication control information are registered at the MIB of the layer 7 management entity (I-KE). The MIB information of the layer 7 management entity is defined in detail in annex A.

4.4.4.2 Function

The layer 7 management entity shall have the following information, at least.
(1) Application (the initialization service user) information.
(2) The communication control information

4.4.4.2.1 Application management

The layer 7 management entity shall manage the application information in order to provide service for the initialization service user (application) on the base station / the mobile station. The application information for each the initialization service user (application) shall be registered each time the RegisterApplicationRSU(Beacon)/ RegisterApplicationOBU(Vehicle) is received, and the corresponding application information shall be de-registered each time the DeregisterApplication is received.

It may use the application management list for the registration. The application management list is shown in Table. 4.4.4.2.1 for reference.

Table. 4.4.4.2.1 Example of the application management list

AID	EID	Mandatory	Priority	Profiles	Parameters

4.4.4.2.2 Communication control information management

The communication control information is required for the association procedures. This information has properties of the initialization service user (application) that has accomplished the association already and is continuing communication between the peer initialization service user (application).

This information shall be generated after the accomplishment of the association and be added or revised each time when the NotifyApplicationRSU(Beacon) or NotifyApplication OBU(Vehicle) is transmitted to the initialization service user (application).

The communication control information for the given initialization service user (application) shall be deleted when the DeregisterApplication is received or all of the services for plural applications has terminated on the base station side. On the mobile station side, this information shall be deleted when the DeregisterApplication is received or the mobile station identifies another base station.

It may use the communication control information list for the management. The communication control information management list on the mobile station side is sown in Table. 4.4.4.2.2 for reference.

Table. 4.4.4.2.2 Example of the communication control information management list

LID	AID	EID	Mandatory	Priority	Profiles	Parameters	Norm_end (Note2)	status of application (Note1)	Release timer value (Note3)	SC	LRI	FID	Related Application status. (Note4)

Where
LID: Link address
AID, EID: identifier of application
M: Mandatory
Priority: priority for applications requested by service users.
Profiles: the layer 7 profiles.
Parameter: the layer 7 parameters required for management
SC: the comparison results with application identifiers of the base station provided by the layer 2 within the FCMC and the application identifiers that has registered at the layer 7 management entity (I-KE).
LRI: Initialization (association) mode identifier. (Either normal type of association or simplified association procedure is implemented.)
FID: the base station identifier on the layer 2

Note1) Status of application performance is described in subclause 4.4.5.6.
Note2) Whether or not an application of the initialization service user was normally accomplished. It assumed the value of the Norm_end is substituted its field.
Note3) the timer that constrains the re-association processes after releasing the association (link) on the mobile station side.
Note4) underlying assumption is as follows.
The linked two communication zones are constructed and each base station provides multiple applications for each zone. It may be that a related application accomplished an application transaction provided by 1st base station (1st communication zone) and another application transaction by 2nd base station (2nd communication zone). In that case, the mobile station needs to identify application which base station was provided. It may be usually identified as the 1st base station in the stand-alone communication zone.

4.4.4.3 Communication Profiles

General Communication System Profiles shall represent characteristics of the communication partners. These characteristics shall be the same or compatible for two communicating partners. Two classes of characteristics shall be distinguished as follows.

(1) Settable characteristics
These characteristics shall be parameters of the system that may be set to a special value in general in each system. They shall be distinguished between characteristics where the wrong setting will lead to communication errors or will disable the communication between the partners and characteristics where the wrong setting will not lead to a communication error or will not disable the communication between the partners.

(2) Abilities
These characteristics shall be abilities of the systems that are present or not. If one communication partner uses this ability the other partner shall also have this ability to be able to understand the incoming data.

Refer to the communication profiles in this standard for Annex P.

4.4.4.4 Layer 7 management service interface specification

4.4.4.4.1 Overview of Interactions

The layer 7 management entity (ALME) provides the following primitives to a system management entity (SME) or a MAC sublayer management entity (MLME).

The primitives associated with the MIB access service are as follows.

ALME-GET.request
ALME-GET.confirm
ALME-SET.request
ALME-SET.confirm

The ALME-GET.request primitive is passed to the ALME to request that the user-entity (the SME or the MLME) is able to get the value of the MIB attributes that are stored in a Management Information Base (MIB) of the ALME. The ALME-GET.confirm is passed from the user-entity (the SME or the MLME) to convey the results of the previous action associated with the ALME-GET.request primitive.
The ALME-SET.request primitive is passed to the ALME to request that the user-entity (the SME or the MLME) is able to set the value of the MIB attribute. The ALME-SET.confirm is passed from the ALME to convey the results of the previous action associated with the ALME-SET.request primitives.

4.4.4.4.2 Management service interface specification

The layer 7 management entity (ALME) provides the services to a system management entity (SME). The management information specific to the layer 7 represented as the layer 7 Management Information Base (MIB).

This subclause describes in detail the primitives and parameters associated with the service specified in subclause 4.4.4.4.1. The parameters are abstractly described, and specified in view of the necessity for the receive entity. A specific implementation is not constrained in the method of making this information available. Fig. 4.4.4.4 shows the logical relationship of primitives.

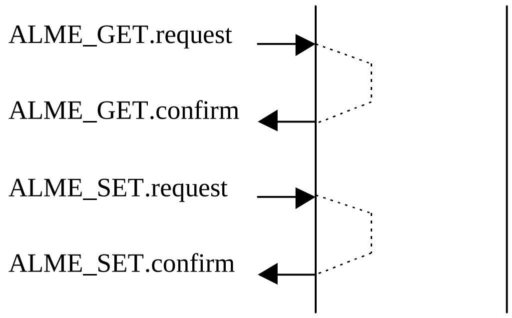


Fig.4.4.4.4 Time-sequence diagram of the MIB access service

4.4.4.4.2.1 ALME-GET.request

(1) Function
This primitive is to request for the layer 7 MIB access service.

(2) Semantics of Service Primitive
This primitive shall provide parameter as follows.
ALME-GET.request (MIB-attribute)

The MIB-attribute parameter is specific to the attribute of the MIB.

(3) When Generated
This primitive is generated by the SME to request for getting the MIB attribute of the ALME and is passed to the ALME.

4.4.4.4.2.2 ALME-GET.confirm

(1) Function
This primitive is to report the results of the action associated with the ALME-GET.request.

(2) Semantics of Service Primitive
This primitive shall provide parameters as follows.

ALME-GET.confirm (status, MIB-attribute, MIB-attribute-value)

The status parameter indicates the success or failure of the MIB-attribute reading requests.
The MIB-attribute parameter is specific to the attribute provided by the ALME-GET.request.
The MIB-attribute-value is specific to the value of the attribute itself.

Note 1) If a type of invalid attribute is set, the status will indicate the failure.
Note 2) If the status indicates the failure, the MIB-attribute-value will not assure of the validity.

(3) When Generated
This primitive is generated by the ALME to report the results of the previous action provided by the ALME-GET.request primitives and is passed to the SME.

4.4.4.4.2.3 ALME-SET.request

(1) Function
This primitive is to request for the MIB access service.

(2) Semantics of Service Primitive
This primitive shall provide parameters as follows.

ALME-SET.request (MIB-attribute, MIB-attribute-value)

The MIB-attribute parameter specifies the attribute of the MIB.
The MIB-attribute-value is specific to the value provided by the ALME-SET.request.

(3) When Generated
This primitive is generated by the SME to request for writing the MIB attribute of the ALME and is passed to the ALME.

4.4.4.4.2.4 ALME-SET.confirm

(1) Function
This primitive is to report the results of the action provided by the MLME-SET.request.

(2) Semantics of Service Primitive
This primitive shall provide parameters as follows.

ALME-SET.confirm (status, MIB-attribute)

The status parameter indicates the success or failure of the setting MIB-attribute request provided by ALME-SET.request.
The MIB-attribute parameter is specific to the attribute provided by ALME-SET.request.

Note) If a type of invalid attribute is set, the status will indicates the failure.

(3) When Generated
This primitive is generated by the ALME to report the results of the previous action provided by the ALME-SET.request primitives and is passed to the SME.

4.4.4.5 Relation with the MLME (layer 2 management entity)

The layer 7 uses the MLME_GET / MLME_SET primitives of the MLME (layer 2 management entity) for getting or setting variables, that are the connection variable NUMLINK, the slot assignment state variable SLT_STATUS and the transmission state variable TR_STATUS.

(1) Connection variable NUMLINK
The number of the NUMLINK is incremented “1” when the layer 7 accepts the association (initialization) request, and be decrement “1” when the layer 7 releases the association accepted and registered previously.

(2) Slot assignment state variable SLT_STATUS / transmission state variable TR_STATUS
Before the transmission request for an LPDU, the layer 7 reads the SLT_STATUS and the TR_STATUS. If the state of the SLT_STATUS shows “out_time” or the state of the TR_STATUS shows busy, the layer 7 move to the state of the waiting the transmission.

4.4.5 Association (Initialization) Procedures

This subclause describes in detail association (Initialization) procedures in DSRC system.
The SDL figure related to this procedure is attached to Annex G.

Note) When the T-KE transfers BST, the LLC service primitives use DL-UNITDATA.req with response request (Flowcontrol=2). When the T-KE transfers VST, the LLC service primitives use DL-UNITDATA.req without response request (Flowcontrol=1).

4.4.5.1 Normal Association (Initialization) Procedures

4.4.5.1.1 Scope

The I-KE shall perform the normal association (initialization) between the base station and the mobile station with exchanging the BST/VST.

4.4.5.1.2 Procedures (Sequence)

The layer 7 (the I-KE and the T-KE) shall perform the normal association (initialization) procedures on the base station side and the mobile station side according to following sequence steps as illustrated in Fig. 4.4.5.1.

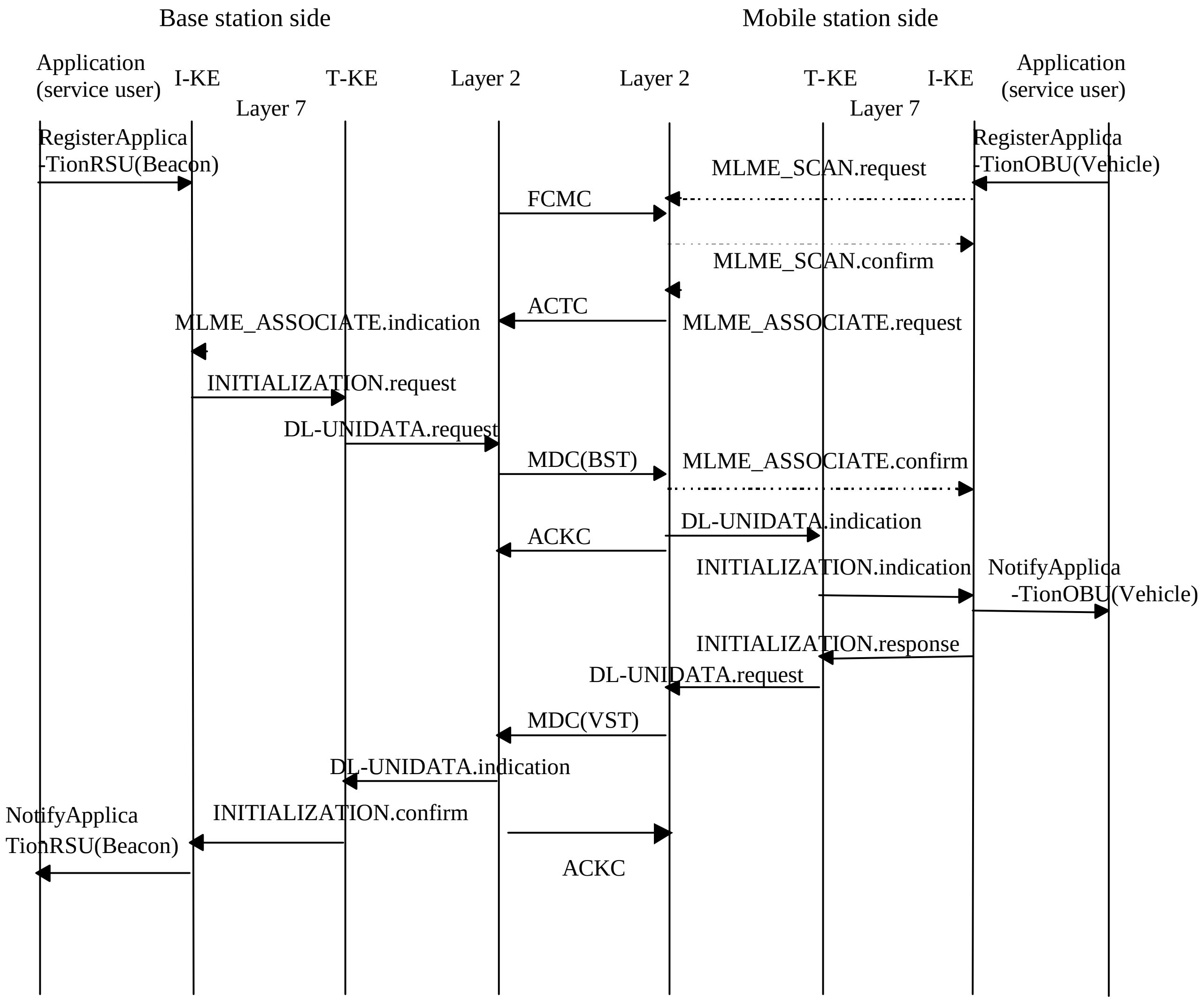


Fig.4.4.5.1 Normal Association Sequence

4.4.5.1.2.1 Normal Association (Initialization) Procedures on the mobile station

4.4.5.1.2.1.1 Search of Communication zone

The I-KE on the mobile station uses MLME_SCAN.request primitives provided by the layer 2 management entity to search communication zone provided by the base station. The invocation of MLME_SCAN.request primitives shall be provided as follows.

(1) The mobile station is activated and can communicate.
(2) Not fulfill Association request in subclause 4.4.5.1.2.1.2.
(3) Not fulfill Normal Association confirm response in subclause 4.4.5.1.2.1.3.
(4) Accords to Association release in subclause 4.4.5.3.

If the I-KE on the mobile station issues MLME_SCAN.request primitives to Layer 2 management entity, it waits for MLME_SCAN.comfirm primitives which is informed from Layer 2 management entity.

4.4.5.1.2.1.2 Association request

If The I-KE on the mobile station receives MLME_SCAN.comfirm primitives which is informed from layer 2 management entity and the parameter passed by its primitives is effective, it performs the processing of association request. Association request uses MLME_ASSOCIATE.request primitives provided by layer 2 management entity. The invocation of MLME_ASSOCIATE.request primitives shall be provided as follows.

(1) There is an available AID in service_code parameter passed by MLME_SCAN.confirm primitives.
(2) When ccz_status passed by MLME_SCAN.confirm primitives will indicate concatenated communication zone and connection sequence of the corresponding mobile station accords to configuration information of transceiver which is indicated tri_status parameter.

The parameter passed to layer 2 management entity by MLME_SCAN.confirm primitives specifies as follows.

1) link_address : The link_address parameter is specific to private link address of self managed by I-KE on the mobile station
2) initialization_mode : The initialization_mode parameter is specific to the value according to the communication profile of self

3) application_id : The application_id parameter is specific to the value for register into application identifier flag of LRI in subclause 4.2.4.2.3.1.5. Its value is generated by result of service_code parameter passed by MLME_SCAN.cofirm primitives.

4) priority : The priority parameter is specific to the value of normal assignment.

If the I-KE on the mobile station issues MLME_ASSOCIATE.request primitives to Layer 2 management entity, it waits for MLME_ASSOCIATE.comfirm primitives which is informed from Layer 2 management entity.

4.4.5.1.2.1.3 Normal Association (Initialization) confirm response

If the I-KE on the mobile station receives MLME_ASSOCIATE.confirm primitives which is informed from layer 2 management entity and the status parameter passed by the its primitives indicates success, it performs the processing of confirm response. The processing of Association (Initialization) confirm response checks the BST registered into the InitializationPramaeter of INITIALIZATION.indication after reception of MLME_ASSOCIATE.confirm primitives and responds to the base station using INITIALIZATION.response. The invocation of Association (Initialization) response primitives shall be provided as follows.

(1) There is an available AID in the mobile station of self, reference to mandApplications and nonmandApplications in the BST.
(2) When the profile specified by AID chosen in (1) is compared with profile or profileList in the BST and the station of self has communication profile which accord to the condition shown in Annex P.

Note) The action of avoidance when INITIALIZATION.indicate can not receive is not specified as requirements for mounting

The Initialization parameter specifies as follows.

1) profile : The profile parameter is specific to the value for the condition in shown Annex P.

2) application : The AID List accord to above-mentioned invocation condition. The application parameter is specific to information registered by its application using RegisterApplicationOBU(Vehicle).

3) obeConfiguration : The obeConfiguration parameter is specific to information according to data structure of self station.

If The I-KE on the mobile station responds to the base station using InitializationParameter primitives, it informs Association (Link) to application in self station accord to the above-mentioned invocation condition using NotifyApplicationOBU(Vehicle).
If I-KE informs NotifyApplicationOBU(Vehicle), The InitializationParameter specifies as follows.

1) RSU(Beacon): The RSU(Beacon) parameter is specific to rSU provided by the BST.
2) Priority : The Priority parameter is specific to the position from the head of the corresponding application in the BST in mandatory application, it is specific to the value which applied the priority when application registered and the number of mandatory application in application list in non-mandatory application.
3) EID : If the I-KE on the mobile station received the EID by the BST, the EID parameter is specific to its EID. If not received, not use.
4) LID : The LID parameter is specific to LID of self.
5) Parameter : If there are parameters received by the BST, the Parameter parameter is specific to its parameter. If not parameters, not use.

4.4.5.1.2.2 Normal Association (Initialization) Procedures on the base station

4.4.5.1.2.2.1 Association response

If the I-KE of the base station receives MLME_ASSOCIATE.indication primitives which is informed from the layer 2 management and the parameter passed by the corresponding primitives is effective, it shall perform the response processing of association. The association response uses INITIALIZATION.request primitives. The invocation of association (Initialization) request primitives shall be provided as follows.

(1) The link_address parameter passed by the MLME_ASSOCIATE.indication primitives is private link address, does not overlap link address of the mobile station which connected by self station.
(2) The application provided by the self station was registered the application_id parameter passed by the MLME_ASSOCIATE.indication.
(3) The priority parameter passed by MLME_ASSOCIATE.indication primitives indicates normal assignment.

Note) Refer to Annex N for processing of link address overlap.

The InitializationParameter is specified to BST. The parameter of BST specifies as follows.

1) rSU	: identifier of the base station
2) time	: time information
3) profile	: The value defined by Annex P.
4) mandApplication	: The mandatory application list provided by the base station. The mandApplication parameter is specific to information which is registered by the corresponding application using RegisterApplicationRSU(Beacon).
5) nonmandApplication	: The nonmandatory application list provided by the base station.The mandApplication parameter is specific to information which is registered by the corresponding application using RegisterApplicationRSU(Beacon).
6) profileList	: The value defined by Annex P.

When the I-KE of the base station issues INITIALAZATION.request primitives, it waits for INITIALZATION.confirm after NUMLINK I is incremented “1”.

Note) The action of avoidance when INITIALIZATION.confirm primitives can not receive is not specified as requirements for mounting. After avoidance, NUMLINK is decremented “1”.

4.4.5.1.2.2.2 Normal Association (Initialization) confirm

If the I-KE of the base station receives INITIALAZATION.confirm primitives, it is specified to the profile according to VST which was registered to parameter of the corresponding primitives. The I-KE of the base station generates association information and performs association (Link) management to the application specified in VST of the corresponding mobile station, it shall perform association (Link) notify to the corresponding application in self using NotifyApplicationRSU(Beacon) primitives. If the I-KE of the base station notifies NotifyApplicationRSU(Beacon), the parameter of the corresponding primitives specifies as follows.

1) Priority	: The Priority parameter is specific to the position from the head of the concerned application in the BST in mandatory application, it is specific to the value which applied the number of the mandatory application and the position of the corresponding application in application list in nonmadatory application.
2) EID	: If the I-KE of the base station received EID by the VST, the EID parameter is specific to its EID. If not received, not use.

3) LID : The LID parameter is specific to LID which received in INITIALIZATION.confirm.
4) Parameter : If there are parameters received by the VST, the Parameter parameter is specific to its parameter. If not parameters, not use.
5) obeConfiguration : The obeConfiguration parameter is specific to obeConfiguration which received in VST.

4.4.5.1.3 Initialization Internal Service Primitives

(1) Scope
The initialization internal services for the I-KE shall be provided by the T-KE regarding to the normal initialization (association) procedure.
These services are used for setting the information (the contents of the BST/VST) needed for initialization (association) to the I-KE. A specific implementation is not constrained in the method of making this information available.

(2) Format
The Initialization Internal Service Primitive shall provide parameters as follows.

INITIALIZATION.request (~~[~~LID~~]~~, Initialization Parameter]
INITIALIZATION.indication (~~[~~LID~~]~~, Initialization Parameter]
INITIALIZATION.response (LID, Initialization Parameter]
INITIALIZATION.confirm (LID, Initialization Parameter]

(3) Initialization Parameter
The Initialization Parameter specifies the BST in the case of the INITIALIZATION.request / the INITIALIZATION.indication. The Initialization Parameter specifies the VST in the case of the INITIALIZATION.response / INITIALIZATION.confirm. The data structure of BST/VST is shown in Annex H.

Note) NotifyApplicationRSU(Beacon) issues each application of application list in VST as a unit. NotifyApplicationOBU(Vehicle) issues each application of application list in BST as a unit.

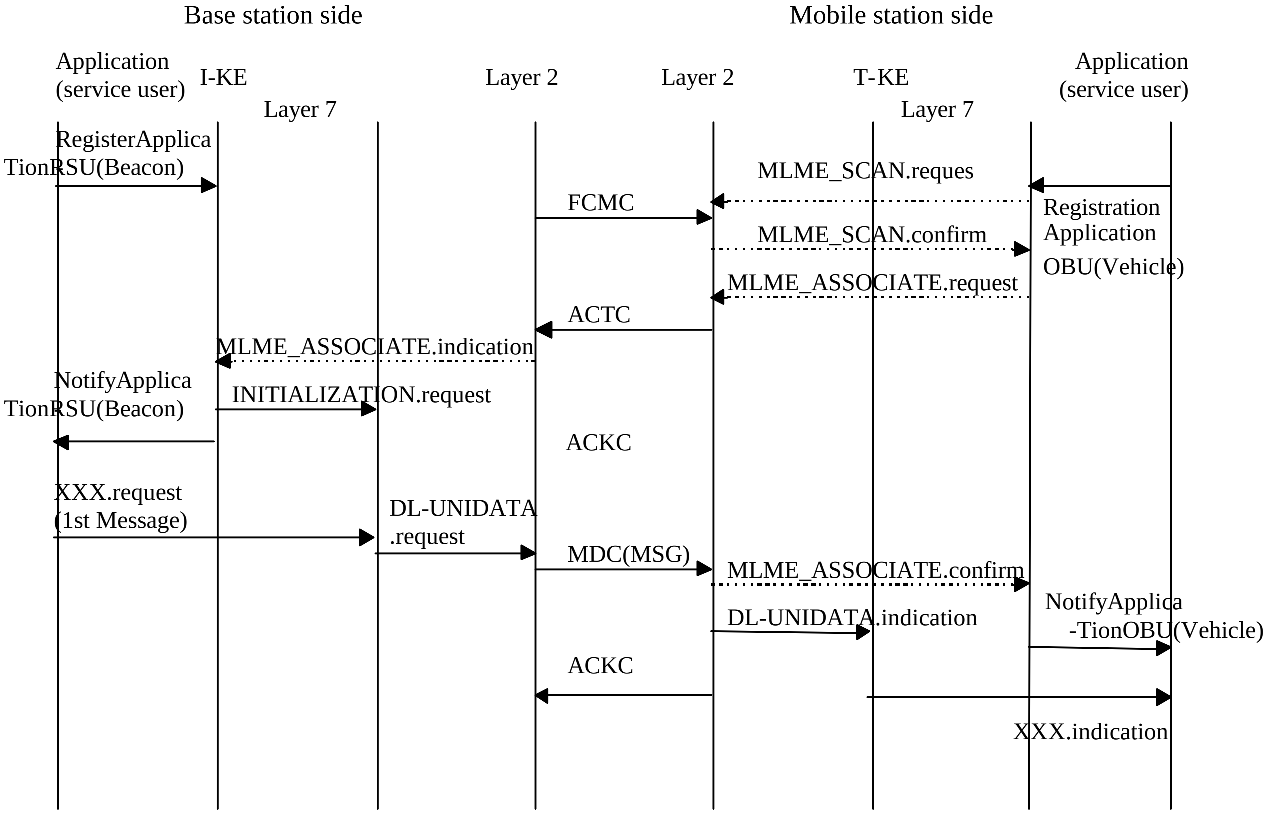
4.4.5.2 Simplified Association Procedures

4.4.5.2.1 Scope

The simplified association procedures may be used with omitting the exchange of the BST/VST.

4.4.5.2.2 Procedures (Sequence)

The layer 7 (the I-KE and the T-KE) shall perform the simplified association (initialization) procedures on the base station side and the mobile station side according to the following sequence steps as illustrated in Fig. 4.4.5.2.



Note) " … " shows inter-layer management service

Fig.4.4.5.2 Simplified Association Sequence

4.4.5.3 Association Release procedures

4.4.5.3.1 Scope

If the I-KE of the base station receives End(Ready)Application primitives and all application terminates, it shall send the release of communication association to the mobile station. If The I-KE of the mobile station receives End(Ready)Application primitives from all application, or it receives EVENT-REPORT(Release) primitives from the base station, it shall release communication. If the I-KE of the mobile station receives EVENT-REPORT.request primitives from the base station, it shall release communication even if it does not receive End(Ready)Application primitives from the all application of the mobile station. The I-KE of the mobile station shall not send the EVENT-REPORT.request primitives. If the application of the mobile station notifies abnormal release using Norm_end parameter of the End(Ready)Application primitives and performs re-association, the Re-association processing at the layer 7 carries out only for application which has notified abnormal release using Norm_end parameter. After reception of EVENT-REPORT primitives, if the RLT is effective and End(Ready)Application primitives is normal, the mobile station sends the MLME_RLT.request primitives and releases association. When the release timer is set up, the I-KE of the mobile station sends MLME_RLT.request primitives, it receives End(Ready)Application primitives and releases association. When the release timer is not set up, the I-KE of the mobile station sends the MLME_SCAN.request primitives.

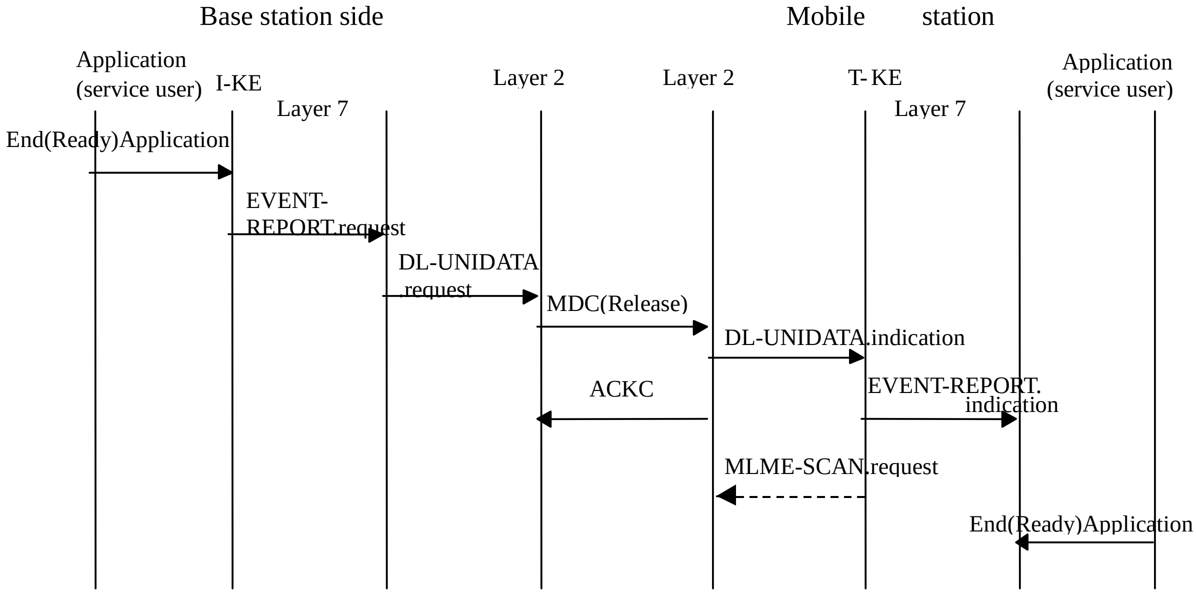
Note1) If The I-KE of the mobile station receives failure information from status parameter of the MLME_ASSOCIATE.confirm for the reason of NRQmax over etc. , it shall perform association (initialization) procedure. Specifically, The I-KE of the mobile station begin association (initialization) procedure by the MIME_SCXAN.request after the progress time which specified by the release_time parameter provided by the MLME_SCAN.confirm.

Note2) When the each application of the mobile station receives release, can consider association release after the setting time progress of the connection timer which each has. In addition, It assumes that connection timer which application holds is reset whenever the application received Notify ApplicationOBU(Vehicle). When the I-KE of the mobile station received release, the layer 7 can notify to the application that the base station released association using inter primitives of NotifyApplicationOBu(Vehicle)_Release etc. , its procedure is not specified.

Note3) The Access Credentials, Mode, Flow Control in the EVENT.REPORT.request primitives shall provide parameter as follows. In addition, the value of EID is "0".
Access Credentials = empty (No Use)
Mode = FALSE
Flow Control = 1

4.4.5.3.2 Procedures (Sequence)

The layer 7 (the I-KE and the T-KE) shall perform the association release procedures on the base station side and the mobile station side according to following sequence steps as illustrated in Fig. 4.4.5.3.



Note) "…" shows inter layer management service

Fig.4.4.5.3 Association Release Sequence

4.4.5.4 Association procedures for linked communication zones.

4.4.5.4.1 Scope

The linked two communication zones are constructed in series in the traveling direction, and each base station provides plural applications for each zone. It may be that a related application accomplished through a communication transaction provided by the 1st base station (the 1st communication zone), and another communication transaction by 2nd base station (the 2nd communication zone) in order. In that case, the mobile station shall perform the association procedures after entering each communication zone, respectively.
When the mobile station enters the 2nd communication zone (the 2nd base station) after the accomplishment of the association with the 1st base station (the 1st communication zone), the I-KE of the mobile station shall not associate with the same 1st base station. When the I-KE received the MLME_SCAN.confirm from the MLME, it shall not perform the association procedures for such the 1st base station.

4.4.5.4.2 Procedures (Sequence)

The layer 7 (the I-KE and the T-KE) shall perform the association procedures for linked communication zones on the base station side and the mobile station side according to following sequence steps as illustrated in Fig. 4.4.5.4.

It may be different primitives are used for performing its association procedures, since the service (application) provider may provide a variety of application (s) in which has the same or different identifier (s), AID (s) or EID (s).

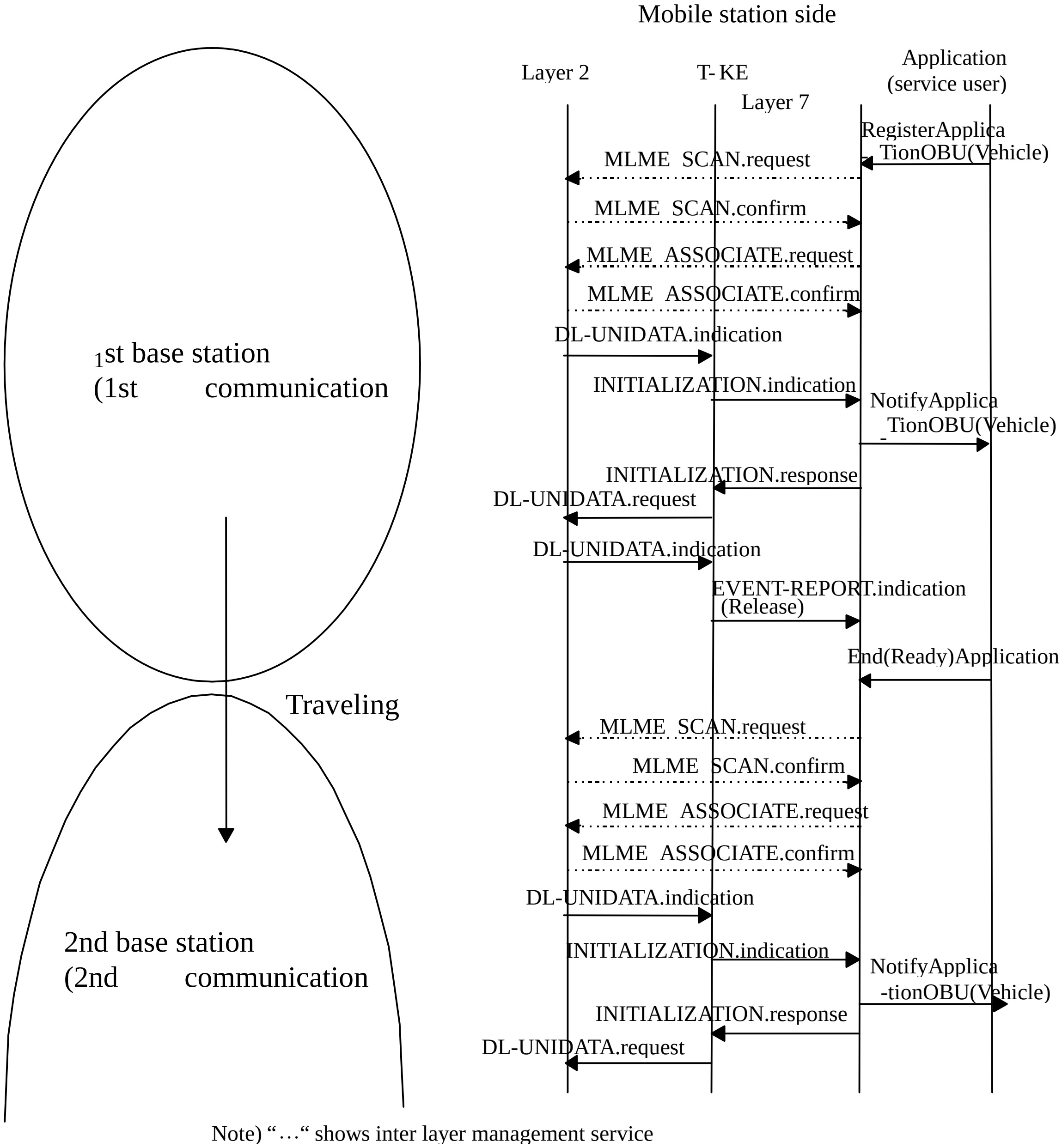


Fig.4.4.5.4 Association Sequence in Linked Communication Zone

4.4.5.5 Association procedures with Release timer

When all of the applications that are registered have been normally accomplished their application transactions by receiving EndApplication primitives, the release timer (t10) shall be set in order to constrain the re-association with the same base station on the mobile station side during a certain period.

However, when there is at least one application, which has notified the abnormal accomplishment state by the EndApplication, it shall not be set in order to re-associate immediately.

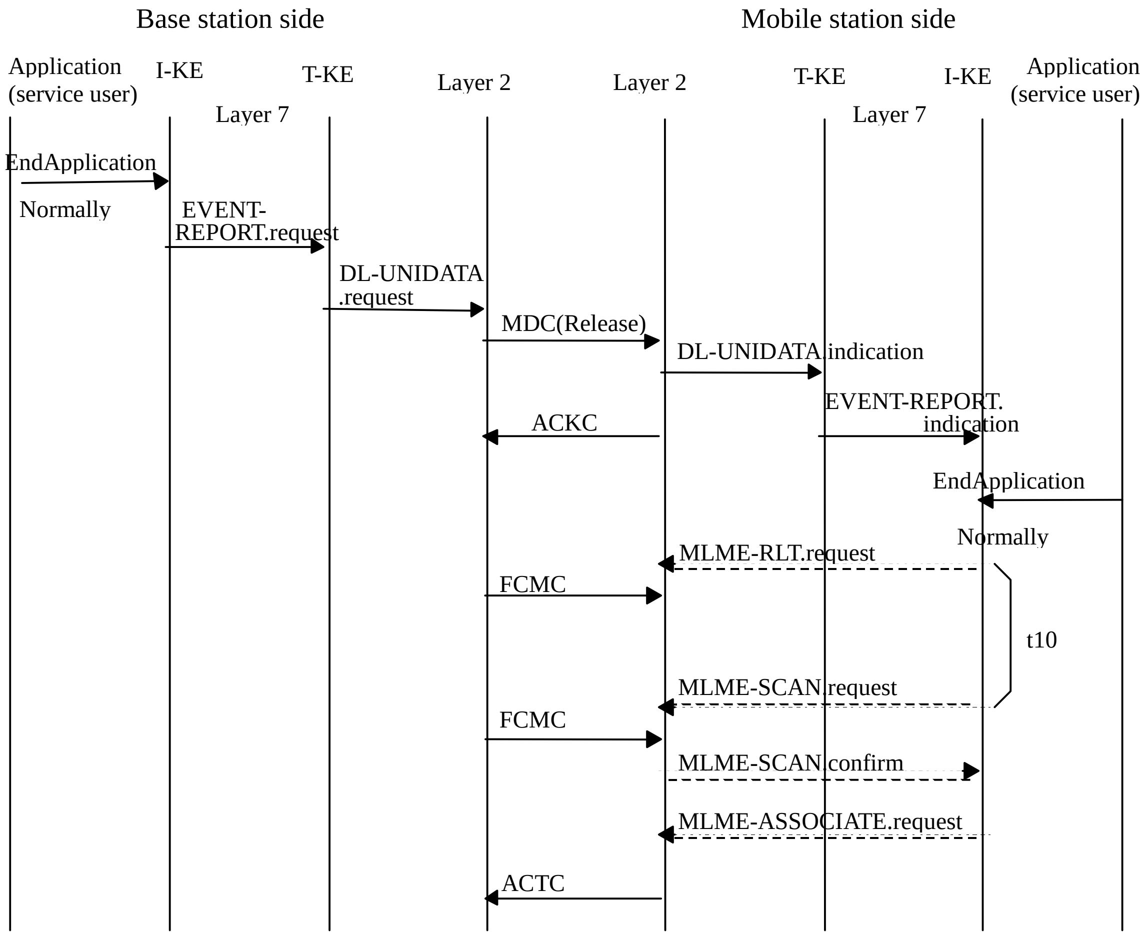
Furthermore, when the different applications related on the application level are provided in the linked communication zones and the association release procedures with the 1st base station have been accomplished, it shall perform the association procedures with the 2nd base station whether or not the release timer is set.

When the release timer is operating, the mobile station recognizes the base station, which indicates the invalid release timer field, it shall perform the association procedures with corresponding base station.

If the release timer is set, it shall be performed the association procedures according to following sequence steps as illustrated in Fig. 4.4.5.5.1.

If the release timer is not set, it shall perform the re-association procedures according to following sequence steps as illustrated in Fig. 4.4.5.5.2.

If the mobile station identifies the release timer is invalid, it shall perform the re-association procedures according to following sequence steps as illustrated in Fig. 4.4.5.5.3



Note) "…" shows inter layer management service

Fig.4.4.5.5.1 Re-association Sequence with Release Timer

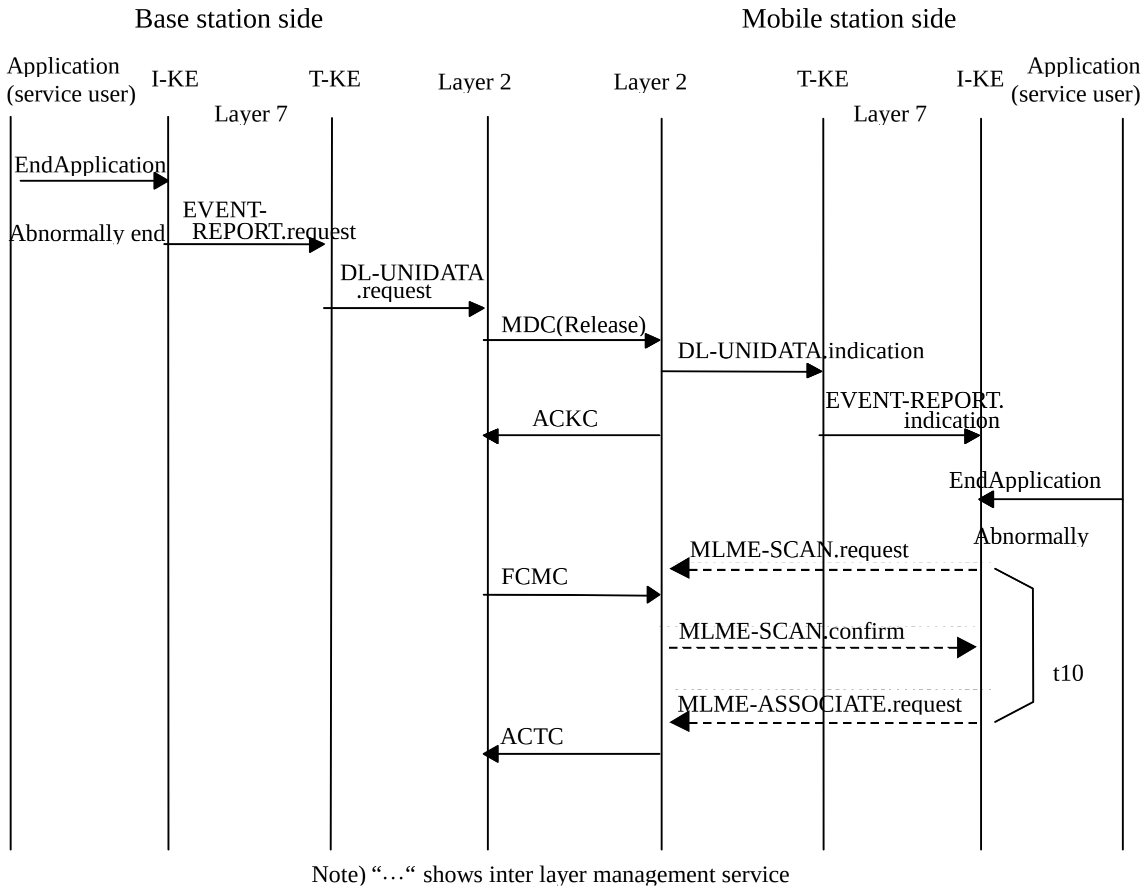
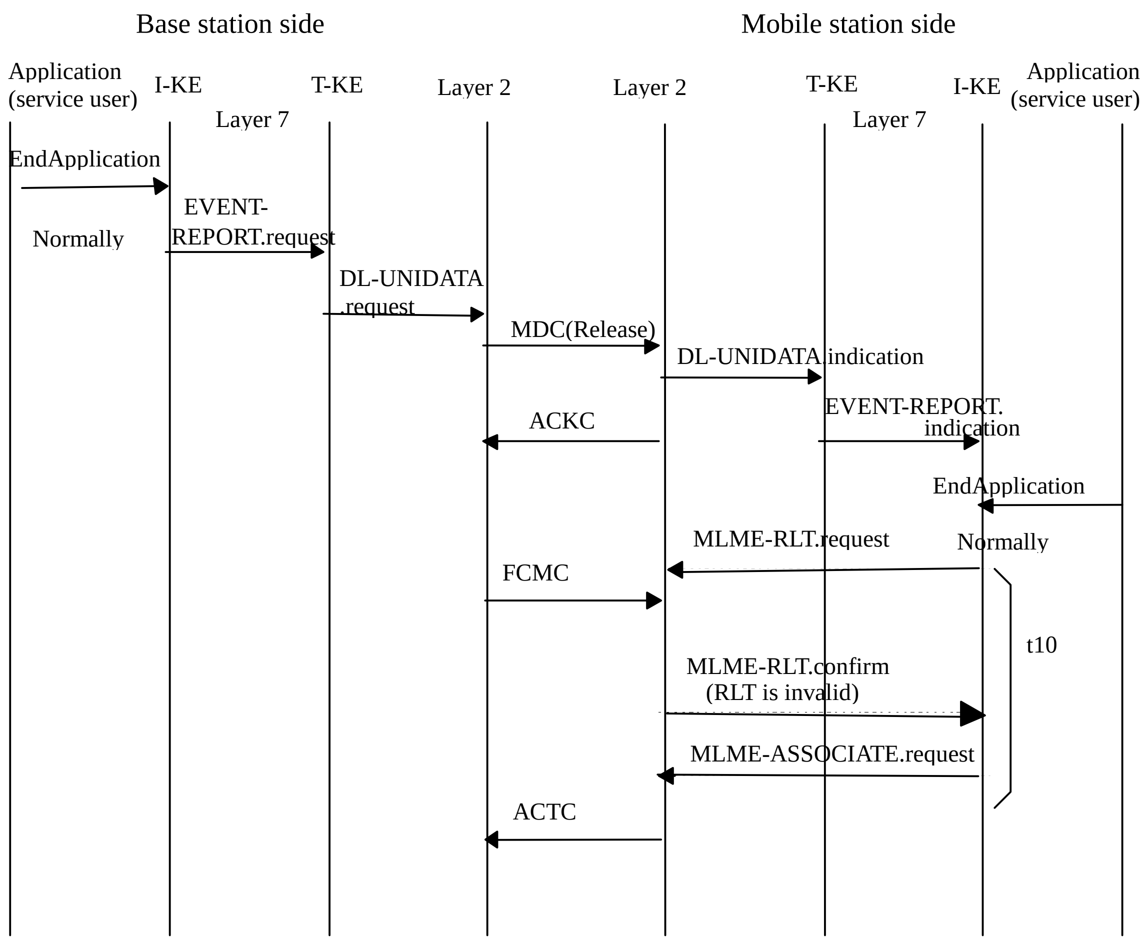


Fig.4.4.5.5.2 Re-association Sequence without Release Timer



Note) "…" shows inter layer management service

Fig.4.4.5.3 Re-association Sequence with invalid Release Timer value

4.4.5.6 Management of the connection state of application (s)

The management for the current operating state of application (s) shall be performed not to communicate with the same application on the base station side and the mobile station side.
When the layer 7 (the I-KE and the T-KE) sends NotifyApplicationOBU(Vehicle) to an application (kernel service user), it shall be regarded the subject application is operating. When End(Ready)Application from the subject application (kernel service user) is received, it shall move its state to the accomplishment of the service. The example of procedures (sequence) is shown in Fig. 4.4.5.6.1.

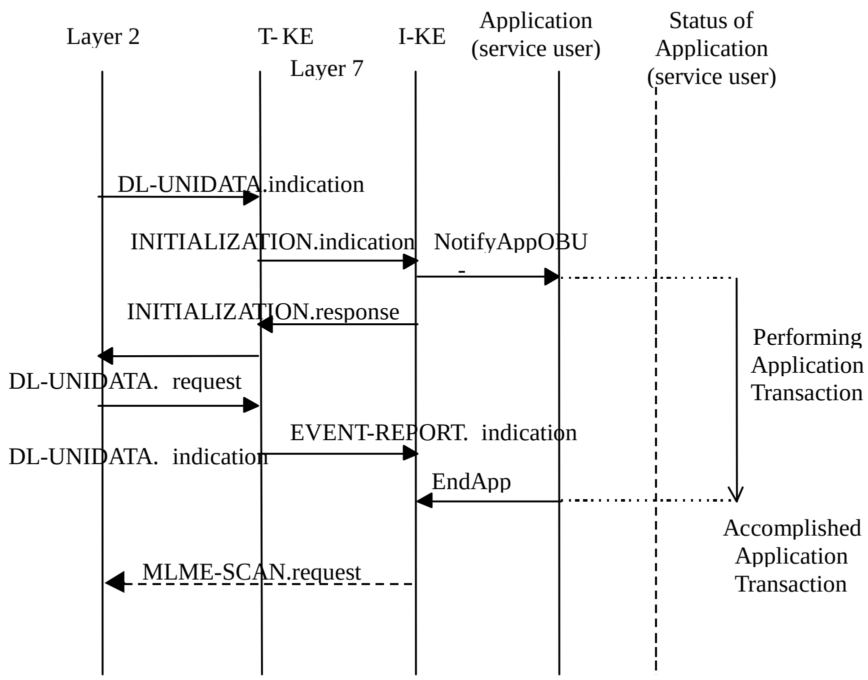


Fig.4.4.5.6.1 Management of Application-Status Sequence

However, in this communication environment, when the communication transaction for the application confirmed previously on the base station and the mobile station side has not yet started, or a long time has elapsed after previous application transaction, the mobile station may be out of the communication zone. (The base station may lose the peer application (service user).)

In above case, when the application (service user) would like to maintain service between the peer application, the layer 7 may not receive the End(Ready)Application and the association is maintained for long time as shown in Fig. 4.4.5.6.2.

Therefore, considering the above conditions, it is required that the application has a connection (maintenance) timer and the maximum time maintained the service (connection time). If it is over this maximum time, the application (service user) should disconnect.

Note) Synchronizing the operation starting time for the connection (maintenance) timers on the base station side and the mobile station side, it may be able to re-associate immediately. In case plural applications are performed, when some of them accomplish abnormally (the status of each application is notified by Norm_end parameter of EndApplication), re-association procedure shall be applied to only abnormal-ended applications.

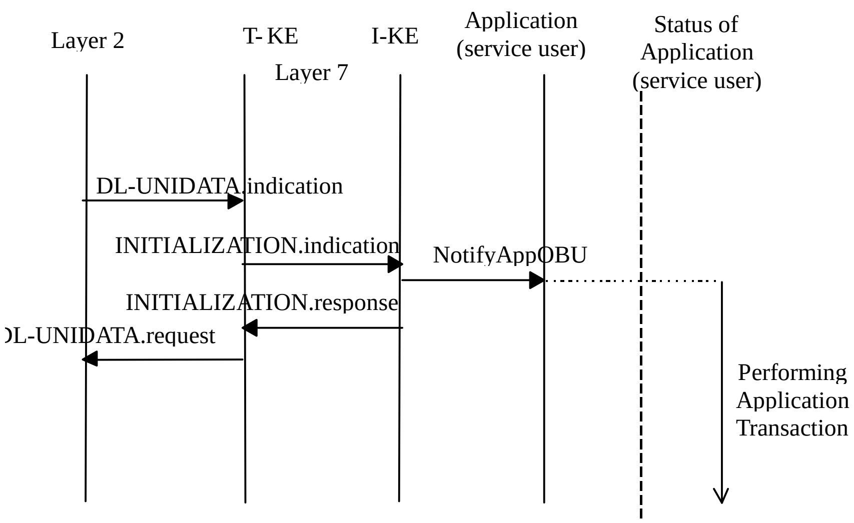


Fig.4.4.5.6.2 Management of Application-Status Sequence (2)

4.4.6 Communication procedures for applications

Annex G shows SDL diagrams for these procedures.

4.4.6.1 Broadcast transfer service

4.4.6.1.1 Scope

On the base station, the B-KE may cyclically send the data stored in the Broadcast Pool to the mobile stations using BroadcastData primitive provided by the I-KE and the SET.request primitives provided by the T-KE. Its interval period of the broadcasting service is t11.

On base station side, the B-KE should store the received data in the Broadcast Pool, and it should realize the collection and distribution of information for different applications in the mobile station exchanging the GetBroadcastData.request and the GetBroadcastData.confirm provide by the B-KE.

4.4.6.1.2 Procedures (Sequence)

The layer 7 may perform the broadcast data transfer procedures on the base station side and the mobile station side according to following sequence steps as illustrated in Fig. 4.4.6.1.

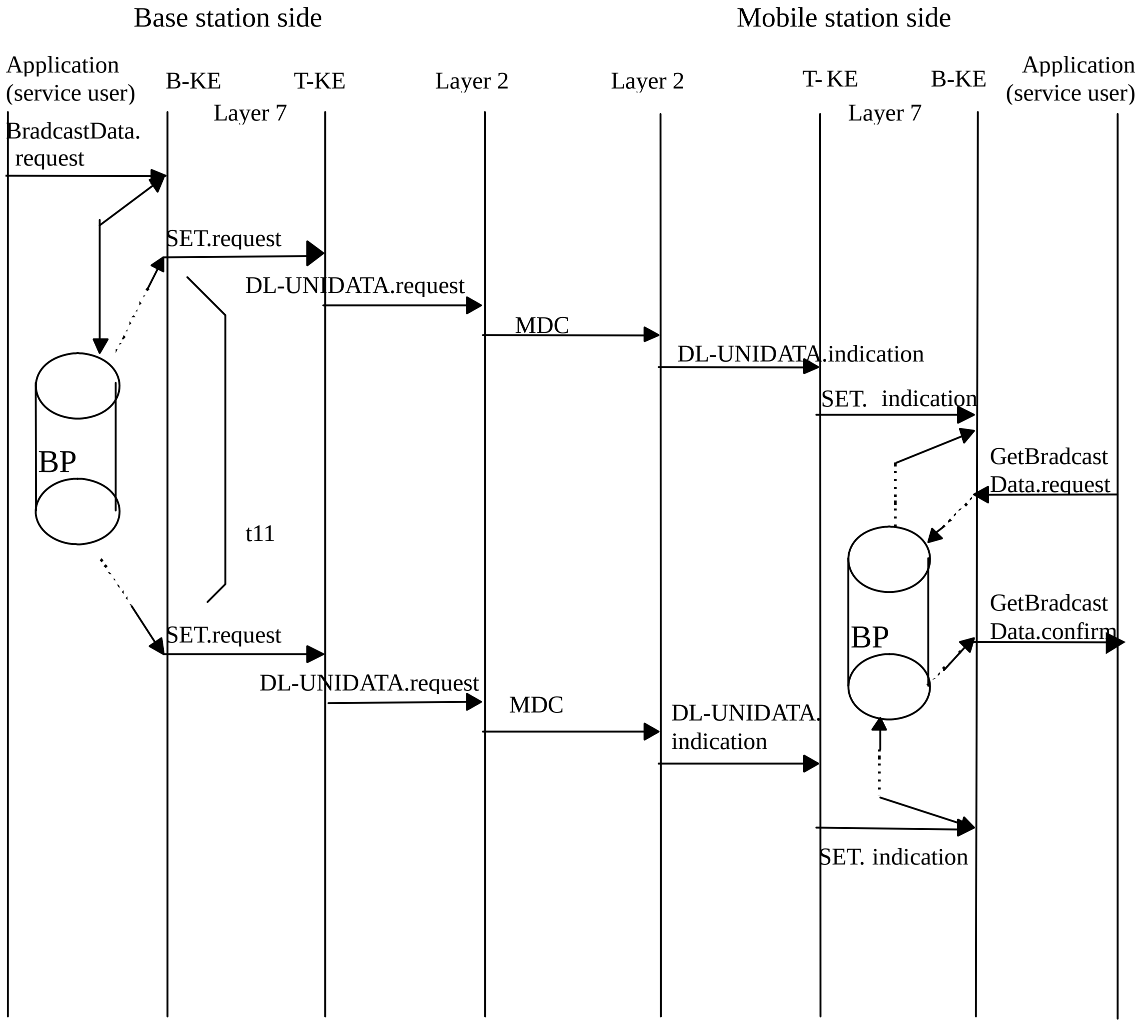


Fig.4.4.6.1 Broadcast Data Transfer Sequence

4.4.6.2 Procedures for Point-to-Point Data Transfer

4.4.6.2.1 Scope

The peer applications (service users) shall perform the data transfer for point-to-point communication using GET/SET/ACTION/EVENT_REPORT service primitives provided by the T-KE on the base station and the mobile station.

4.4.6.2.2 Procedures (Sequence)

Fig. 4.4.6.2 shows the example of the Point-to-Point data transfer procedures (sequence) using GET service primitive.

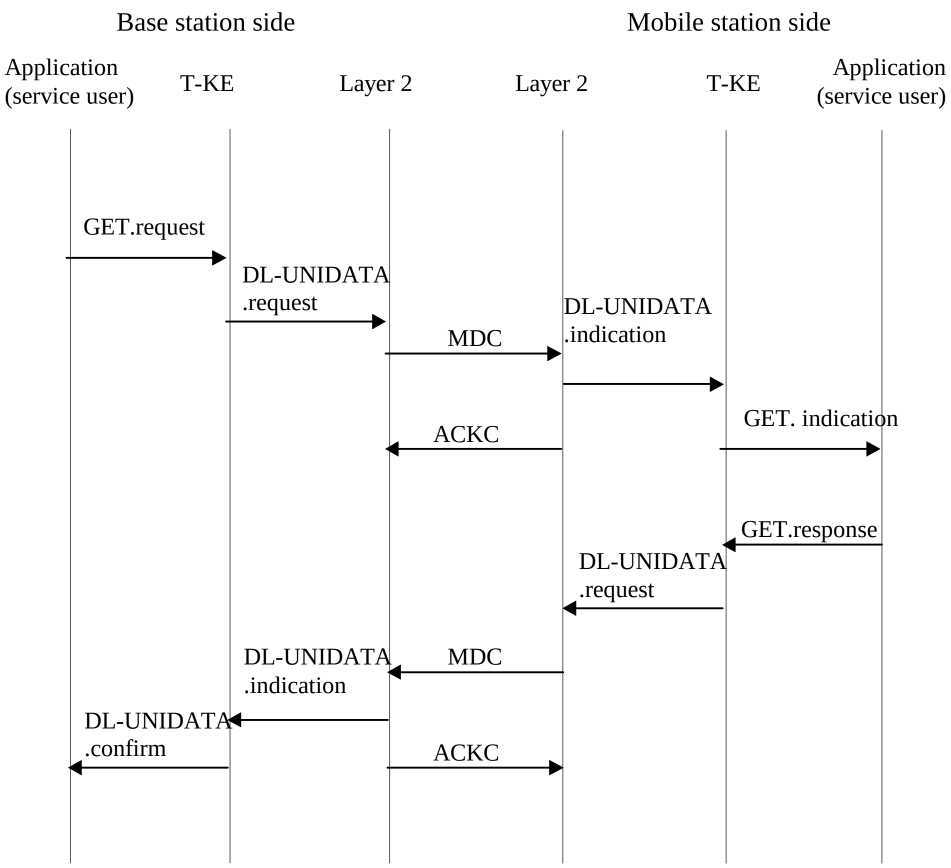


Fig.4.4.6.2 Point-to-Point Data Transfer Sequence

4.4.6.3 Procedures for Data Transfer with Priority

The I-KE shall register at the MIB the priorities for applications received inside the BST. This information is given to the T-KE.

The layer 7 shall inquire about the transmission state whether or not the transmission of the layer 2 for PDUs is available at this time. If it is available, the layer 7 shall pass an LPDU with the highest priority for transmission in respect to priorities registered by RegisterApplicationRSU(Beacon) primitives. If it is not available, the layer 7 shall wait during a certain defined period (t12) and ask again. Fig. 4.4.6.3 shows the data transfer procedures (sequence) with the priority.

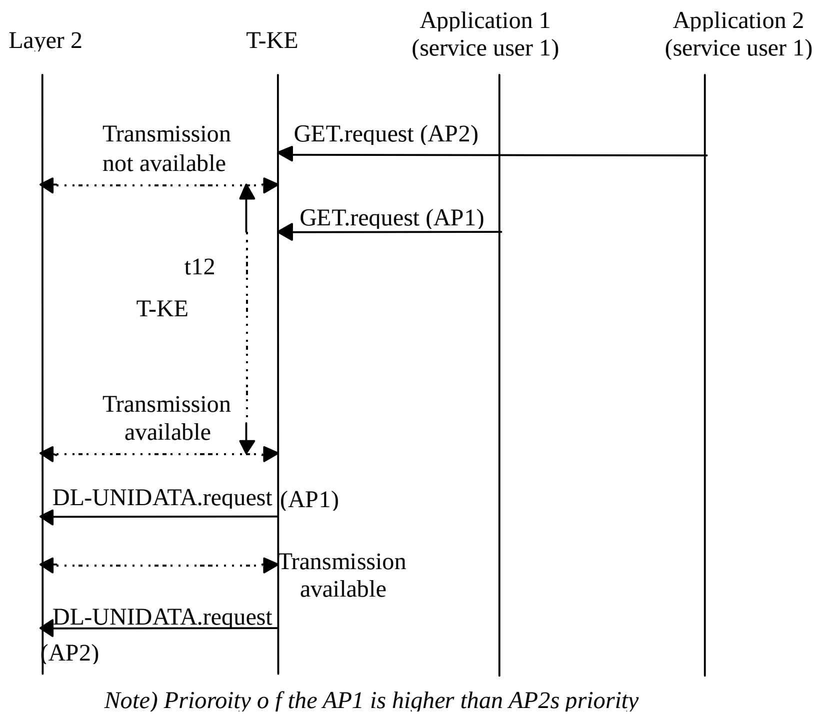


Fig.4.4.6.3 Data with priority Transfer Sequence

4.4.6.4 Encoding/Decoding

On the base station side / mobile station side, the T-KE shall encode the request and response PDUs according to ASN. 1-BASIC-PER, UNALIGNED. The T-KE shall add “0” bits until the number of bits is a multiple of eight.

The T-KE shall decode the PDU. If more than 7 trailing bits are received and if not more than 7 bits in sequence have the value “0”, these “0” bits are removed as bits inserted to achieve an octet alignment.

Definition of ASN.1 datatypes may import modules from application (service user). However, the functionalities of importing procedures for ASN.1 modules from applications are not used in this standard at this time. The parameters required the definition of ASN.1 decoding / encoding rule on the application (service user) side, the datatypes shall be OCTET STRING type, in the following parameters.
The service interface and procedures for importing ASN.1 modules from applications is the subject of further ongoing study and resolution. (see annex H).

(1) ACTION service ……………ActionParameter, ResponseParameter
(2) EVENT_REPORT service …EventParameter
(3) ApplicationList………………parameter
(4) Attribute …………………… AttributeValue

Note) APDU shall be encoded or decoded from the most significant bit (MSB) of each octet.

4.4.6.5 Concatenation/Deconcatenation

4.4.6.5.1 Scope

Plural (two) consecutive APDU fragments may be mapped on one LPDU. APDU header for each APDU shall be added at the beginning, since the peer layer 7 (destination) may be easily de-concatenated the concatenated APDU.
However, if the concatenation is not made, a PDU header, demanded at minimum shall be added to an APDU.

4.4.6.5.2 Conditions for Concatenation

The concatenation shall be only permitted under following three conditions;

1) In the case of concatenation of two APDUs, the LIDs are the same and the length of one concatenated LPDU is less than the maximum LPDU length.

2) When the waiting state for the layer 2 transmission has occurred, the current state is the ready state.

3) The flowcontrol parameter of each APDU that is intended to concatenate meets the conditions specified in Table. 4.4.6.5.2.

Table. 4.4.6.5.2. The combination conditions of the flowcontrol parameters of APDUs

Flowcontrol Parameter		1	2	4	7	10	12
1	DL_UNIDATA.request without response	√	√	√	–	–	√
2	DL_UNIDATA.request with response	√	–	–	–	–	–
4	DL_DATA_ACK.request	√	–	–	–	–	–
7	DL_REPLY.request	–	–	–	–	–	–
10	DL_REPLY_UPDATE.request	–	–	–	–	–	–
12	DL_UNIDATA.request wait response	√	–	–	–	–	–

√: Available   : not available

Note) On concatenating an APDUs having the flowcontrol parameter "1" and an APDU having the flowcontrol parameter "12" into one PDU, the concatenation of each PDU is not actually be made, and the APDU having the flowcontrol parameter "1" is made the transmission using the flowcontrol parameter "2".

4.4.6.5.3 PDU header

The T-KE shall add a PDU header to the PDUs that are going to deliver to the layer 2 (the LLC sublayer). The PDU header shall consist of a PDU indicator, a PDU number, a PDU counter and a PDU extension indicator. The PDU header shall have the format as illustrated in Fig. 4.4.6.5.

Bit number

8	7	6	5	4	3	2	1
PDU indicator	PDU Number				PDU counter		Extension indicator

Fig. 4.4.6.5. The PDU header format

4.4.6.5.3.1 PDU indicator

It shall be “1”.

4.4.6.5.3.2 PDU number

The APDU passed from the B-KE, the number set to, $[0000]_B$ or $[0001]_B$ shall be used. It shall be set to the number from 2 through 15.

Note) The basic and the mobile station must not estimate PDU number when receiving an APDU.

4.4.6.5.3.3 PDU counter

It shall be “0”.

4.4.6.5.3.4 PDU counter extension indicator

It shall be “1”.

Empty page

4.5 Systems Management

4.5.1 Introduction

Systems Management (SME) provides mechanisms to monitor, control and coordinate resources in the environment of the radio communication system specified in this standard, and services to communicate information (MIB etc.) which is relevant to those resources.

Those resources are regarded as managed objects with defined properties in order to describe management operations on the resources. Information required for systems management is provided through local input.

4.5.1.1 Systems Management Model

Figure 4.5.1.1 indicates that the interactions, which take place between systems management application entities, are abstracted in terms of management operations and notifications that are issued by one entity to other. These entities exchange management information, using systems management services.

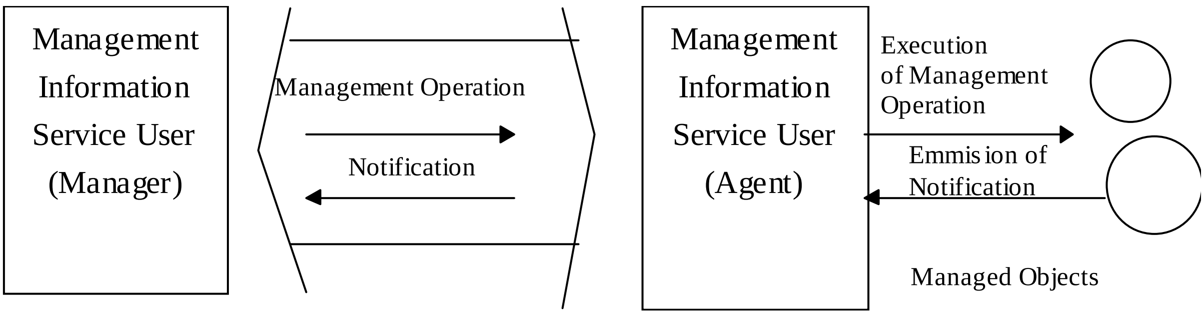


Fig. 4.5.1.1 Interaction of the Systems Management

For the purpose of systems management, management applications are categorized as management information service users and are achieved through the interactions between two management information service users. For each interaction, one management information service user takes the role of a manager, while the other takes the role of an agent.

A management information service user taking the role of an agent manages the managed objects within its local system environment as a part of a distributed application. An agent performs management operations on managed objects according to management operations provided by a manager. An agent may also send notifications emitted by managed objects to a manager.

Management information services user taking the role of a manager issues management operations and receives notifications.

The concept of a manager is not limited only to applications participating in systems management. Other applications that need to access to management information may use management information services.

4.5.1.2 Scope

Systems management specified in this standard is applicable to the systems management processes in the local systems environment. This standard specifies management information services taking place between two management information service users (one taking the manager role, the other the agent role).

The implementation matters on how to provide the services specified in this standard are out of the scope of this standard.

Details of the management application are out of this standard. Therefore, the management operation by a manager which is dependent on the contents of the management application, the semantics of the information or commands exchanged by the services and the managed objects defined in the aspect of management are not subject to standardization.

Note) The radio communication system architecture in this standard does not include the management operation in which the information is exchanged on a remote management entity.

The management operation, which does not need the management information exchange with a manager, is defined as a part of the function of an agent in this standard. The content of those management operations is specified in this standard.

4.5.2 Service Interface of Systems Management

4.5.2.1 Outline of Services

Management information services are used between management information service users of the peer application process to exchange information and commands for systems management.

Information transfer services are categorized into the following two services.

(1) Management notification service
(2) Management operation service

Note) Management information service provider is defined as the abstracted concept for the entire entity, providing the management information services to the management information service user in the local system environment.

4.5.2.2 Management Notification Service

Definition of the notification and the resulting behavior of the communication entity depend on the specification of the managed object which generates the notification, and are excluded in the scope of management information services. However, some notifications are often used for the system management. The service (SME_EVENTREPORT service) applicable to the information transfer for those notification are therefore defined.

A management information service user (agent) to report the event invokes SME_EVENTREPORT service on the managed object to a peer management information service user (manager).

This service is applicable to both the confirmed-service mode (requiring response) and non-confirmed-service mode (requiring no response).
Figure 4.5.2.2 shows the logical relationship of each primitive.

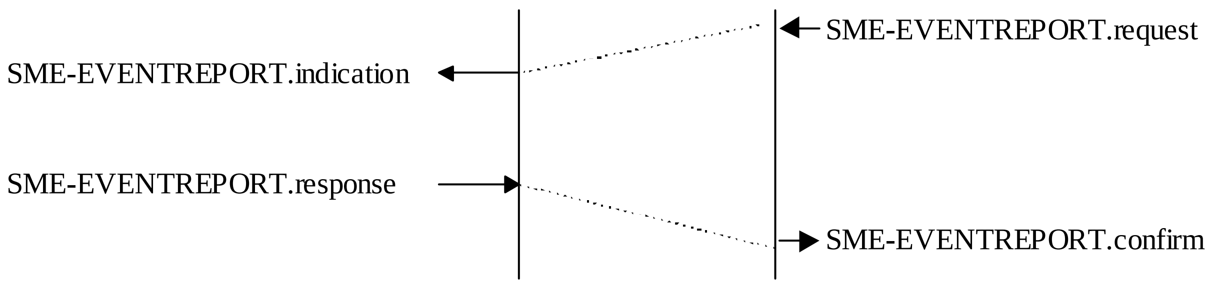


Fig. 4.5.2.2 Time Sequence Diagrams of the Management Notification Service

4.5.2.2.1 SME_EVENTREPORT.request

(1) Function
This primitive is the service request primitive for the management notification service.

(2) Semantics of Service Primitive

This primitive shall provide the following parameters.

SME_EVENTREPORT.request
(Mode, event_type, event_time, event_parameter)

The mode parameter shall indicate the mode required for the operation. The value for this parameter shall indicate either confirmed-service mode or non-confirmed-service mode.
The event_type parameter shall specify the type of the event to be reported.
The event_time parameter shall indicate the time when the event occurred. This parameter is optional.
The event_parameter parameter shall indicate the information relevant to the event. This parameter is optional.

(3) When Generated

The agent to report the confirmed event to the manager generates this primitive. This primitive is passed from the agent to the management information service provider.

4.5.2.2.2 SME_EVENTREPORT.indication

(1) Function

This primitive is the service indication primitive for the management notification service.

(2) Semantics of Service Primitive

This primitive shall provide the following parameters.

SME_EVENTREPORT.indication
(Mode, event_type, event_time, event_parameter)

The mode parameter shall indicate the mode required for the operation. The value for this parameter shall indicate either confirmed-service mode or non-confirmed-service mode.
The event_type parameter shall specify the type of the event to be reported.
The event_time parameter shall indicate the time when the event occurred. This parameter is optional.
The event_parameter parameter shall indicate the information relevant to the event. This parameter is optional.

(3) When Generated

This primitive is passed from the management information service provider to the manager to report the arrival of the SME_EVENTREPORT.request.

4.5.2.2.3 SME_EVENTREPORT.response

(1) Function
This primitive is the service response primitive for the management notification service.

(2) Semantics of Service Primitive
This primitive shall provide the following parameters.

SME_EVENTREPORT.response
(event_type, response_time, response_parameter, status)

The event_type parameter shall indicate the type of the event reported by the corresponding SME_EVENTREPORT.indication.
The response_time parameter shall indicate the time of the response. This parameter is optional.
The response_parameter parameter shall indicate the response information for the report of the event. This parameter is optional.
The status parameter shall indicate the status of the operation. This parameter includes error codes of the operation for the reported event. This parameter is optional.

(3) When Generated
The manager generates this primitive when the mode parameter of the previous associated SME_EVENTREPORT.indication indicates the confirmed-service mode. This primitive is passed from the manager to the management information service provider.

4.5.2.2.4 SME_EVENTREPORT.confirm

(1) Function
This primitive is the confirmation service primitive for the management notification service.

(2) Semantics of Service Primitive
This primitive shall provide the following parameters.

SME_EVENTREPORT.confirm
(event_type, response_time, response_parameter, status)

The event_type parameter shall indicate the type of the event. The response is identified to be the response for the reported event by this parameter.
The response_time parameter shall indicate the time of the response. This parameter is optional.
The response_parameter parameter shall indicate the response information for the report of the event. This parameter is optional.

The status parameter shall indicate the status of the operation. This parameter includes error codes for the operation of the manager. This parameter is optional.

(3) When Generated
This primitive is passed from the management information service provider to the agent to indicate the arrival of the SME_EVENTREPORT.response.

4.5.2.3 Management Operation Service

Management operation services are categorized as follows.

(1) SME_GET service
(2) SME_SET service
(3) SME_RESET service

A manager to request an agent to retrieve the management information invokes SME_GET service. This service is applicable only to the confirmed-service mode and requires response.
A manager to request an agent to modify the management information invokes SME_SET service. This service is applicable both to the confirmed-service mode and non-confirmed-service mode. Response is required in case of confirmed-service mode.
A manager to request an agent to initialize the management information invokes SME_RESET service. This service is applicable only to the confirmed-service mode and requires response.
Figure 4.5.2.3 shows the logical relationship of each primitive.

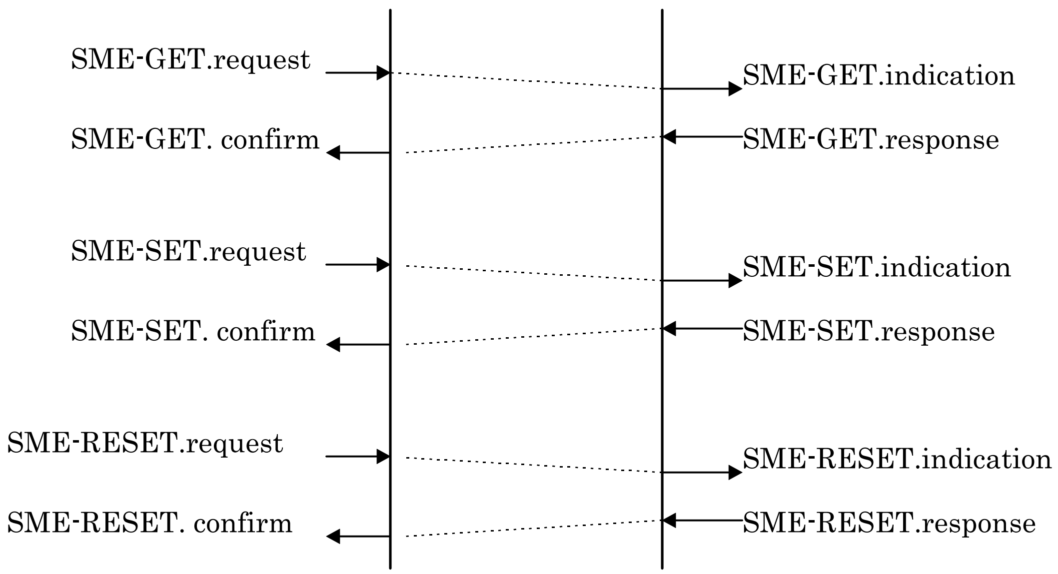


Fig. 4.5.2.3 Time Sequence Diagrams of the Management Operation Service

4.5.2.3.1 SME_GET.request

(1) Function
This primitive is the service request primitive for the management operation service.

(2) Semantics of Service Primitive
This primitive shall provide the following parameters.

SME_GET.request (layer_id, MIB_attribute)

The layer_id parameter shall specify the identifier of the layer to be retrieved.
The MIB_attribute parameter shall indicate the name of the variables in the MIBs defined for each layer.

(3) When Generated
The manager to require the agent to retrieve the management information generates this primitive. This primitive is passed from the manager to the management information provider.

4.5.2.3.2 SME_GET.indication

(1) Function
This primitive is the service indication primitive for the management operation service.

(2) Semantics of Service Primitive
This primitive shall provide the following parameters.

SME_GET.indication (layer_id, MIB_attribute)

The layer_id parameter shall specify the identifier of the layer to be retrieved.
The MIB_attribute parameter shall indicate the name of the variables in the MIB to be retrieved.

(3) When Generated
This primitive is passed from the management information service provider to the agent to indicate the arrival of the SME_GET.request.

4.5.2.3.3 SME_GET.response

(1) Function
This primitive is the service response primitive for the management operation service.

(2) Semantics of Service Primitive
This primitive shall provide the following parameters.

SME_GET.response
(status, MIB_attribute, MIB_attribute_value)

The status parameter shall indicate the results of the retrieval of the variables taken place on receipt of SME_GET.indication. Either success or failure is applicable to the value of this parameter.
The MIB_attribute parameter shall indicate the name of the variables designated by SME_GET.indication.
The MIB_attribute_value parameter shall indicate the value for those variables.

NOTE) when the status parameter indicates failure, the MIB_attribute_value shall be null.

(3) When Generated
This primitive is generated by the agent to report the result of the retrieval, carried out by receiving the SME_GET.indication, to the manager. This primitive is passed from the agent to the management information provider.

4.5.2.3.4 SME_GET.confirm

(1) Function
This primitive is the confirmation service primitive for the management operation service.

(2) Semantics of Service Primitive
This primitive shall provide the following parameters.

SME_GET.confirm
(status, MIB_attribute, MIB_attribute_value)

The status parameter shall indicate whether the results of the retrieval are success or failure.
The MIB_attribute parameter shall indicate the name of the variables designated by SME_GET.indication. The response is identified by this parameter to be corresponding to the required operation.
The MIB_attribute_value parameter shall indicate the value for those variables.

(3) When Generated
This primitive is passed from the management information service provider to the manager to report the arrival of the SME_GET.response.

4.5.2.3.5 SME_SET.request

(1) Function
This primitive is the service request primitive for the management operation service.

(2) Semantics of Service Primitive
This primitive shall provide the following parameters.

SME_SET.request
(mode, layer_id, MIB_attribute, MIB_attribute_value)

The mode parameter specifies the required mode for the operation. The possible value for this parameter is either confirmed-service mode or non-confirmed-service mode.
The layer_id parameter shall specify the identifier of the layer to be modified.
The MIB_attribute parameter shall indicate the name of the variables in MIBs defined for each layer.
The MIB_attribute_value parameter shall indicate the value for the variables to be modified.

(3) When Generated
The manager to require the agent to modify the management information generates this primitive. This primitive is passed from the manager to the management information provider.

4.5.2.3.6 SME_SET.indication

(1) Function
This primitive is the service indication primitive for the management operation service.

(2) Semantics of Service Primitive
This primitive shall provide the following parameters.

SME_SET.indication
(mode, layer_id, MIB_attribute, MIB_attribute_value)

The mode parameter specifies the required mode for the operation. The possible value for this parameter is either confirmed-service mode or non-confirmed-service mode.
The layer_id parameter shall specify the identifier of the layer to be modified.
The MIB_attribute parameter shall indicate the name of the variables in the MIB to be modified.
The MIB_attribute_value parameter shall indicate the value for the variables to be modified.

(3) When Generated
This primitive is passed from the management information provider to the agent to indicate the arrival of SME_SET.request.

4.5.2.3.7 SME_SET.response

(1) Function
This primitive is the service response primitive for the management operation service.

(2) Semantics of Service Primitive
This primitive shall provide the following parameters.

SME_SET.response (status, MIB_attribute)

The status parameter shall indicate the results of the modification of the variables taken place on receipt of SME_SET.indication. Either success or failure is applicable to this parameter.
The MIB_attribute parameter shall indicate the name of the variables designated by SME_SET.indication. The response is identified by this parameter to be corresponding to the required operation.

(3) When Generated
The agent generates this primitive when the mode parameter of the previous associated SME_SET.indication indicates the confirmed-service mode. This primitive is passed from the agent to the management information service provider.

4.5.2.3.8 SME_SET.confirm

(1) Function
This primitive is the confirmation sevice primitive for the management operation service.

(2) Semantics of Service Primitive
This primitive shall provide the following parameters.

SME_SET.confirm (status, MIB_attribute)

The status parameter shall indicate whether the result of the modification is success or failure.
The MIB_attribute parameter shall indicate the name of the variables designated by the SME_GET.indication. The response is identified by this parameter to be corresponding to the required operation.

(3) When Generated
This primitive is passed from the management information service provider to the manager to report the arrival of the SME_SET.response.

4.5.2.3.9 SME_RESET.request

(1) Function
This primitive is the service request primitive for the management operation service.

(2) Semantics of Service Primitive
This primitive shall provide no parameters.

SME_RESET.request ( )

(3) When Generated
The manager to require the agent to initialize the management information generates this primitive. This primitive is passed from the manager to the management information service provider.

4.5.2.3.10 SME_RESET.indication

(1) Function
This primitive is the service indication primitive for the management operation service.

(2) Semantics of Service Primitive
This primitive shall provide no parameters.

SME_RESET.indication ( )

(3) When Generated
This primitive is passed from the management information serviceprovider to the agent to indicate the arrival of the SME_RESET.request.

4.5.2.3.11 SME_RESET.response

(1) Function
This primitive is the service response primitive for the management operation service.

(2) Semantics of Service Primitive
This primitive shall provide the following parameter.

SME_RESET.response (status)

The status parameter shall indicate the result of the initialization of the management information taken place on receipt of the SME_RESET.indication. Either success or failure is applicable to this parameter.

(3) When Generated
This primitive is generated by the agent to report the result of the initialization of the management information, taken place on receipt of the SME_RESET.indication, to the manager. This primitive is passed from the agent to the management information service provider.

4.5.2.3.12 SME_RESET.confirm

(1) Function
This primitive is the confirmation service primitive for the management operation service.

(2) Semantics of Service Primitive
This primitive shall provide the following parameter.

SME_RESET.confirm (status)

The status parameter shall indicate the result of the initialization of the management information taken place on receipt of the SME_RESET.indication. Either success or failure is applicable to this parameter.

(3) When Generated
This primitive is passed from the management information service provider to the manager to report the arrival of the SME_RESET.response.

4.5.3 System Management Procedure

4.5.3.1 Report of Event

An agent issues a SME_EVENTREPORT request primitive to a management information service provider to report an event to a manager.

On receipt of the primitive the management information provider shall issue a SME_EVENTREPORT indication primitive to the manager.

In the confirmed-service mode, the manager shall issue a SME_EVENTREPORT response primitive to the management information service provider to report the result whether the SME_EVENTREPORT request primitive was accepted or not.

In the confirmed-service mode, the management information service provider shall issue a SME_EVENTREPORT confirm primitive to the agent.

4.5.3.2 Retrieval of Management Information

A manager issues a SME_GET request primitive to a management information service provider to require an agent to retrieve the values of variables in the MIB.

On receipt of the primitive the management information service provider shall issue a SME_GET indication primitive to the agent.

If the agent is not capable of carrying out the operation, the agent shall issue a SME_GET response primitive containing the status parameter of failure to the management information service provider.

If the agent is capable of carrying out the operation, the agent shall identify the designated layer according to the layer_id parameter, and issue a XX_GET request primitive (either ALME, MLME or PLME is applicable to XX) to the layer management entity supported by the designated layer to request the retrieval of the values. The values are derived from the XX_GET confirm primitive of the layer management entity.

On receipt of the XX_GET confirm primitive containing status parameter of success, the agent shall issue a SME_GET response primitive with the MIB_attribute_value parameter of the retrieved value and the status parameter of success to the management information service provider. On receipt of the XX_GET confirm primitive containing status parameter of failure, the agent shall issue a SME_GET response primitive with the status parameter of failure to the management information service provider.

If the layer_id is not defined, the agent shall derive the values of variables from the MIB that the agent is allowed to access directly.

On successful retrieval of the values, the agent shall issue a SME_GET response primitive containing status parameter of success to the management information service provider. On unsuccessful retrieval of the values, the agent shall issue a SME_GET response primitive containing status parameter of failure to the management information service provider.

On receipt of the SME_GET response primitive from the agent, the management information service provider shall issue a SME_GET confirm primitive to the manager and thus complete the operation of the management information retrieval.

4.5.3.3 Modification of Management Information

A manager issues a SME_SET request primitive to a management information service provider to require an agent to modify the values of variables in the MIB.

On receipt of the primitive the management information service provider shall issue a SME_SET indication primitive to the agent.

If the agent is not capable of carrying out the operation, the agent shall issue a SME_SET response primitive containing the status parameter of failure to the management information service provider.

If the agent is capable of carrying out the operation, the agent shall identify the designated layer according to the layer_id parameter, and issue a XX_SET request primitive (either ALME, MLME or PLME is applicable to XX) to the layer management entity supported by the designated layer to request the modification of the values.

On receipt of the XX_SET confirm primitive containing the status parameter of success, the agent shall issue a SME_SET response primitive with the status parameter of success to the management information service provider. On receipt of the XX_SET confirm primitive containing the status parameter of failure, the agent shall issue a SME_SET response primitive with the status parameter of failure to the management information service provider.
If the layer_id is not defined, the agent shall modify the values of variables from the MIB that the agent is allowed to access directly.

On successful modification of the values, the agent shall issue a SME_GET response primitive containing the status parameter of success to the management information service provider. On unsuccessful modification of the values, the agent shall issue a SME_SET response primitive containing the status parameter of failure to the management information service provider.

On receipt of the SME_SET response primitive from the agent, the management information service provider shall issue a SME_SET confirm primitive to the manager and thus complete the operation of the management information modification.

4.5.3.4 Initialization of Management Information

A manager issues a SME_RESET request primitive to a management information service provider to require an agent to initialize the values of variables in the MIB.

On receipt of the primitive the management information service provider shall issue a SME_RESET indication primitive to the agent.

If the agent is not capable of carrying out the operation, the agent shall issue a SME_RESET response primitive containing the status parameter of failure to the management information service provider.

If the agent is capable of carrying out the operation, the agent shall derive the initial values for each MIB of the respective layers from the MIB under its own control, and shall issue XX_RESET request primitives (either ALME, MLME or PLME is applicable to XX) for each layer to request each layer management entity to modify the values respectively.

If all the received XX_RESET confirm primitives from those layers contain the status parameter of success, the agent shall issue a SME_RESET response primitive with the status parameter of success to the management information service provider. If at least one of the received XX_RESET confirm primitives contain the status parameter of failure, the agent shall issue a SME_RESET response primitive with status parameter of failure to the management information service provider.

On receipt of the SME_RESET response primitive from the agent, the management information service provider shall issue a SME_RESET confirm primitive to the manager and thus complete the operation of the management information initialization.

4.5.4 Independent Management Operation of Agent

4.5.4.1 Failure Detection of Mobile Station

An agent shall maintain a timer (failure detection timer) which is independent of the other functions.

The agent shall periodically initialize the failure detection timer in order not to make it expired.

On detection of the expiration of the failure detection timer, the agent shall regard the mobile station to have failed, and shall carry out the necessary operation at least to prevent the erroneous transmission.

The maximum value of the failure detection timer shall be t9 sec.

Chapter 5 Measurement Methods

In subcaluse 5.1 Transmission system and subcalause 5.2 reception system, the measurement methods are presented for transceiver with attaching connectors to antenna and pattern generator. For transceiver without attaching connectors, the measurement methods are given in subclause 5.3. The attaching connectors to antenna should have enough return loss to measure with measurement test sets.

5.1 Transmission system

Detailed explanations on measurement methods are given subclauses 5.1.1 through 5.1.12.

For a subclause in which more than one measurement method is described, any method can be used as long as the measurement accuracy is maintained.
The following subclauses are common for all the measurement methods.

(a) The standard encoding test signal used for modulation shall be pseudo noise random test signal.

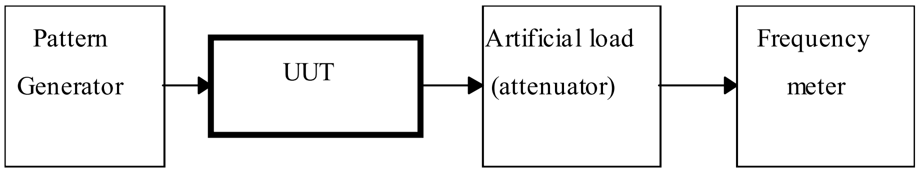
The generator polynomial shall be: $1+X^{14}+X^{15}$

(b) In the case of ASK modulation, definition for inner burst section shall be at least 73 octets ranging from the beginning of the symbol immediately after ramp up to the end of the symbol immediately before ramp down. In the case of π/4 shift QPSK modulation, it shall be at least 270(TBD) octets ranging from the beginning of the symbol immediately after ramp up to the end of the symbol immediately before ramp down.

(C) In the case of ASK modulation, definition of outer burst section shall be at least 94 symbols from the end of the symbol immediately before ramp down minus 3 symbols to the beginning of the symbol immediately after ramp up of the next slot minus 3 symbols. In the case of π/4 shift QPSK modulation, it shall be at least 186(TBD) symbols from the end of the symbol immediately before ramp down minus 3 symbols to the beginning of the symbol immediately after ramp up of the next slot minus 3 symbols.

5.1.1 Frequency tolerance

(1) Measuring system diagram



(2) Conditions for measuring instrument

a. A frequency counter shall be used as the frequency meter.

(3) Conditions for unit under test (UUT) and measuring procedures

a. Test frequency should be set for transmission.
Output signal of pattern generator shall be the standard encoding test signals. UUT shall be set continuously transmitting mode.

b. When fixed pattern test signals for modulation is used by test mode UUT the offset by test signals may be rectified.

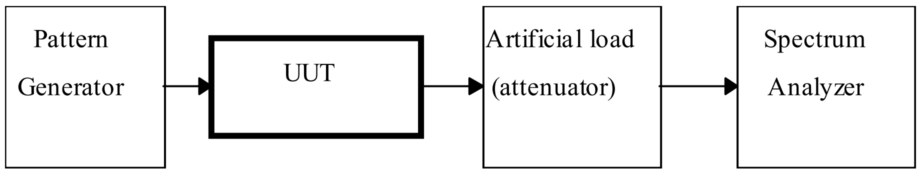
c. When a transmitter can output non-modulated carrier waves and features a circuitry system in which the center of modulation spectrum becomes the carrier frequency, non-modulated can be applied.

(4) Other methods

In the case of radio equipment using a circuitry in which the frequency accuracy of the reference oscillator becomes the transmit output frequency accuracy, measurement can be done directly with the reference oscillator output frequency.

5.1.2 Transmission spurious

(1) Measuring system diagram



(2) Conditions for UUT
The test frequency is set for transmission and output power is continuous. When a transmitter can output non-modulated carrier waves and features a circuitry system in which the center of modulation spectrum becomes the carrier frequency, non-modulated can be applied.

(3) Measuring procedures

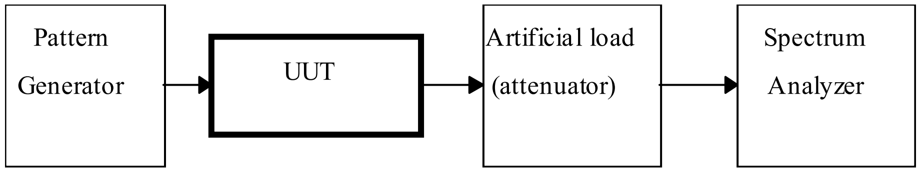
a. The spurious shall be searched for from 100kHz to 18GHz except for center frequency +/- 7.2MHz.

b. The center frequency of spectrum analyzer shall be tuned with the detected spurious frequency.

c. The power distribution shall be measured by the spectrum analyzer. The measured power shall be converted to the power in bandwidth of 4.4MHz in case that the measured power varies when the resolution bandwidth changes.

5.1.3 Occupied bandwidth

(1) Measuring system diagram



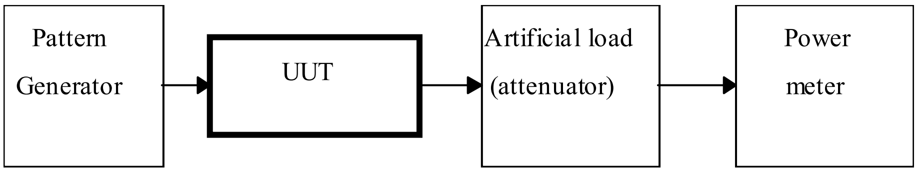
(2) Conditions for unit under test (UUT) and measuring procedures

a. Test frequency should set for transmission.
Output signal of pattern generator shall be the standard encoding test signals.
UUT should set to continuously transmitting mode.

b. The frequency sweeping range of spectrum analyzer should about 2 to 3.5 times the occupied bandwidth standard.

5.1.4 Transmit power

(1) Measuring system diagram



(2) Condition for measuring instrument
The power shall be measured in the positive peak mode for ASK modulation. The positive peak mode or the effective power mode shall be applied for π/4 shift QPSK modulation.

(3) Conditions for unit under test (UUT)

a. Test frequency should set for transmission.
Output signal of pattern generator shall be the standard encoding test signals.
UUT shall set continuously transmitting mode.

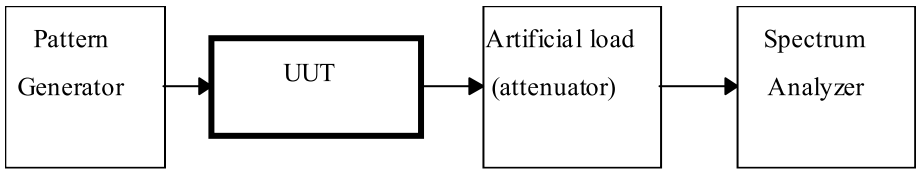
b. When a transmitter can output non-modulated carrier waves and features a circuitry system in which the center of modulation spectrum becomes the carrier frequency, non-modulated can be applied.

(4) Definition of transmitting power

The transmitting power of ASK modulation is defined peak power. In case of 50% mark the transmitting power equal to measuring power plus 3dB. When the transmitter output non-modulated carrier the transmitting power equal to measuring power.
In case of π/4 shift QPSK modulation, the transmitting power is defined as the average power during the burst cycle. The transmitting power is equal to the measuring power when the power is measured in the continuous non-modulated wave.

5.1.5 Leakage power during carrier off period

(1) Measuring system diagram



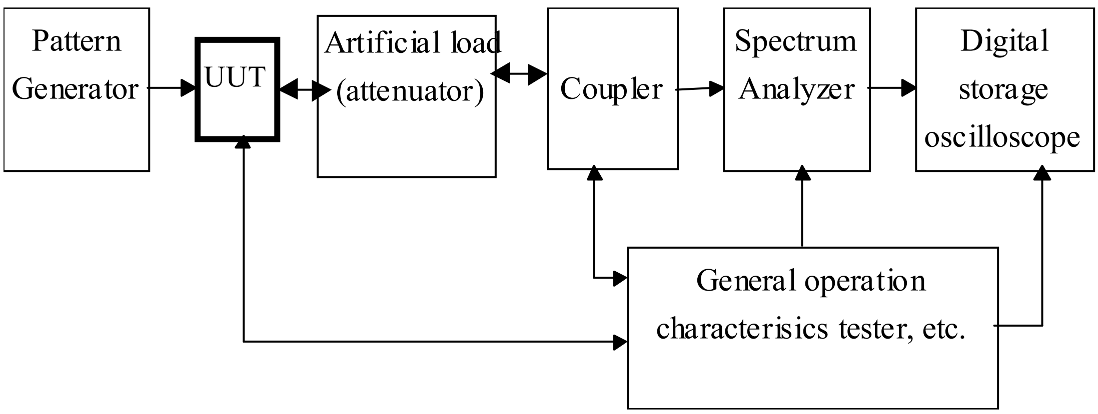
(2) Conditions for unit under test (UUT)

a. Test frequency shall set for transmission.
UUT shall set continuously carrier off mode.

5.1.6 Burst transmission transient response time

<In case of using general operation characteristics tester>

(1) Measuring system diagram



(2) Conditions for measuring instruments

a. The general operation characteristics tester or equipment which can output the trigger signal corresponding to the timing of the transmission burst shall be used.

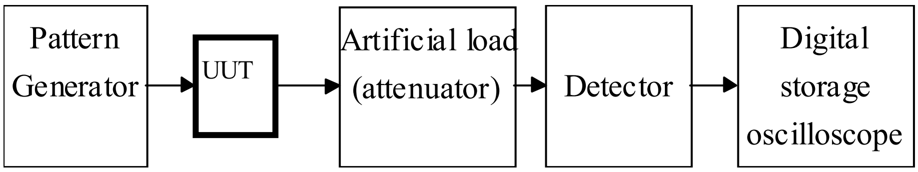
b. A spectrum analyzer attaching a video output terminal shall used. Also, the vertical axis of the oscilloscope for the entire measuring system comprised of spectrum analyzer and oscilloscope shall pre-calibrated using the power meter.

(3) Conditions for unit under test (UUT)

a. Test frequency shall set for transmission.
UUT shall be set to the mode of normal operation.

<In case of direct detecting modulated signal>

(1) Measuring system diagram



(2) Conditions for measuring instruments

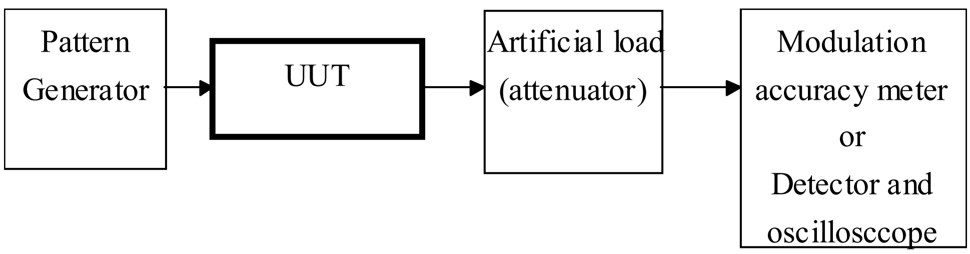
The output signal of pattern generators to be set as shown below:
All "0" or all "1" or recurring pattern of "01".

(3) Conditions for unit under test (UUT)
a. Test frequency shall be set for transmission.

5.1.7 Modulation index, Modulation accuracy

5.1.7.1 Modulation index (ASK Modulation)

(1) Measuring system diagram



(2) Conditions for measuring instruments
The modulation accuracy meter shall have a reception roll-off filter function and be capable of measuring the difference of effective value between the ideal signal and the signal that is actually transmitted.

(3) Conditions for unit under test (UUT)

a. Test frequency shall be set for transmission.
UUT shall be set continuously transmitting mode.
b. When a transmitter can set non-modulated carrier output mode and continuously carrier off mode, it can be applied that the modulation index is obtained from the carrier on/off ratio.

5.1.7.2 Modulation accuracy (π/4 shift QPSK Modulation)
The leakage power of carrier wave from UUT shall be sufficiently suppressed.

(1) Definition of modulation accuracy

a. Definition
The receiving data can be expressed as the following formula because no interference between symbols when the ideal transmitting signal is received through the wide bandwidth of receiving filter and the ideal sampling is performed in the middle of symbols.

$S(k) = s(k-1)e^{j\{\pi/4 + B(k)\cdot\pi/2\}}$ …(5.1.7.2-1)
B(k)=0,1,2,3 is referred to the following table.

Xk	Yk	B(k)
0	0	0
0	1	1
1	1	2
1	0	3

Xk and Yk denote the transformed data through the serial-parallel conversion from the sequence of binary data.
In case of the actual transmitting signal, the interference between symbols shall happen and the modulation accuracy shall be defined as the difference between the ideal and actual signals.

b. Formula of definition

$Z(k) = [C_0 + C_1 \cdot \{S(k) + E(k)\}] \cdot W^k$ …(5.1.7.2-2)

$W=e^{dr+jda}$: da[rad/symbol] is the frequency offset that correspond to phase angle. And dr[neper/symbol] is the amplitude variation.
C_0 : The constant origin offset that means unbalance quadrature modulation.
C_1 : The complex constant, which means the transmitting signal power and the transmitting signal phase.

E(k) : the residual vector error of Sample S(k).

The sum of square of vector error can be expressed as follows.

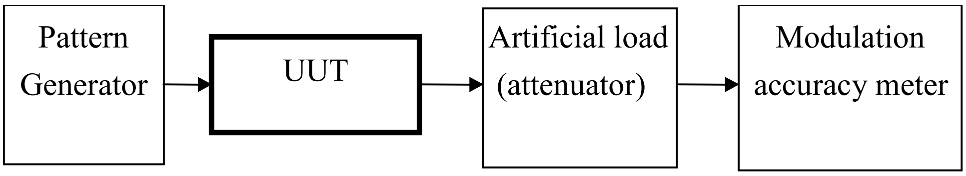
$$\sum_{k=MIN}^{MAX}\left|E(k)\right|^2 = \sum_{k=MIN}^{MAX}\left|[\{Z(k)\cdot W^{-k} - C_0\}/C_1] - S(k)\right|^2 \ldots(5.1.7.2\text{-}3)$$

C0, C1 and W shall be selected as the above sum shall be minimized, and the vector error for each symbol shall be calculated through C0, C1 and W. The sampling timing of receiving symbols shall also be optimized as the vector error shall be minimized.
MIN and MAX of slots can be given as follows.

MIN=1 :Vector after ramp up.
MAX=1049 :Vector before ramp up.

The efficient value of vector error can be calculated as the square root of $\sum\left|E(k)\right|^2/1049$, and shall be defined as the modulation accuracy.

(2) Measuring system diagram



(3) Conditions for measuring instruments
Measuring equipment for modulation accuracy shall provide the receiving filter with sufficient wide bandwidth and the difference of vector error between the ideal and actual transmitting signals.

(4) Conditions for unit under test (UUT)
UUT shall be set in the transmitting frequency.

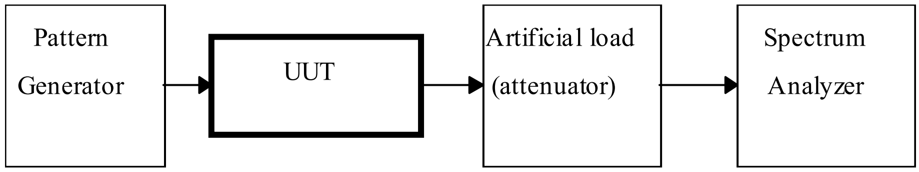
(5) measuring procedure

a. Measure the vector error between the ideal and actual transmitting signals.

b. Sum the square of vector error for each sampling point and calculate the square root of the sum divided by the number of phase discrimination point within the slot (1049).

5.1.8 Adjacent channel leakage power

(1) Measuring system diagram

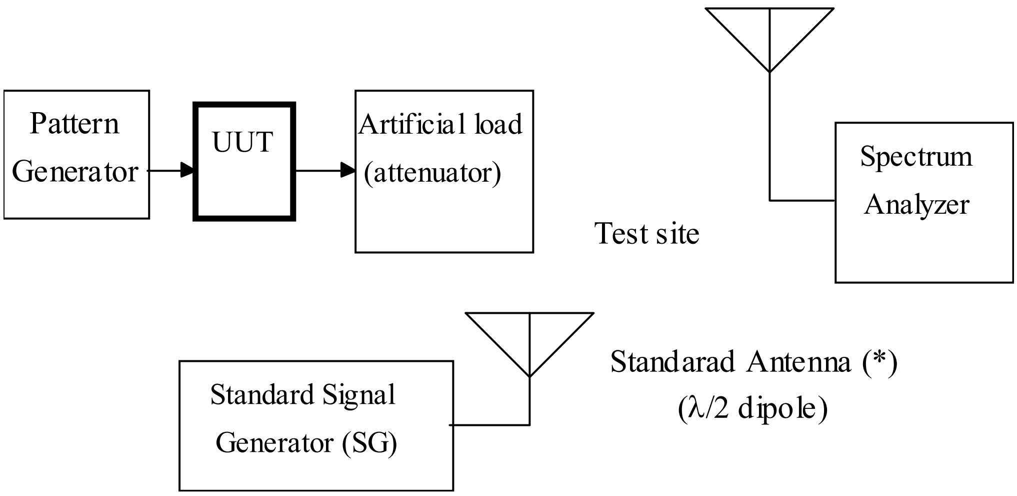


(2) Conditions for unit under test (UUT)

(a). Test frequency shall be set for transmission.
UUT shall be set continuously transmitting mode.

5.1.9 Cabinet radiation

(1) Measuring system diagram



*Pre-calibrated antenna equivalent to λ/2 dipole antenna can be applied.
Conditions for measuring instruments

(2) Conditions for measuring instruments

a. The antenna terminal of the unit under test (UUT) is terminated with an artificial load.

b. Measurement is done in the open site or anechoic chamber at distance of 3m with directional antenna for measurement. It is better to suppress the reflected ground wave to avoid trouble due to complication of height pattern. Therefore, it is better to cover the floor in the middle of measurement with absorbing materials.

c. If one side of the UUT exceeds 60 cm the distance of measurement shall be greater than 5 times the distance. If the measuring frequency is less than 100 MHz,measurment is done in the 30 m test site.

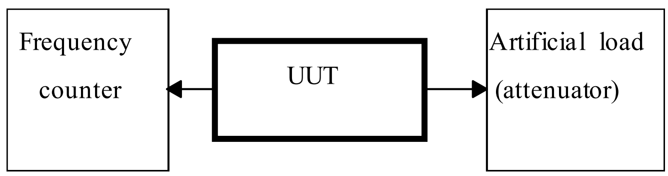
d. In case that the RF coupler is applied, the coupler shall be calibrated for every measuring frequency in the open site using the same type of equipment. λ/2 dipole antenna shall be applied as the standard antenna.

(3) Conditions for unit under test (UUT)

a. Test frequency shall be set for transmission.

5.1.10 Modulation signal rate tolerance

(1) Measuring system diagram



(2) Conditions for measuring instruments

The measuring accuracy of the frequency meter should be over one digit larger than the permissible deviation of the applicable frequency.

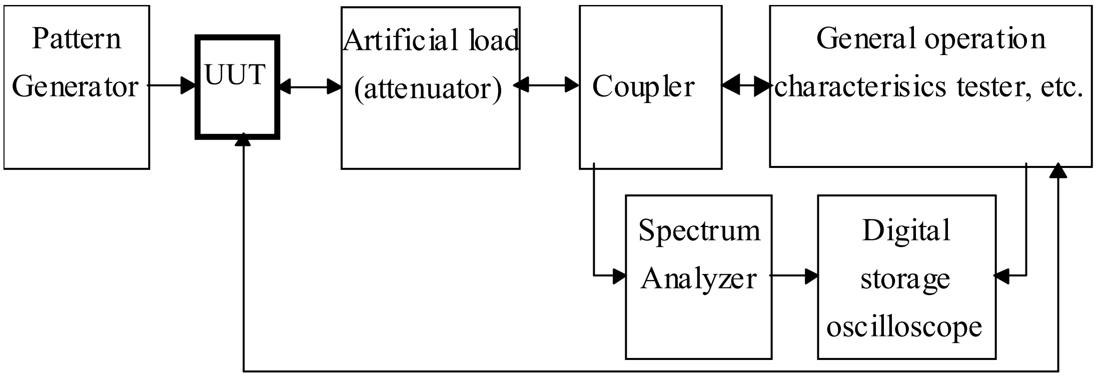
(3) Conditions for unit under test (UUT)

a. Test frequency shall be set for transmission.
UUT shall be set continuously transmitting mode.

5.1.11 Deviation of absolute signal transmission time

<In case of using general operation characteristics tester>

(1) Measuring system diagram



(2) Conditions for measuring instruments

a. The general operation characteristic tester shall feature the base station function to establish connection to the unit under test (UUT).

b. The general operation characteristics tester shall be capable of yielding the difference between the tester's transmission timing and UUT's transmission timing.

c. The general operation characteristics tester which can output the trigger signal corresponding to the timing of the transmission burst shall be used.

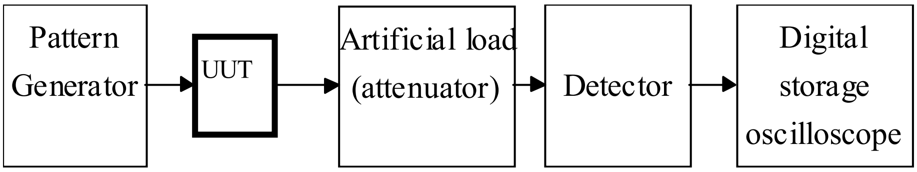
d. A spectrum analyzer attaching a video output terminal shall be used.

(3) Conditions for unit under test (UUT)
UUT shall be set to the normal operation.
a. Test frequency shall be set for transmission.

(4) Other methods
Direct measurement of transmitting and receiving digital data in UUT and general operation characteristic tester is also applicable. This measurement shall be conducted by the digital oscilloscope or the logic analyzer.

<In case of direct detecting modulated signal>

(1) Measuring system diagram



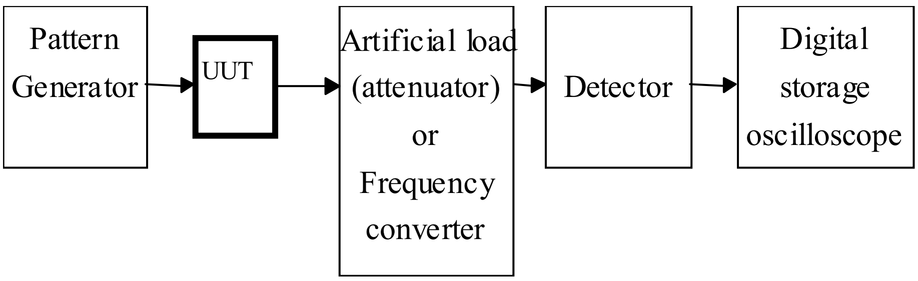
(2) Conditions for measuring instruments
The output signal of pattern generators to be set as shown below:
All "0" or all "1" or recurring pattern of "01".

(3) Conditions for unit under test (UUT)

a. Test frequency shall be set for transmission.

5.1.12 Eye pattern
(Only ASK modulation is applied)

(1) Measuring system diagram



(2) Conditions for unit under test (UUT)

a. Test frequency shall be set for transmission.
UUT shall be set continuously transmitting mode.

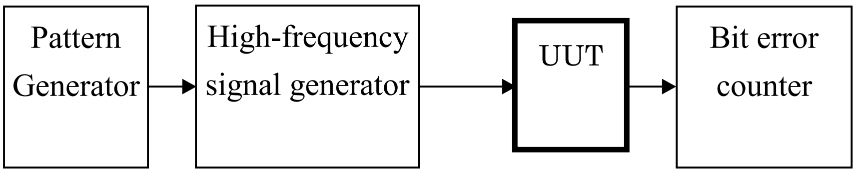
(3) Other method
The characteristics obtained from the measuring the envelope of the UUT output signal can be applied directly without detector.

5.2 Reception system

Detailed explanation on measurement methods are given subclauses 5.2.1 through 5.2.6. Common measuring procedures involving bit error measurement are shown below.

< Bit error measurement>

(1) Measuring system diagram
This diagram presents basic bit error measuring system. On each measurement methods necessary fixtures shall be supplied.



(2) Conditions for measuring instruments

a. High-frequency signal generator

ASK modulation
Frequency : transmission frequency
Stability : within $\pm 1\times 10^{-5}$
Modulation index : more than 0.8
Adjacent channel leakage power: 40dB or more
Level Adjustment : should be measured by power meter with the standard encoding continuous test signal.

$\pi/4$ shift QPSK modulation
Frequency : transmission frequency
Stability : within $\pm 1\times 10^{-6}$
Modulation accuracy : r.m.s error within 3%(recommend)
Adjacent channel leakage power: ±30dB or more at 5MHz separation (recommend)
±40dB or more at 5MHz separation (recommend)
Level Adjustment : should be measured by power meter with the standard encoding continuous test signal.

b. Pattern generator

ASK modulation
Clock frequency : 1024 kHz

Clock accuracy : within $\pm 1\times 10^{-6}$

$\pi/4$ shift QPSK modulation
Clock frequency : 2048 kHz
Clock accuracy : within $\pm 5\times 10^{-6}$

(3) Conditions for unit under test (UUT)

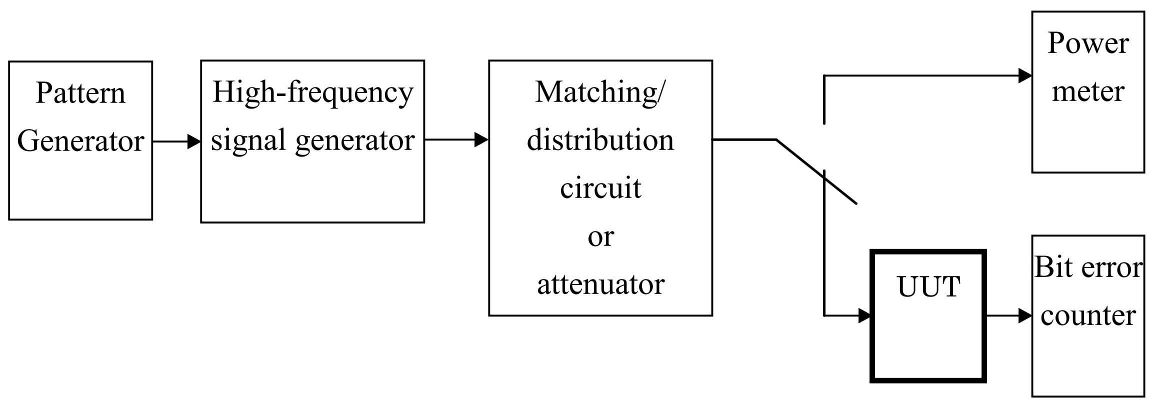
a. The UUT shall be set to the frequency for reception.

b. The mobile station shall be set to the mode of only receiving.

(Note) Error rate can also be obtained by accumulating the number of errors within the slot data. Number of slot data shall exceed 10^6 bits.

5.2.1 Reception sensitivity

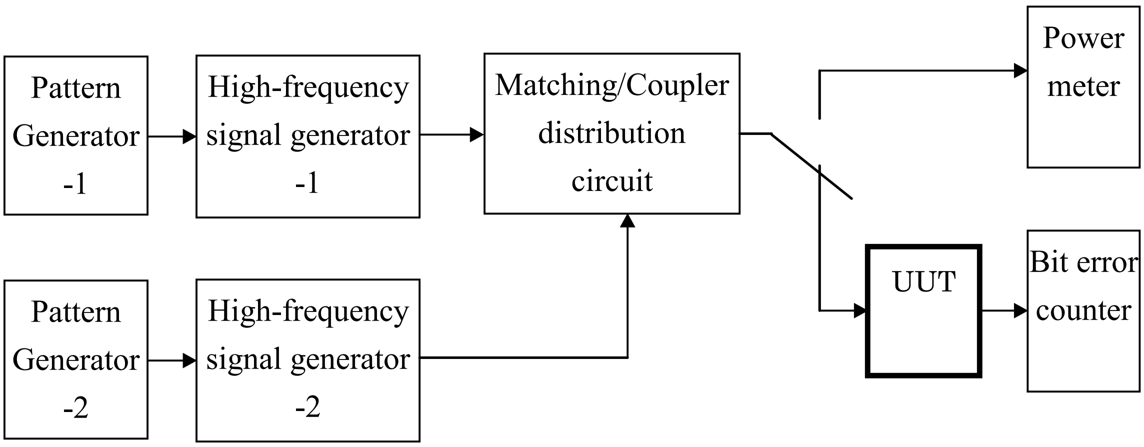
Measuring system diagram



(2) Conditions for measuring instruments and for UUT
Refer to < Bit error measurement>.

5.2.2 Adjacent signal selectivity

(1) Measuring system diagram

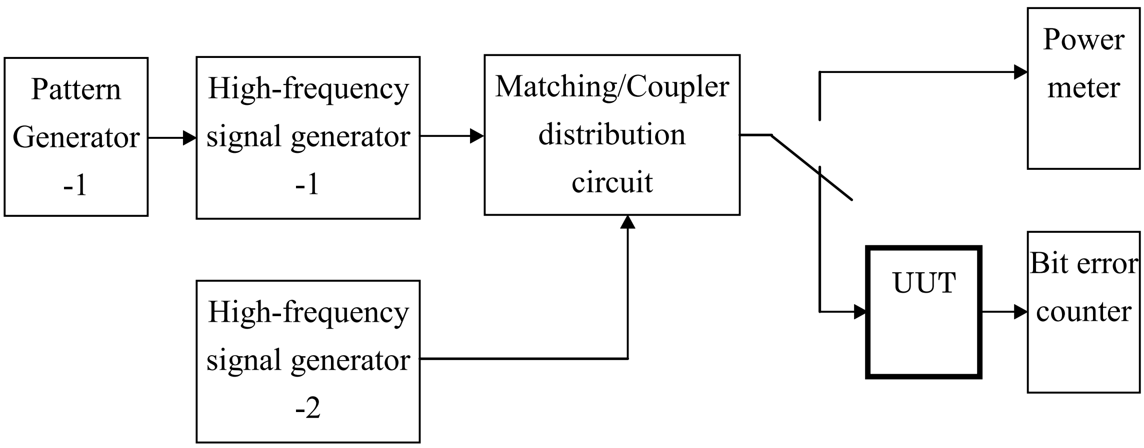


(2) Conditions for measuring instruments and for UUT
Refer to < Bit error measurement>.

(3) Pattern generator-2
the generator polynomial of pattern generator-2 can be different from the polynomial of the pattern generator-1.

5.2.3 Spurious response rejection ratio

(1) Measuring system diagram



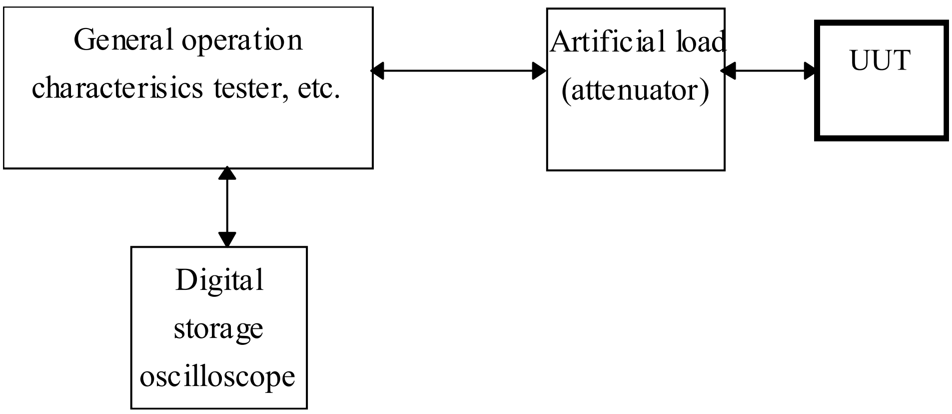
(2) Conditions for measuring instruments and for UUT
Refer to < Bit error measurement>.

5.2.4 Cabinet radiation (Informative)

The UUT shall be set to the frequency for reception.
The other conditions and the measurement procedures are the same as subclause 5.1.9.

5.2.5 Channel selection time of mobile station (Informative)

(1) Measuring system diagram



(2) Conditions for measuring instruments and for UUT
Refer to < Bit error measurement>.

5.2.6 Strength of secondary radio emission (Informative)

The UUT shall be set to the frequency for reception.
The other conditions and the measurement procedures are the same as subclause 5.1.5.

5.3 Measurement methods of without attaching connectors

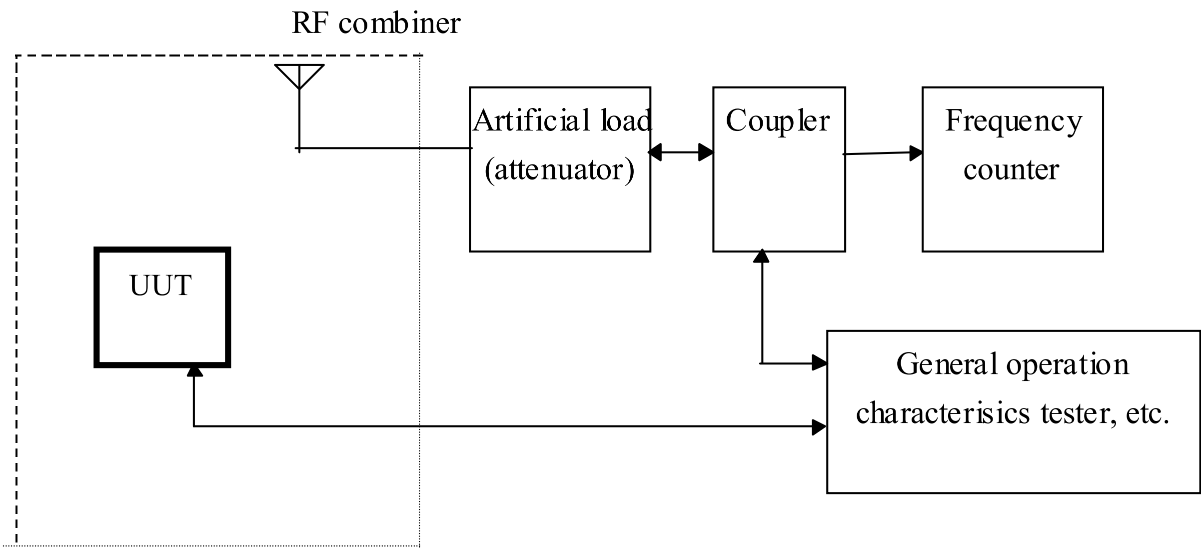
The UUT (transceiver) without connectors to antenna or to pattern generator should be tested following manner and referred the measurements diagram below.

The UUT should have a facility to mesure by establishing connection to the general operation characteristic tester and be changed the specific parameters by the commands from the tester. It can be applied that the commands are received directly from the tester through cables.

5.3.1 Transmission system

5.3.1.1 Frequency tolerance

(1) Measuring system diagram



(2) Conditions for measuring instruments

a. The reception level of UUT shall be set enough power to demodulate without errors.
And the output power of the general operation characteristic tester shall be set small power to ignore the leakage of the coupler to the frequency counter.

b. When a transmitter can output non-modulated carrier waves and features a circuitry system in which the center of modulation spectrum becomes the carrier frequency, non- modulated can be applied and the frequency counter can be directly connected to the RF combiner.

(3) Conditions for UUT

a. Test frequency shall be set for transmission.

UUT shall be set to continuously transmitting mode.

b. When a transmitter can output non-modulated carrier waves non-modulated can be applied.

(4) Coding signals
Bellow are the coding signals:

The internal signal of UUT
The received signal from the general operation characteristic tester through RF combiner.
The received signal from the general operation characteristic tester through cable.

5.3.1.2 Transmission spurious

(1) Measurement procedures

This measurement is done in the test site the same as the measurement of cabinet emission. The conditions for instruments or for UUT are the same as subclause 5.1.2 and the test coding signal is same subclause 5.3.1.1 (4).

(2) Result calculation
Equivalent radiation power = (above measurement power) / (relative gain of test antenna)

Relative gain = (maximum gain of the test antenna) / gain of (standard dipole antenna)*

*1.64

5.3.1.3 Occupied bandwidth

The conditions for instruments or for UUT are same subclause 5.1.3 and the test coding signal is the same as subclause 5.3.1.1.

5.3.1.4 Transmit power

(1) Measurement procedures

This measurement shall done in the test site as same as the measurement of cabinet emission. The conditions for instruments or for UUT are same subclause 5.1.4 and the test coding signal is same subclause 5.3.1.1 (4).

(2) Result calculation
Equivalent radiation power = (above measurement power) / (relative gain of test antenna)

Relative gain = (maximum gain of the test antenna) / gain of (standard dipole antenna)*

*1.64

5.3.1.5 Leakage power during carrier off period

The conditions for instruments or for UUT are the same as subclause 5.1.5 and the test coding signal is the same as subclause 5.3.1.1. (4).

5.3.1.6 Burst transmission transient response time

The conditions for instruments or for UUT are same subclause 5.1.6 and the test coding signal is same subclause 5.3.1.1.

5.3.1.7 Modulation index

The conditions for instruments or for UUT are same subclause 5.1.7 and the test coding signal is the same as subclause 5.3.1.1.

5.3.1.8 Adjacent channel leakage power

The conditions for instruments or for UUT are the same as subclause 5.1.8 and the test coding signal is the same as subclause 5.3.1.1.

5.3.1.9 Cabinet radiation

This measurement is same as subclause 5.1.3.2 Transmission spurious and the test coding signal is same subclause 5.3.1.1.

5.3.1.10 Modulation signal rate tolerance

The conditions for instruments or for UUT are the same as subclause 5.1.10 and the test coding signal is the same as subclause 5.3.1.1.

5.3.1.11 Deviation of absolute signal transmission time

The conditions for instruments or for UUT are the same as subclause 5.1.10 and the test coding signal is the same as subclause 5.3.1.1.

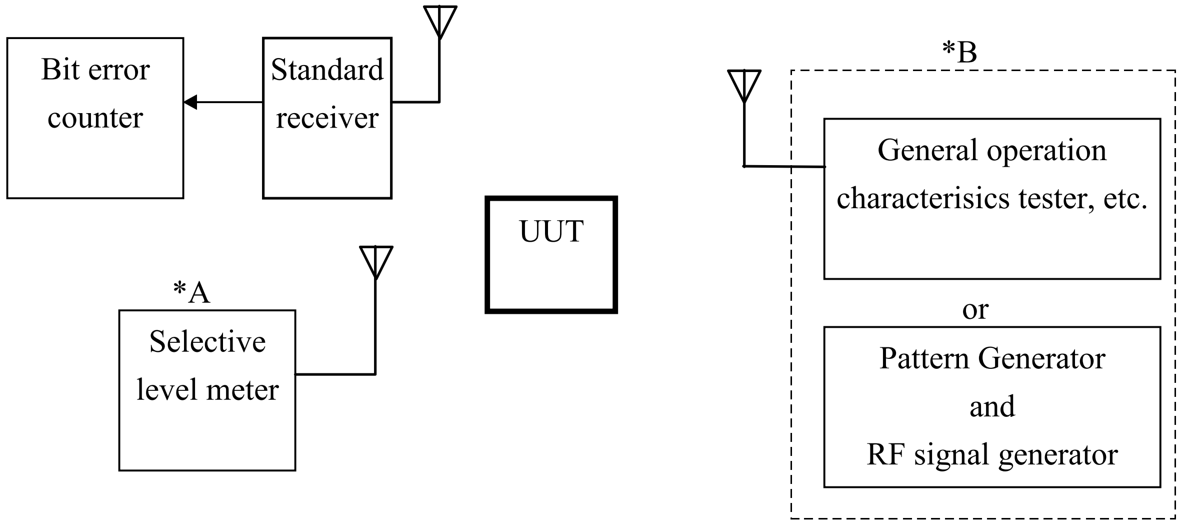
5.3.1.12 Eye pattern

The conditions for instruments or for UUT are same subclause 5.1.12 and the test coding is same subclause 5.3.1.1.

5.3.2 Reception system

5.3.2.1 Reception sensitivity (measuring in test site)

(1) Measuring system diagram



(2) The conditions for instruments or for UUT

a. The conditions of test site are the same as subclause 5.1.9 “Cabinet radiation”.

b. The set *A should be able to measure the received power at the position of UUT. The antenna *A shall be 1/2 dipole antenna or standard antenna with right-hand circular polarization.

c. The set *B should accord with the tester of subclause 5.1.2

d. The standard receiver should be able to receive the signal from UUT and output demodulated data in accordance with subclause 5.1.2 to the bit error counter.
The standard receiver should be placed at about 3m from the UUT and an about 4.2m from the antenna *B in order to receive the signal from UUT without errors and not to interfere the measurement.

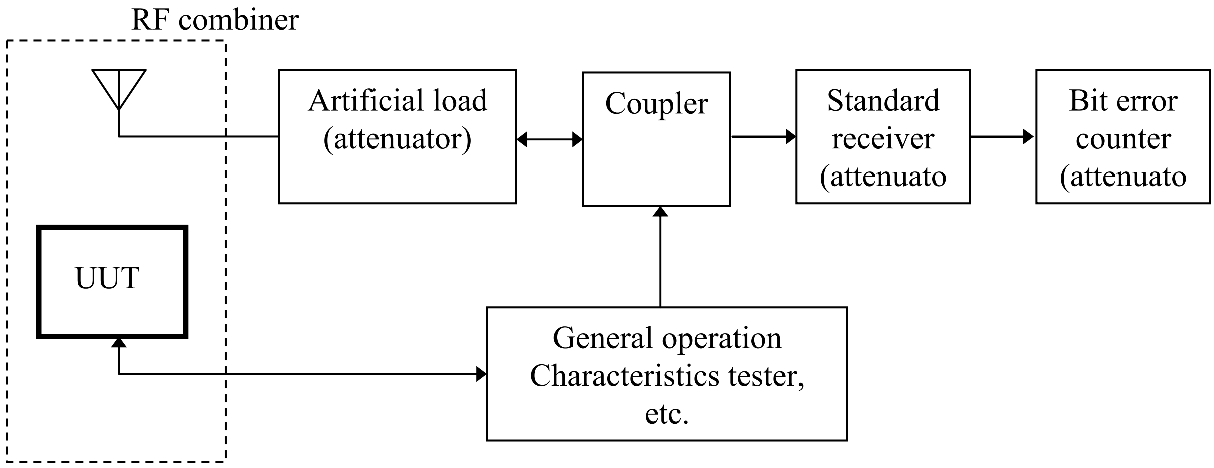
e. When UUT is able to output the demodulated data from attached connectors, the bit error counter can be applied to connect directly to UUT.

(3) Conditions for unit under test (UUT)

a. The UUT shall be set to the frequency for reception.

5.3.2.2 Reception sensitivity (measuring with RF combiner)

(1) Measuring system diagram



(2) The conditions for instruments

a. The RF combiner shall be corrected at each transmission frequency in test site the same as measuring " cabinet radiation " assuming that the effect to UTT is negligible.

b. The reception level of standard receiver from UUT shall be set to enough power to receive without errors. And the output power of the general operation characteristic tester shall be set small power to ignore the leakage of the coupler to the standard receiver.

(3) Conditions for unit under test (UUT)

a. The UUT shall be set to the frequency for reception.

5.3.2.3 Adjacent signal selectivity

The conditions for instruments or for UUT are the same as subclause 5.2.2 using RF combiner.

5.3.2.4 Spurious response

(1) Measuring in test site

a. The test site and receiving power are same as subclause 5.3.2.1 "Reception sensitivity".

b. The test circuit for combining the undesired signal with the desired signal is the same as the circuit in subclause 5.2.2. The undesired signal shall be set to the specific level, which meets the ratio to the desired signal is equal to the defined value in spurious response specification.

(2) Measuring with RF combiner

a. The RF combiner and receiving power are same as subclause 5.3.2.1 “Reception sensitivity”.

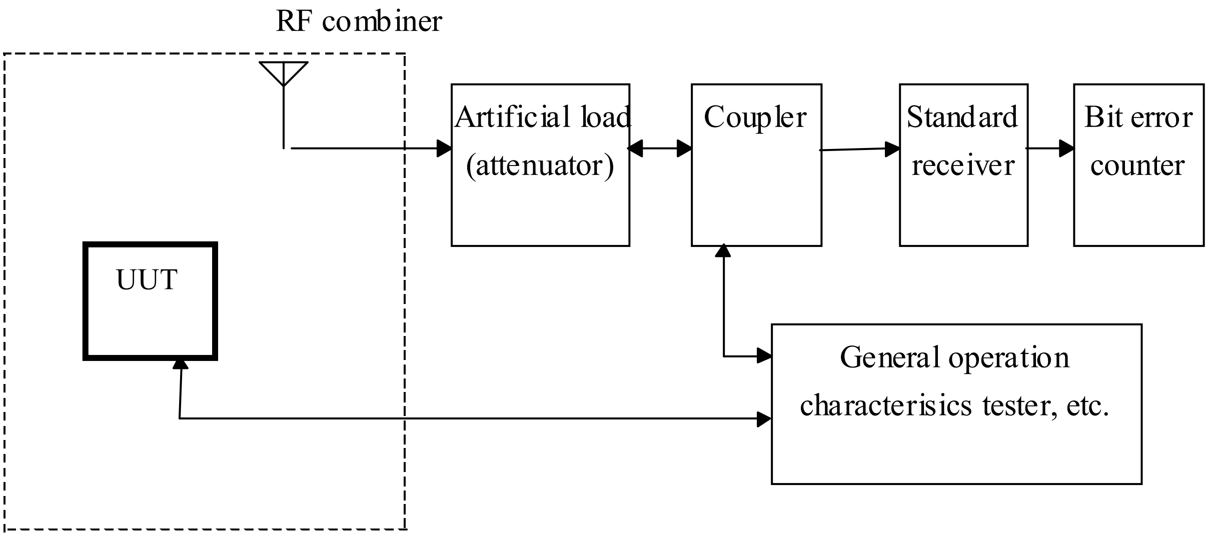
b. The test circuit for combining the undesired signal with the desired signal is the same as the circuit in subclause 5.2.2. The undesired signal shall be set to the specific level, which meets the ratio to the desired signal is equal to the defined value in spurious response specification.

5.3.2.5 Cabinet radiation

This measurement is the same as subclause 5.1.3.2 “Transmission spurious”.

5.3.2.6 Channel selection time of mobile station

(1) Measuring system diagram



(2) Conditions for measuring instruments and for UUT

Refer to < Bit error measurement>.

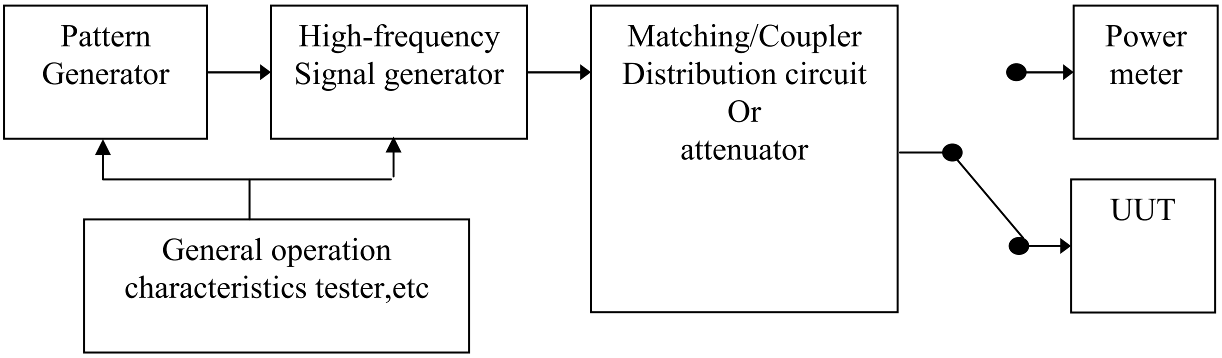
5.3.2.7 Strength of secondary radio emission

The UUT shall be set to the frequency for reception.
The other conditions and the measurement procedures are the same as subclause 5.3.1.5.

5.4 Test equipment

5.4.1 Carrier sense function (Measurement methods of with attaching connectors)

(1) Measuring system diagram



(2) Conditions for measuring instruments

a. The general operation characteristic tester shall feature the following functions.
It can select a frame class (A,B and C at Table. 4.2.9), and can output trigger timings of transmitting Frame Control Message Slot of selected frame class to pattern generator and high-frequency signal generator.

b. Signal generator
Refer to < Bit error measurement>.

c. High-frequency signal generator output signals modulated by Pattern generator signals to communication control slot at channel selected by General operation characteristics tester.
Refer to < Bit error measurement> about others.

d. Time constant of Power meter shall be enough long to display exact effective value of power.

(3) Conditions for unit under test(UUT)

The UUT shall be set to the frequency for testing.

(4) Measuring procedures

a. The Power meter shall be corrected to measure –78 dBm e.i.r.p. exactly considering the period of frame time and the period of communication control slot time.

b. Channel of General operation characteristics tester shall be set the frequency for testing.

c. Start UUT, then Conform to transmit no slots at all.

d. The Power meter shall be corrected to measure –78 dBm e.i.r.p. exactly considering the period of frame time and the period of communication control slot time.

e. Channel of General operation characteristics tester shall be set the adjacent frequency for testing.

f. Start UUT,then Conform to transmit no slots at all.

g. When there are two channel as the adjacent frequency for testing ,repeat d,e and f for the remaining frequency .

5.4.2 Carrier sense function (Measurement methods of without attaching connectors)

(1) Measuring in test site

a. The condition of test site are the same subclause 5.3.2.1 “Reception sensitivity”. The Power meter shall be set to enough input level to measure on behalf of regulated sensitivity, then measure the same method.

b. The constitution of measurement is that UUT and Test equipment are able to face, UUT can receive commands of measurement by air interface to perform measurement.

c. It is to measure as the method of with attaching connectors.
   Note) Refer to subclause 5.3 “The measurement methods of without attaching connector”

(2)Measuring with RF combiner

a.The condition of RF combiner are the same subclause 5.3.2.1 “Reception sensitivity”.

b.UUT shall be set in RF combiner, the connector of RF combiner is used as antenna connectors, then it is to measure as the method of with attaching connectors.

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Chapter 6 Definitions and Abbreviations

6.1 Definitions

[Activation slot (ACTS)]

Communication slot for multiple activation channels (ACTC) for remote mobile station to enter the communication link of base station.

[Association]

Service to register the remote mobile station link address to the communication link of the base station to permit communication between base station and remote mobile station. It has the same meaning as the initialization.

[Application service data unit (ASDU)]

Data associated with a Service Primitive invocation of an Application Service Element in the layer 7.

[Application data unit (ADU)]

Data unit specified in an application and transferred between two application entities.

[Application protocol data unit (APDU)]

Data unit exchanged between peer Application Service Elements.

[Application Service Element (ASE)]

A part of an Application Entity response. The layer 7 that provides a communication environment capability, using underlying LLC services where appropriate. The Application Service Elements describe the encapsulation of data structures by offering a well-defined set of Service

[Attributes]

This is defined in the layer 7. An Attribute has an associated value, which can exhibit structure. The value of an Attribute can determine or reflect the behavior of the element. The value of an Attribute is observed or modified by sending a request to an element to read (GET) or write (SET) the value. Operations on Attributes are defined to be performed upon the Element that contains the Attributes and not directly upon the Attributes.

[Base station]

Fixed communication equipment on the roadside. Provides one or more down channels and one or more up channels. Performs communication with plural mobile stations. It has the same meaning as the roadside unit (RSU) or the beacon.

[Beacon Service Table (BST)]

A BST is generated in the layer 7 of the base station. On the layer 7 of the base station, the I-KE collects application identifiers, initial data, and protocol layer parameter relevant for the communication. The application identifiers are stored in the BST as a priority list defining the order in which applications are served. The base station transmits the BST. The reception of the BST on the mobile station side is the initiator of each data transfer from applications on mobile station side. The vehicle's I-KE evaluates a received BST and indicates the availability (including parameter) of services to the corresponding Application and Application Service Elements.

[Broadcast Kernel Element (B-KE)]

The B-KE of the layer 7 is responsible for the collection, broadcast and retrieval of data for plural applications and/or plural mobile stations.

[Broadcast link address]

The pre-defined SAP used as a broadcast (all parties) address. It can never be the address of a single SAP on the layer 2.

[Broadcast Pool]

This is defined in the layer 7. File, cyclically broadcast from the base station to the mobile stations. Records may be independent inserted from several Service Users.

[Coding]

A function performed by the Transfer Kernel Element, which transfers the data from a special local syntax (related to the local hardware) into transfer syntax common for all communication systems (with the same applications on them). The peer Transfer-service-provider decodes this data from transfer syntax into its own local syntax. The common abstract description of this data is the abstract syntax notice 1 (ASN.1).

[Command]

An instruction in data communications. It is represented in the control field of a LPDU and transmitted by an LLC. It causes the addressed LLC(s) to perform a specific data link control function.

[Concatenation]

A function performed by the Transfer Kernel Element of the layer 7 to map multiple Application Layer Protocol Data Units or the layer 7 Fragments into one layer 2 Logical Service Data Unit.

[Data link]

An assembly of two or more terminal installations and the interconnecting communications channel operating according to a particular method that permits information to be exchanged between the remote layer 2 entities.

[Down link]

Communication channel on which the base stations transmits its information to mobile stations.

[Element]

Application Service Element or User Element, Elements in the layer 7 are abstractions of data processing and data communication resources. These elements represent the parts of the communication system building up response. using the layer 7 functions.

[Element Identifier]

The registered name of a layer 7 (Application Layer) Kernel Service User which is unambiguous in each piece of equipment and the same for the same Element in each Communication System.

[Entity]

An active element within a system.

[Fragmentation]

A function performed by the Transfer Kernel Element of the layer 7 to map one Transfer-SDU on plural LSDU .

A function performed by MAC sub layer of the layer 2 to map one LSDU on plural MPDU.

[Frame control message Slot (FCMS)]

Frame control information field for the communication profile and information such as data slot, for making communication with base station.

[Grand Mobile station]

A mobile communication facility capable of receiving information from the base stations on the downlink, also capable of transmitting information on the uplink. This is abbreviated to Mobile station. It is the same meaning of the on-board equipment.

[Head of Line]

Queuing discipline (also: strict priority queuing or fixed priority queuing), a number of queues are served in priority order, each queue is served in First-Come-First-Serve order.

[Identifier]

This is defined in the layer 7. The unique IDs of equipment. The term identifier is used in a different concept from the term element identifier.

[Initialization Kernel Element (I-KE)]

This is functional entity of the layer 7. The I-KE is responsible for the initialization of the communication on the level of the Layer 7.

[Initialization]

Service to register the remote mobile station link address to the communication link of the base station to permit communication between base station and remote mobile station. It has the same meaning as the association.

[Layer 1(L1)]

The conceptual layer of transmitting or receiving signals through physical medium channel. This layer provides service for the layer 2. It is the same meaning of the physical layer.

[Layer 2 (L2)]

The conceptual layer of control or processing logic existing in the hierarchical structure of a station that is responsible for maintaining control of the data link. This layer provides service for the layer 7. It has the same meaning as the data link layer.

[Layer 7 (L7)]

The layer 7 contains all functions, which imply communication between a base station and a mobile station not already performed by lower layers. These include functions performed by programs as well as functions performed by human beings.

This layer provides service for applications. It has the same meaning as the application layer.

[Layer management entity (LME)]

Management entity determined for each layer for facilitating control of the entire system, which is not specified by services of each layer (the layer 1, the layer 2 (MAC sublayer and LLC sublayer) and the layer 7).

[Layer 7 Management]

This is a part of communication system management in layer 7.

This Management provides parameters to layer 1,2 and 7 by entity ,and has a function which provides and collects information to control communication system.

[Link address]

Service access point address at the beginning of an LPDU, which identifies the SAP, designated to receive PDU and the SAP transmitting the PDU.

[Link service data unit (LSDU)]

Data unit exchanged between LLC sublayer and layer 7.

[LLC Protocol Data Unit (LPDU)]

Data Unit exchanged between two LLC protocols instances.

[Logical link control (LLC)]

A part of communication facility that supports the logical link control function of one or more logical links. The LLC generates command PDUs for transmission, and interprets received command PDUs and response PDUs.

LLC provides the following functions.

(1) Initialization of transmission/reception of PDU

(2) Control of data flow

(3) Interpretation of received command PDUs and generation of appropriate response PDUs.

(4) Actions regarding error control and its recovery function in LLC sublayer

[LLC control field]

The first control field of LPDU. The content of the control field is interpreted as following by the link address of the received destination LLC(s),

(1) As a command, instructing the performance of function specified by the source LLC.

(2) As response, replying the source LLC .

[MAC control field]
The portion of the frame that holds the control information fields that permits MAC sublayer to perform suitable control.

[MAC protocol data unit (MPDU)]
Data unit exchanged between MAC sublayers.

[MAC service data unit (MSDU)]
Data unit exchanged between LLC sublayer and MAC sublayer.

[Manager]
Management information service user that can issues management operations and receives notifications in interaction of the systems management.

[Managed object]
A side of the resource management in the OSI environment managed via system management process.

[Management Information Provider]
The concept of a whole entity provides the management information to Management Information Service Users.

[Management Information Base]
A conceptual memory of information database in the OSI environment.

[Management Information Service]
Services are provided by Application Service User Elements specified in the system management entity.

[Management Information Service User]
Users of the Management Information Services provided by Management Information Provider.

[Medium access control (MAC)]
The part of a data station that supports the medium access control functions that resides just below the LLC sublayer. The MAC procedures include framing/deframing data units, and acquiring the right to use underlying physical medium.

[Message data slot (MDS)]
Communication slot for data transmission/reception in a communication frame.

[Mobile station]
A mobile communication facility capable of receiving information from the base stations on the downlink, also capable of transmitting information on the uplink. It is the same meaning of the on-board equipment.

[Multicast (group) link address]
A destination address assigned to a collection (group) of SAPs to facilitate their being addressed collectively.

[Multiplexing]
A function within the Transfer Kernel Element of the layer 7 by which one LLC-SAP is used to support more than one Transfer-service-user.

[Notification]
At the layer 7, Elements may be defined to emit notifications when some internal or external event occurs .This is specific to the means that emit them. At system management, This is defined as the information of event that occur in a particular management object.

[Octet]
A bit-oriented element that consists of eight contiguous binary bits.

[On-board equipment (OBE or OBU)]
On-board equipment capable of receiving information from the base stations on the downlink, also capable of transmitting information on the uplink. It has the same meaning as the mobile station.

[Private link address]
Used as an address to perform point-to-point communication between the base station. The remote mobile station creates this.

[Profile]
Information about transmission capabilities and settings in the different communication layers and Application Processes. A profile is identified by an INTEGER.

[Protocol data unit (PDU)]
Data unit exchanged between same level protocol layer.

[Response]
.Response to data communication. Set in control field of LPDU , and transmitted by LLC. A specific data link control is performed by LLC specifying address

[Road side equipment (RSU)]
Fixed communication equipment on the roadside. Provides one or more down channels and one or more up channels. Performs communication with plural mobile stations. It has the same meaning as the base station.

[Service]
Functions provided to next upper layer.

[Service Primitive (SP)]
An abstract implementation of independent interaction between a Service User and a Service Provider.

[Service Provider]
An application Service Element or a communication Layer provides a special capability to Application Elements or a User Element by means of Service Primitives.

[Service User]
An application Service Element or a User Element which makes use of a service of a Service Provider.

[System management Application Entity]
An application entity which executes the function of the system management.

[System management entity (SME)]
System management layer that functions in coordination with the layer management entity that is determined for each layer for facilitating controlling of the entire system, which is not specified by services of the layer 1, the layer 2 or the layer 7.

[System Management Service]
Group of service primitives named for providing services in system management entity.

[System Management Operation]

Operation for executing the system management to managed objects.

[Transfer Kernel Element (T-KE)]

The T-KE of the layer 7 is responsible to transfer an APDU to the peer group entity. It includes the needed functions between the network layer and the presentation Layer. These functions are (de-) coding to transfer syntax, Fragmentation/Concatenation, and (de-) Multiplexing with priority handling.

[Up link]

Communication channel on which the mobile station transmits its information to the base station.

[User Element]

A part of the application process in the layer 7 which uses application service elements needed to execute the communication demanded by the application process.

[Vehicle Service Table (VST)]

The VST is the answer to the BST from I-KE in the layer 7 of the mobile station . It contains the identifiers of all application present in the BST and registered in the mobile station and the profile used in communication after sending VST.

6.2 Abbreviations

[A]

ACPI	: Activation Possibility Identifier
Ack	: Acknowledged
ACKC	: Ack Channel
ACnC/R	: Acknowledge command/response
ACTC	: Activation Channel
ACTS	: Activation Slot
ADU	: Application Data Unit
AI	: Acknowledgement Information field
AID	: Application Element Identifier
AP	: Application Process
API	: Application Identifier
APDU	: Application Protocol Data Unit
ASDU	: Application Service Data Unit
ASE	: Application Service Element
ASK	: Amplitude Shift Keying
ASN.1	: Abstract Syntax Notation One
ATI	: Area Type Identifier

[B]

BER	: Bit Error Rate
BP	: Broadcast Pool
B-KE	: Broadcast Kernel Element
BST	: Beacon Service Table

[C]

CCZ	: Continuous Communication Zone identifier
CEN	: European Committee for Standardization
CI	: Control Information subfield of SCI
CM	: Communication Mode identifier
CRC	: Cyclic Redundancy Check
C/L	: Continued/Last
C/R	: Command/Response
CW	: Continuous Wave

[D]

DRI	: Data transmission Rate Identifier

DSRC : Dedicated Short-range Communication
DR : Direction Identifier

[E]
EID : Element Identifier
E.I.R.P(e.i.r.p) : Equivalent Isotropic Radiation Power

[F]
FCMS : Frame Control Message Slot
FCMC : Frame Control Message Channel
FDMA : Frequency Division Multiple Access
FID : Fixed Equipment ID
FRG : Fragmentation
FSI : Frame Structure Information field
FTI : Frequency Type Identifier

[G]

[H]

[I]
ID : Identifier
IID : Invoker Identifier
IMI : Initialization Mode Identifier
ITU : International Telecommunication Union
ITU-R : ITU-Radio Communication Bureau
I-KE : Initialization Kernel Element
ISO : International Organization for Standardization

[J]

[K]

[L]
L1 : Physical Medium Laye (Layer 1)
L2 : Data Link Layer (Layer 2)
L7 : Application Layer (Layer 7)
LI : Length indicator information field of LPDU
LID : Link Address

LLC	: Logical Link Control
LME	: Layer Management Entity
LPDU	: Link Protocol Data Unit
LRI	: Link Request Information field
LSAP	: LLC Service Access Point
LSB	: Least Significant Bit
LSDU	: LLC Service Data Unit

[M]

MAC	: Medium Access Control
mand.	: Mandatory
MDC	: Message Data Channel
MDS	: Message Data Slot
MIB	: Management Information Base
MPDU	: MAC Protocol Data Unit
MSB	: Most Significant Bit
MSDU	: MAC Service Data Unit

[N]

Nack	: Not acknowledged
non-mand	: Non Mandatory

[O]

OBE	: On-Board Equipment (Mobile station)
OSI	: Open Systems Interconnection

[P]

PDU	: Protocol Data Unit
PHY	: Physical Layer (Layer 1)
PR	: Preamble
PN	: Pseudo random Noise
PPI	: Physical layer Profile Identifier
PVI	: Protocol Version Information field
req/ind	: request/indication
resp/conf	: response/confirm

[Q]

QPSK	: Quadrature Phase Shift Keying

[R]

RF	: Radio Frequency
RLT	: Release Timer information field
RSU	: Road Side Unit (base station)

[S]

SAP	: Service Access Point
SC	: Service Code
SCI	: Slot Control Information field
SEQ	: Sequence Number
SI	: Slot Identifier
SIG	: Signaling Channel information field
SLN	: Slot Number Information field
SME	: System Management Entity
SP	: Service Primitive
STA	: Status of receiving ACTC

[T]

TDMA	: Time Division Multiple Access
TDI	: Time Division Identifier
T-KE	: Transfer Kernel Element
TRI	: Transmitter/Receiver Identifier

[U]

UI	: Unnumbered Information
UW	: Unique Word

[V]

VST	: Vehicle Service Table

[W]

WCNC	: Wireless Call Number Channel (Call sign)
WCNS	: Wireless Call Number Slot

6.3 Variables

6.3.1 Variables in the layer 1

k1, k1max	: Number of ACTSs (activation slots) in half-duplex mode
k2, k2max	: Number of ACTSs (activation slots) in full-duplex mode
n1, n1max	: Number of MDSs (message data slots) in half-duplex mode
n2, n2max	: Number of MDSs (message data slots) in full-duplex mode
m	: Number of slots allocated following FCMS. m is the number of valid SCI (slot control identifier) field in half-duplex mode and 2m is in full-duplex mode.

6.3.2 Variables in the layer 2

(1) MAC sublayer

ASL, ASLmax	: Base station ACTS assignment variable
ASGN	: Group of assignment variable to request slots of base station.
ASGN.LID	: Assignment link address variable
ASGN.DIR	: Assignment direction variable
ASGN.RS	: Assignment response sate variable
ASGN.PR	: Assignment priority variable
FQBUSY	: Base station threshold value for transmission queue state variable
NFR1, NFR1max	: Retry counter of base station (downlink MDS allocation)
NFR2, NFR2max	: Retry counter of base station (uplink MDS allocation)
NMR, NMRmax	: Retry counter of mobile station (uplink MDS transmission)
NRQ, NRQmax	: Link request counter of a mobile station
NRT	: Re-link entry restriction counter
NUMLINK	: Base station connection variable
NUMQ	: Number of a transmission queue
MAXLINK	: Base station link connection maximum number variable
MQBUSY	: Mobile station threshold value for a transmission queue state variable
MSIZE	: Maximum transmission LLC data size number
RSQ	: Reception sequence state variable
SLT_STATUS	: Slot assignment state variable
TR_STATUS	: Transmission request state variable
TSQ	: Transmission sequence state variable
TSQ2.DUP	: Duplication inspection state variable
TSQ2.ACK	: Delivery confirmation state variable
WTC, WTCmax	: Number of a mobile station WCNC transmission

(2) LLC sublayer

V (RI)	: receive state variable (LLC)
V (SI)	: transmit state variable (LLC)
V (RB)	: Reception status state variable (LLC)
N10	: Maximum number of octets of a LPDU (LLC)
N11	: Maximum number of transmission (LLC)
N13	: Acknowledgment time (LLC)

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ANNEX

Annex A. Protocol parameters

1. Layer 1

Management Information Base (MIB) [Informative]

Table 1.1 Control Variables of the Layer 1 in the base station

Parameter		Meaning	Type	Length	Value	Note
F_PPI		Physical profile of the base station	BIT STRING	3 bit		Stored as SIG and PPI in FCMC
PHY TEST						
	CWMode	CW Transmission Mode Selection	BIT STRING	2 bit	0..3	0: CW Transmission Inhibit (*) 1: 1 Fixed Pattern Selection 2: Undefined 3: Undefined
	PNSendMode	PN Pattern Transmission Mode Selection	BIT STRING	2 bit	0..3	0: PN Pattern Transmission Inhibit (*) 1: Consecutive Transmission of Split phase encoded PN pattern 2: Consecutive Transmission of NRZ encoded PN pattern 3: Undefined
	SendMode	Test Mode Transmission Pattern Selection	BIT STRING	2 bit	0..3	0: PN Pattern Transmission Inhibit (*) 1: Consecutive Transmission of Splitphase encoded 1 fixed pattern 2: Consecutive Transmission of NRZ encoded 0 and 1 repetition pattern 3: Undefined
	CarrierOFF	Carrier Mask	BOOLEAN	1bit	0,1	0: Carrier Transmission Authorized (*) 1: Carrier Transmission Inhibit

Note) (*) indicates the default value.

Table 1.2 Control Variables of the Layer 1 in the mobile station

Parameter		Meaning	Type	Length	Value	Note
O_PPI(n)		Physical profile of the mobile station	BIT STRING	3 bit		n : substantiated number
PHY CNT						
	SIG LEVEL	Receiving Level	OCTET STRING	2 oct		Depending on the precision of signal quantized
	CH SEL	Frequency Switching	BOOLEAN	3 bit	0,,7	0 : 5795 / 5835MHz 1 : 5805 / 5845MHz 2 : 5800 / 5840MHz 3 : 5775 / 5815MHz 4 : 5780 / 5820MHz 5 : 5785 / 5825MHz 6 : 5790 / 5830MHz 7 : Undefined
PHY TEST						
	CWMode	CW Transmission Mode Selection	BIT STRING	2 bit	0..3	0: CW Transmission Inhibit (*) 1: 1 Fixed Pattern Selection 2: Undefined 3: Undefined
	PNSendMode	PN Pattern Transmission Mode Selection	BIT STRING	2 bit	0..3	0: PN Pattern Transmission Inhibit (*) 1: Consecutive Transmission of Split phase encoded PN pattern 2: Consecutive Transmission of NRZ encoded PN pattern 3: Undefined
	SendMode	Test Mode Transmission Pattern Selection	BIT STRING	2 bit	0..3	0: PN Pattern Transmission Inhibit (*) 1: Consecutive Transmission of Split phase encoded 1 fixed pattern 2: Consecutive Transmission of NRZ encoded 0 and 1 repetition pattern 3: Consecutive Transmission of NRZ encoded PN pattern 4: Undefined
	CarrierOFF	Carrier Mask	BOOLEAN	1bit	0,1	0: Carrier Transmission Authorized (*) 1: Carrier Transmission Inhibit

Note) (*) indicates the default value.

2. Layer 2

2.1 Value of Timer Counter used in MAC sublayer (see subclause 4.3.3.4)

(1) Maximum value of Retry Counter in the base station (downlink MDC) (NFR1max)
NFR1max shall be 127at maximum.

(2) Maximum value of Retry Counter in the base station (uplink MDC) (NFR2max)
NFR2max shall be 127at maximum.

(3) Maximum value of Retry Counter in the mobile station (uplink MDC) (NMRmax)
NMRmax shall be 127 at maximum.

(4) Maximum value of Link Request Counter in the mobile station (NRQmax)
NRQmax shall be 127 at maximum.

(5)Re-link Entry Request Constraint Counter (NRT) **[Informative]**
According to the Status of State of acceptance of ACTCs (STA) as shown in Table 4.2.4.2.1.8.1-4, the value shall be as shown in Table 2.1-1.

Table 2.1-1 Values of Re-link Request Constraint Counter

STA subfield b7	b8	Status of Receiving ACTC	NRT
0	0	100 ~50%	RT1 (= 1)
1	0	~25%	RT2 (= 2)
0	1	~12.5%	RT3 (= 4)
1	1	~0%	RT4 (= 4)

State of acceptance of ACTCs
(6) Value of Receiving ACTC (TRA) **[Informative]**

State of acceptance of ACTCs(STA), shown in Table 4.2.4.2.1.8.1-4, shall be specified as shown in Table 2.1-2 according to the Value of Receiving ACTC.

Table 2.1-2 Values of receiving ACTC (TRA)

STA subfield b7	b8	Status of Receiving ACTC	TRA (= MAXLINK- NUMLINK)
0	0	100 ~50%	SLI (= MAXLINK)
1	0	~25%	SL2 (= MAXLINK/2)
0	1	~12.5%	SL3(= MAXLINK/4)
1	1	~0%	SL4 (= MAXLINK/8)

(7) The maximum number of the base station connection variable(MAXLINK) **[Informative]**
MAXLINK shall be greater than the number of slots available as MDSs.

(8) The maximum number of the base station ACTC assignment variable (ASLNmax)
ASLNmax shall be less than 3 at maximum.

(9) The maximum number of the mobile station WCNC transmission counter (WTCmax)
WTCmax shall be 2.

(10) Threshold value of the base station transmission status (FQBUSY) **[Informative]**
The FQBUSY shall be 90% of the queue capacity for transmission.

(11) Threshold value of the mobile station transmission status (MQBUSY) **[Informative]**
The MQBUSY shall be 90% of the queue capacity for transmission.

2.2 Timer, Counter and Field Length used in the LLC sublayer (See subclause 4.3.4.5.5)

(1) Maximum number of Octets in a PDU in the LLC sublayer (N10)
The maximum number for N10 is not defined in this standard.

(2) Minimum number of octets in a PDU in the LLC sublayer.
Minimum number of octets in a Command PDU shall be 1 octet.
Minimum number of octets in a Response PDU shall be 2 octets.

(3) Maximum Number of Transmissions by the LLC sublayer (N11).
N11 shall be 127 at maximum.

(4) Response (acknowledgement) time in the LLC sublayer of the base station (N13FE)
N13FE is the time corresponding to 1 frame.

(5) Response (acknowledgement) time of the LLC sublayer of the mobile station (N13ME)
N13ME is the time corresponding to 1 frame.

2.3 Management Information Base (MIB) [Informative]

Table2.3-1 Variables of Frame Control Message Channel (FCMC)

Parameter			Meaning	Type	Length	Value	Note
FCMC							
	SIG						
		PVI	Protocol Version Information field	BIT STRING	2 bit	0..3	
		PPI	Physical Profile Identifier	BIT STRING	3 bit		
		FTI	Frequency Type Identifier	BIT STRING	2 bit		
		CCZ	Continuous Communication Zone Identifier	BIT STRING	1 bit		
		TRI	Transmitter / Receiver Identifier	BIT STRING	2 bit		
		TDI	Time Division Identifier	BIT STRING	1 bit		
		ATI	Area Type Identifier	BIT STRING	2 bit		
	FID		Fixed Equipment ID	OCTET STRING	1 bit		
	FSI						
		CM	Communication Mode Identifier	BIT STRING	1 bit		
		SLN	Slot Number Information Field	BIT STRING	3 bit		
	RLT						
		VALID	Release Timer Validation Identifier	BIT STRING	1 bit		
		VALUE	Release Time Value	BIT STRING	7 bit		
	SC		Service Code	OCTET STRING	7 oct		
	SCI(n)						n = 1..8
		CI	Control Information Subfield	OCTET STRING	1 oct		See Table2.3.-2, Table2.3.-3 and Table2.3.-4
		LID	Link Address Field	OCTET STRING	4 oct		

Table 2.3-2 Control Variables of MDS

Parameter		Meaning	Type	Length	Value	Note
CI						
	SI	Slot Identifier	BIT STRING	2 bit	00	MSB is in the left
	ST	Signal Type Identifier	BIT STRING	3 bit		
	DRI	Signal Transmission Speed	BIT STRING	2 bit		
	DR	Direction Identifier	BIT STRING	1 bit		

Table 2.3-3 Control Variables of ACTS

Parameter		Meaning	Type	Length	Value	Note
CI						
	SI	Slot Identifier	BIT STRING	2 bit	11	MSB is in the left
	ACPI	Activation Possibility Identifier	BIT STRING	1 bit		
	STA	State of acceptance of ACTCs	BIT STRING	2 bit		

Table 2.3-4 Control Variables of WCNS

Parameter		Meaning	Type	Length	Value	Note
CI						
	SI	Slot Identifier	BIT STRING	2 bit	00	MSB is in the left
	DRI	Signal Transmission Speed	BIT STRING	2 bit		

Table2.3-5 (1) Variables of the MAC sublayer in the base station

Parameter		Meaning	Type	Length	Value	Note
FMAC_PVI		Protocol Version of the base station	BIT STRING	2bit		Stored as SIG,PVI in FCMC
ASGN						
	LID	Link Address Field	OCTET STRING	4 oct		
	DIR	Direction	BIT STRING	1 bit		1: Uplink 0: Downlink
	RS	Response	BIT STRING	1 bit		1: Response 0: No Response
	PR	Priority	BIT STRING	1 bit		1: Priority Assignment 0: Normal Assignment
FMAC_CNT						
	MAXLINK	Maximum Number of Link Connections	INTEGER	1 oct	0..127	
	NUMLINK	Current Number of Link Connections	INTEGER	1 oct	0..127	
	ASLNmax	Number of ACTS Location	INTEGER	1 oct	0..3	
	FQBUSY	Threshold value of Transmission State	INTEGER	1 oct	0..127	
	SL1	Threshold value of Transmission State	INTEGER	1 oct		SL1 < SL2
	SL2	Threshold value of Transmission State	INTEGER	1 oct		SL2 > SL3
	SL3	Threshold value of Transmission State	INTEGER	1 oct		SL3 > SL4
	SL4	Threshold value of Transmission State	INTEGER	1 oct		
	NFR1max	Maximum value of Retry Counter in Base Station (BS)	INTEGER	1 oct	0..127	Downlink
	NFR2max	Maximum value of Mobile Station Retry Counter in Base Station	INTEGER	1 oct	0..127	Uplink
FMAC_ STATUS						
	ASLN	Number of ACTS Location	INTEGER	1 oct	0.. ASLNmax	
	NUMQ	Status value of Transmission Queue	INTEGER	1 oct	0..127	1: busy 0: idle
	TR_STATUS	Transmission State Variable	BOOLEAN	1 bit		1: out time 0: in time
	SLT_STATUS	State Variable of Slot Assignment	BOOLEAN	1 bit		n = 1..8
FMAC_RETRY(n)						n = 1..8
	NFR1	Retry Counter in Base Station (BS)	INTEGER	1 oct	0..127	Downlink
	NFR2	Mobile Station Retry Counter in Base Station	INTEGER	1 oct	0..127	Uplink

Table2.3-5 (2) Variables of the MAC sublayer in the base station

Parameter	Meaning	Type	Length	Value	Note
FMAC_SEQ(m)					m = 1…MAXLINK
TSQ	State Variable of Transmit Sequence	INTEGER	1 oct	0..7	
TSQ2(n)					N=0..7
TSQ2(n).DUP	Duplication inspection state variable	BOOLEAN	1 bit	0,1	
TSQ2.ACK	Delivery confirmation state variable	BOOLEAN	1 bit	0,1	0: Nack 1: Ack
RSQ(n)	State Variable of Receiving Sequence	BOOLEAN	1 bit	0,1	N= 0..7
FMAC_TEST					
ACK_MASK	Mask Variable of ACKC Transmission Process	BOOLEAN	1 bit	0,1	0:Transmission admitted (*) 1:Transmission inhibit
RETRY_MASK	Mask Variable of Retry Process	BOOLEAN	1 bit	0,1	0:Retry process admitted (*) 1:Retry process prohibit
CRC_MASK	Mask Variable of CRC	BOOLEAN	1 bit	0,1	0: CRC effective (*) 1: CRC invalid (Does not destroy receiving data)
CRC_ERR(n)	Number of CRC Errors	INTEGER	2 oct	0..32767	Accumulation value of CRC Errors on each slot. When it overflows, -1 shall be set and further accumulation shall be prohibited. n = 1..8

Note) (*) indicates the default value.

Table2.3-6 Variables of LLC sublayer in the base station

Parameter		Meaning	Type	Length	Value	Note
FLLC_CNT						
	N10	Maximum Value of Octets in an LPDU	INTEGER	2 oct		1 octet / bit
	N11	Maximum Number of Transmissions	INTEGER	1 oct	0..127	
	N13FE	Response Time	INTEGER	2 oct		
FLLC_STATUS(m)						m = 1.. MAXLINK
	V(SI)	Transmit State Sequence Variable	BOOLEAN	1 bit	0,1	
	V(RI)	Receive State Sequence Variable	BOOLEAN	1 bit	0,1	
	V(RB)	Reception Status State Variable	OCTET STRING	1 oct		

Table2.3-7 (1) Variables of MAC sublayer in the mobile station

Parameter		Meaning	Type	Length	Value	Note
OMAC_PVI(n)		Protocol version of the mobile station	BIT STRING	2 bit		n: number of substance
ACTC						
	FID	Fixed Equipment ID	OCTET STRING	1 oct		
	LID	Link Address	OCTET STRING	4 oct		
	LRI	Link Request Information Field	OCTET STRING	1 oct		See Table 2.3.-8
OMAC_CNT						
	IDNR	ID Number	BIT STRING	63 bit		See Annex C
	NRQmax	Maximum Number of Link Requests	INTEGER	1 oct	0..127	
	RT1	Limiting Cycle of Link Request	INTEGER	1 oct		1frame / bit RT1 < RT2
	RT2	Limiting Cycle of Link Request	INTEGER	1 oct		1frame / bit RT2 < RT3
	RT3	Limiting Cycle of Link Request	INTEGER	1 oct		1frame / bit RT3 < RT4

Table2.3-7 (2) Variables of MAC sublayer in the mobile station

Parameter			Meaning	Type	Length	Value	Note
OMAC_CNT							
	RT4		Limiting Cycle of Link Request	INTEGER	1 oct		1 frame / bit
	MQBUSY		Threshold value of Transmission State	INTEGER	1 oct	0..127	
	NMRmax		Maximum Number of Retries	INTEGER	1 oct	0..127	
	WTCmax		Maximum Number of WCNC Transmissions	INTEGER	1 oct	2	
OMAC_STATUS							
	NRQ		Maximum Number of Link Requests	INTEGER	1 oct	0..127	
	NRT		Limiting Counter of Retry Link Request	INTEGER	1 oct	0..127	
	NMR		Number of Retries	INTEGER	1 oct	0..127	
	NUMQ		Status Value of Transmission Queue	INTEGER	1 oct	0..127	
	TR _STATUS		Transmission State Variable	BOOLEAN	1 bit		1: busy, 0 : idle
	TSQ		Transmit State Sequence Variable	INTEGER	1 oct	0..7	
	TSQ2(n)						n= 0..7
		TSQ2.DUP	Duplication inspection state variable	BOOLEAN	1 bit	0,1	
		TSQ2.ACK	Delivery confirmation state variable	BOOLEAN	1 bit	0,1	0:Nack 1:Ack
	RSQ(n)		State Variable of Receiving Sequence	BOOLEAN	1 bit	0,1	n= 0..7
	WTC		Number of WCNC Transmissions	INTEGER	1 oct	0..3	
OMAC_TEST							
	ACK_MASK		Mask Variable of ACKC Transmission Process	BOOLEAN	1 bit	0,1	0 :Transmission admitted (*) 1 :Transmission inhibit
	RETRY_MASK		Mask Variable of Retry Process	BOOLEAN	1 bit	0,1	0 : Retry process admitted (*) 1 : Retry process inhibit
	CRC_MASK		Mask Variable of CRC	BOOLEAN	1 bit	0,1	0 : CRC effective (*) 1 : CRC invalid (No receiving data destroyed)
	CRC_ERR		Number of CRC Errors	INTEGER	2 oct	0..32767	Accumulation value of CRC Errors on each slot. When it overflows, -1 shall be set and further accumulation shall be inhibited. n = 1..8

Note) (*) indicates the default value.

Table2.3-8 Variables of Link Request Information

Parameter		Meaning	Type	Length	Value	Note
LRI						
	PR	ID Information of Priority Assignment	BIT STRING	1 bit		
	INIT	ID Information of Initialization Mode	BIT STRING	1 bit		
	RES PVI	Protocol Version Response	BIT STRING	2 bit		
	RES AID	ID Information of Application	BIT STRING	4 bit		

Table2.3.9 Variables of LLC sublayer in On Board Equipment

Parameter		Meaning	Type	Length	Value	Note
OLLC CNT						
	N10	Maximum Value of Octets in an LPDU	INTEGER	2 oct		1 octet / bit
	N11	Maximum Number of Transmissions	INTEGER	1 oct	0..127	
	N13ME	Response Time	INTEGER	2 oct		
OLLC STATUS						
	V(SI)	Transmit State Sequence Variable	BOOLEAN	1 bit	0,1	
	V(RI)	Receive State Sequence Variable	BOOLEAN	1 bit	0,1	
	V(RB)	Reception Status State Variable	OCTET STRING	1 oct		

3. Layer 7

3.1 Timer of Layer Management

(1) Release Timer (t10) **[Informative]**

The value of the t10 is specified by the RLT field described in subclause 4.2.4.2.1.6. The number of units is defined as 0 through 31 and a unit time is also defined as 0.2, 2, 20,and 200 second.

(2) Period of Broadcast Transmission (t11) (See subclause 4.4.6.1) **[Informative]**

T11 shall be the time for 1 frame.

(3) Transmission Wait Timer (t12) (See subclause 4.4.6.3)

T12 shall be a half time of which for 1 frame.

3.2 Management Information Base (MIB) [Informative]

For the moment, you should use 9,10,11 and 12 as Communication profile (see Annex P)

Table3.2-1 Variables of Application List

Parameter		Meaning	Type	Length	Value	Note
Ap_list(i)						i is the number of registered applications
	aid	Application Identifier	INTEGER	1oct	0,.127	
	eid	Element Identifier	INTEGER	1oct	0,.127	
	mandatory	Mandatory / Non Mandatory	BOOLEAN	1oct	0,1	0: Non Mandatory 1: Mandatory
	priority	Priority	INTEGER	1oct	0,.127	
	profile	Profile	INTEGER	1oct	0,.127	
	parameter	Parameter				Depending on the definition of each application

Table3.2-2 Variables of Communication Control

Parameter		Meaning	Type	Length	Value	Note
Com_ctl (j)						j is the number of linked applications
	link_address	Link Address	BIT STRING	32 bit		
	aid	Application Identifier	INTEGER	1oct	0,.127	
	eid	Partner's Element Identifier	INTEGER	1oct	0,.127	
	iid	Element Identifier				
	mandatory	Mandatory / Non Mandatory	BOOLEAN	1oct	0,1	0: Non Mandatory 1: Mandatory
	priority	Priority	INTEGER	1oct	0,.127	
	profile	Profile	INTEGER	1oct	0,.127	
	parameter	Parameter				Depending on the definition of each application
	norm_end	Result of AP Execution	BOOLEAN	1oct	0,1	0: Abnormal Termination 1: Normal Termination
	connect_status	Connection State Variable	BOOLEAN	1oct	0,1	0 : Performing 1 : Terminated
	RLT	Release Timer	INTEGER	1oct		RLT of FCMC is set
	SC	Information of Service Application	OCTET STRING	7 oct		SC of FCMC is set
	LRI	Link Request Information	BIT STRING	8 bit		LRI of ACTC is set
	TRI	Sender / Receiver Identifier	INTEGER	1oct	0,1	0: First Antenna 1: Second Antenna

Table3.2-3 Proprietary Information of the base station

Parameter		Meaning	Type	Length	Value	Note
Beacon						
	man_id	Manufacturer ID	INTEGER	2oct	0,.65535	
	ind_id	Device ID	INTEGER	4oct	0,...	
BEACON_CNT						
	t11	Period of Broadcast Transmission	INTEGER	1oct	0,.127	Used by B-KE
	t12	Transmission Waiting Timer	INTEGER	1oct	0,.127	Used by T-KE
	profile	Communication Profile	INTEGER	1oct	0,.127	9,10,11,12
	time	Current Time	INTEGER	5oct	0,...	

Table3.2-4 Proprietary Information of the mobile station

Parameter		Meaning	Type	Length	Value	Note
obe_conf						
	eq_class	Equipment Class	INTEGER	2oct	0,.32767	
	man_id	Manufacturer ID	INTEGER	2oct	0,.65535	
	obe_status	Mobile station Status	INTEGER	2oct	0,.65535	
OBE CNT						
	t12	Transmission Waiting Timer	INTEGER	1oct	0,.127	Used by T-KE
	profile	Communication Profile	INTEGER	1oct	0,.127	9,10,11,12
	time	Current Time	INTEGER	5oct	0,...	Option

4. System Management

4.1 Failure Detection Timer of the mobile station

The t9, maximum value of Failure Detection Timer, shall be greater than 60 seconds.

4.2 Management Information Base (MIB) [Informative]

The agent manages the variables to be used in Procedure element of the function assigned to System Management. It is added according to the contents of Application for Management. The agent also manages such variable as a Management Variable of each layer, which is not able to set the value autonomously (i.e. the set value is unknown) and requires to be preserved.

Table4.2-1 Management Variables of the base station

Parameter	Meaning	Type	Length	Value	Note
FCMC	FCMC Variable				See Annex A, Table 2.3.-1
FMAC_CNT	Control Variable of MAC sublayer in the base station				See Annex A, Table 2.3.-5
FLLC_CNT	Control Variable of LLC sublayer in the base station				See Annex A, Table 2.3.-6
beacon	Proprietary Information of The base station				See Annex A, Table 3.3.-3
BEACON_CNT	Proprietary Information of the base station				See Annex A, Table 3.2.-3

Table4.2-2 Management Variables of the mobile station

Parameter	Meaning	Type	Length	Value	Note
OMAC_CNT	Control Variable of MAC sublayer in the mobile station				See Annex A, Table 2.3.-7
OLLC_CNT	Control Variable of LLC sublayer in the mobile station				See Annex A, Table 2.3.-9
obe_conf	Proprietary Information of the mobile station				See Annex A, Table 3.2.-4
OBE_CNT	Proprietary Information of the mobile station				See Annex A, Table 3.2.-4
t9	Failure Detection Timer	INTEGER	1 oct	0..60	1 second / bit

Annex B. Communication Environment **[Informative]**

This annex describes the communication environment assumed in the standards of the layer 2 and the layer 7.

1. Basic Classifications of Communication Environment

The following shows the basic classifications of communication environment. AP and the FID represent an application (communication service user) and an identifier of BS (Base Station), respectively.

(1) Classification A: Presence of Overlapping Communication Areas
Separate (Sep.) : Each BS has its own Communication area separately.
Overlap (Ovr.) : Communication areas of plural BS are overlapped.

(2) Classification B: Communication Links when plural BSs exist (location of BSs)
Normal: BSs are not in the closest positions to each other (some communication areas may be overlapped).

Real Time: Plural BSs are very close each other. (including when both separated and overlapped communication areas may exist. “Very close” means here that plural BSs are located so close that mobile stations mistakes to associate with next true BS, because plural BSs are using Release Timer to prevent to associate for a certain period after end communication. For example, an Mobile Station moves between different communication areas of BSs in less than a few seconds. However, even when the communication areas of BSs exist closely, but both communication areas are wide and the association prevented by the Release Timer causes no trouble. These cases are not included .)

(3) Classification C: Classification of the Communication Transactions (Applications) performed in each BSs when plural BSs exist.

Same Application(AP Same): The same contents of communication (i.e. the contents of communication frame) are performed in plural BSs. The same FID is used in the BSs.

Parallel Application(AP Parallel): The different contents of communication are performed with the same transaction in plural BSs, so the multi-transaction is not necessary. The different FIDs are used in the BSs when they exist closely. The number of BSs is not defined. Generally, BSs are located transversely.

Independent Application (Ap ind.): The transactions are performed in plural BSs independently. The different FIDs are used in the BSs when they exist closely. The numbers of BSs are not defined.

Ordered Application(AP Ordered): The transactions have an order and need to be performed consecutively in plural BSs. The different FIDs are used in the BSs when they exist closely. Generally, BSs are located transversely.
(In principle here, The different FIDs are used in the BSs, when the contents of communication in plural BSs are different, and it is possible to mistake FIDs for the mobile station)

(4) Classification D: Control Method of Communication in plural BSs
TDMA: the Time Division Multiplexing controls Associated BSs.
FDMA: the Frequency Division Multiplexing controls Associated BSs.
None: Control Methods mentioned above are not used in the associated BSs at all.

In this annex, the communication environment is described with the combination of Classification A through D mentioned above. For example, the combination of Classification A: Separate, Classification B: Normal, Classification C: Same Application and Classification D: TDMA shall be described as ‘ Separate, Normal, Same Application and TDMA ’.

2. Basic Communication Environment assumed in the Standard of the layer 2, 7
Table. 1 shows an example of the variable setting within FCMC and the basic communication environment assumed in the Standard of Layer 2 and 7. Fig.1, 2, 3, 4 and 5 show the location of BSs.

Table.1 (1) Examples of Variables Setting within FCMC and Basic Communication Environment assumed in the Standard of the layer 2 and the layer 7

Case No.	A Zone Location	B Communication Link	C AP Environment	D Communication Control	BS Location	CCZ	TRI	TDI	FID	Association	Note
1	Sep.	Normal	AP Same		Fig.3	0	xx	0	Same	possible	2 BSs arranged in Traveling Direction (*1)
2	Sep.	Normal	AP Parallel		Fig.1	0	00	0	Dif-ferent	possible	Arranged transversely (Adjacent BSs)
3	Sep.	Normal	AP Inde-pendent		Fig. 1,3,4	0	00	0	Dif-ferent	possible	Arranged normally
4	Sep.	Normal	AP Ordered		Fig. 3,4	0	00	0	Dif-ferent	possible	Depending on the Application
5	Sep.	Real Time	AP Same	TDM	Fig.3	0	xx	1	Same	possible	2 BSs arranged in Traveling Direction (*1)
6	Sep.	Real Time	AP Same	FDM	Fig.3	0	xx	0	Same	Not assumed	2 BSs arranged in Traveling Direction (*2)
7	Sep.	Real Time	AP Same	None	Fig.3	0	xx	0	Same	Partly limited	2 BSs arranged in Traveling Direction (*2)
8	Sep.	Real Time	AP Parallel		Fig.1	0	00	0	Dif-ferent	possible	Same as Case 2 (No meaning of Real Time)
9	Sep.	Real Time	AP Inde-pendent	TDM	Fig.3	1	xx	1	Dif-ferent	possible	2 BSs arranged in Traveling Direction (*3) (Frequency Selection Process can be omitted)
10	Sep.	Real Time	AP Inde-pendent	FDM None	Fig.3	1	xx	1	Dif-ferent	Partly limited	2 BSs arranged in Traveling Direction (*4) (Frequency Selection Process can not be omitted)
11	Sep.	Real Time	AP Ordered	TDM	Fig.3	1	xx	1	Dif-ferent	possible	2 BSs arranged in Traveling Direction (*3) (Frequency Selection Process can be omitted)
12	Sep.	Real Time	AP Ordered	FDM None	Fig.3	1	xx	0	Dif-ferent	Partly limited	2 BSs arranged in Traveling Direction (*4) (Frequency Selection Process can not be omitted)
13	Ovr.	Normal	AP Same	TDM	Fig. 2,5	0	xx	1	Same	possible	Same Application overlapped (*5)

Table.1 (2) Examples of Variables Setting within FCMC and Basic Communication Environment assumed in the Standard of the layer 2 and the layer 7

Case No.	A Zone Loca-tion	B Commu-nication Link	C AP Environ-ment	D Commu-nication Control	BS Loca-tion	CCZ	TRI	TDI	FID	Associ-ation	Note
14	Ovr.	Normal	AP Parallel	TDM	Fig.2	0	00	1	Dif-feren t	possible	Same Application overlapped
15	Ovr.	Normal	AP Inde-pendent	TDM	Fig. 2,5	0	00	1	Dif-feren t	possible	Different Applications overlapped
16	Ovr.	Normal	AP Ordered	TDM	Fig.5	0	00	1	Dif-feren t	possible	Ordered Applications overlapped
17	Ovr.	Real Time	AP Same	TDM	Fig. 2,5	0	xx	1	Same	possible	Same Application overlapped (*5)
18	Ovr.	Real Time	AP Parallel	TDM	Fig.2	0	00	1	Dif-feren t	possible	Same as Case 14 (No meaning of Real Time)
19	Ovr.	Real Time	AP Inde-pendent	TDM	Fig.5	1	xx	1	Dif-feren t	possible	2 BSs arranged in Traveling Direction (*3) (Frequency Selection Process can be omitted)
20	Ovr.	Real Time	AP Ordered	TDM	Fig.5	1	xx	1	Dif-feren t	possible	2 BSs arranged in Traveling Direction (*3) (Frequency Selection Process can be omitted)
21	Ovr.	Norma	-	FDM None	Fig.6	0	xx	0	Dif-feren t	Not assumed	Not assumed at this stage
22	Ovr.	Real Time	AP Inde-pendent	FDM	Fig.6	0	xx	0	Dif-feren t	possible	Assumed adaptation of plural Qos
23	Ovr.	Real Time	AP Same AP Parallel AP Ordered	FDM	Fig.6	0	xx	0	Dif-feren t	Not assumed	Not assumed at this stage
24	Ovr.	-	-	None	Fig. 2,5,6	-	-	-	-	Not assumed	Not assumed at this stage

Notes)

(*1) If Transmitter / Receiver Identifier (TRI) is not used, the configuration of more than 3 components is feasible.

(*2) If Transmitter / Receiver Identifier (TRI) is not used, the configuration of more than 3 components is feasible.

However, the linkage is difficult when the frequency is different.

(*3) Due to the problem of association, the configuration of more than 3 components in traveling direction is not feasible.
(*4) The association is feasible but the Frequency Selection Process can not be omitted.

(*5) If Transmitter / Receiver Identifier (TRI) is not used, the configuration of more than 3 BS components is feasible.

(*6) In this table, x indicates that any possible case can be applied.

(*7) In this table, except for the case clearly defined, the detailed problems of interference between BSs and the transmission time of applications are not considered.

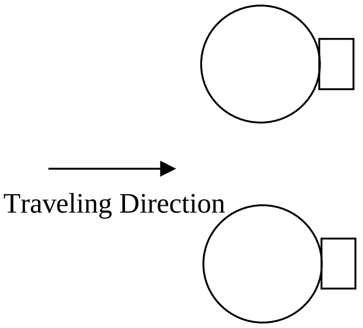


Fig.1 BSs arranged transversely

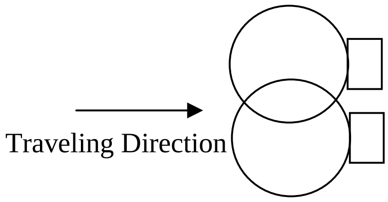


Fig.2 BSs arranged transversely
Their communication zone

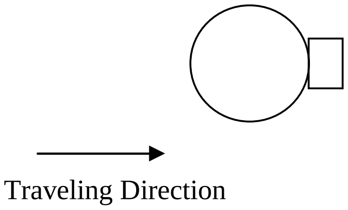


Fig.3 BSs arranged in Traveling Direction

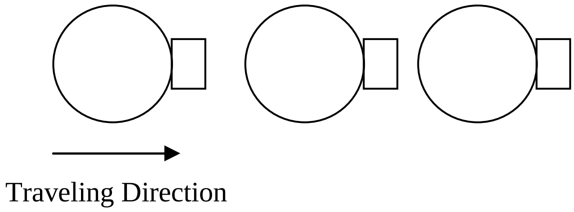


Fig.4 BSs arranged in Traveling Direction

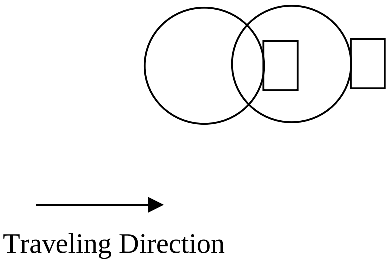


Fig.5 BSs arranged in Traveling Direction
Their communication zone overlapped

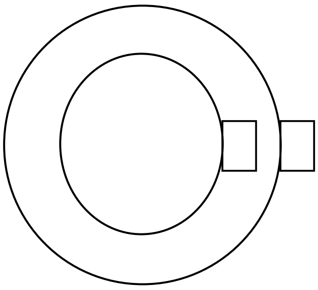


Fig.6 BS communication zone
contained in another zone
(including 2communication zones are
same shape and overlapped)

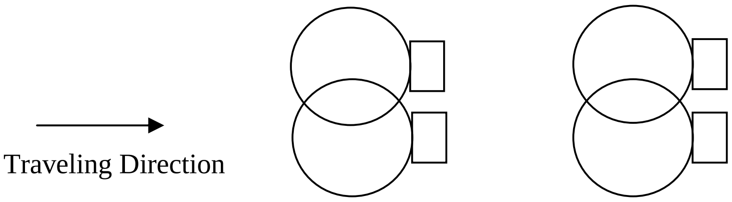


Fig.7 Communication zones of BSs overlapped and arranged at regular intervals
(Combination of the communication zone showed in Fig.2 and Fig.3)

3. Combined Communication Environment

There are so many combinations of the Communication Environment described in the preceding paragraph. For a typical but complex example, the case that BSs with their communication areas overlapped and transversely located, sequentially communicate in the traveling direction (Fig.7) can be assumed. Only this case is considered in this paragraph.

The case that BSs with their communication environment overlapped transversely and perform the same contents of transaction, is described as “Overlap, Normal, AP same or AP Parallel and TDMA” according to the Classification shown in the preceding paragraph. And the case that BS sequentially communicate in the traveling direction can be described as “ Separate, x, AP Ordered and x”. These cases can be described in Table 2.

Table. 2 Adaptation to Combination of Communication Environment

Case	Transverse Arrangement				Traveling Direction Arrangement				Adapta-tion	Note	No.1 BS CCZ,TRI, TDI(*5)	No.2 BS CCZ,TRI, TDI(*5)
	Zone	Link	AP Enviro n-ment	Con-trol	Area	Link	AP Enviro n-ment	Con-trol				
1	Ovr.	Nor-mal	AP Same	TDM	Separate	Normal	AP ordered	X	Possible	Association in traveling direction is Feasible	0,00,X	0,00,X
2	Ovr.	Nor-mal	AP Same	TDM	Separate	Real Time	AP ordered	TDM	Possible	Two BSs in traveling direction (*1)	1,01,1	1,10,1
3	Ovr.	Nor-mal	AP Same	TDM	Separate	Real Time	AP ordered	FDM None	Partly limited (*3)	Two BSs in traveling direction (*2)	1,01,0	1,10,0
4	Ovr.	Nor-mal	AP Parallel	TDM	Separate	Normal	AP ordered	X	Possible	Association in traveling direction is Feasible	0,00,X	0,00,X
5	Ovr.	Nor-mal	AP Parallel	TDM	Separate	Real Time	AP ordered	TDM	Possible	Two BSs in traveling direction (*1)	1,01,1	1,10,1
6	Ovr.	Nor-mal	AP Parallel	TDM	Separate	Real Time	AP ordered	FDM None	Partly limited (*3)	Two BSs in traveling direction (*2)	1,01,0	1,10,0

Notes)

(*1) There is no BS recognition for Transverse Arrangement. And Frequency Selection Process can be omitted. In the case that the association is feasible, The number of BSs in the traveling direction is up to 2.

(*2) There is no BS recognition for Transverse Arrangement. Frequency Selection Process can not be omitted unless the BSs arranged in traveling direction use the same frequency. In the case that the association is feasible, the number of BSs in the traveling direction is up to 2.

(*3) It means that the BS can be adapted, in the case that the time of Frequency Selection causes no problem.

(*4) After the termination of Frequency Selection Process (Not only the termination of normal transmission) between an MS and No.1 BS (CCZ=1) using Time Division (TDI= 1), Frequency Selection Process between the MS and No.2 BS can be simplify. Although it is assumed that a layer of higher order than Layer 2 might request Frequency Selection Process in the various communication environment (for example, locking of Frequency Selection Process for a fixed period of time to perform the next association promptly, in the case of normal / abnormal termination of transmission and so on), The adoption of these procedure is entrusted the manufacturer’s discretion.

(*5) In this case, it is assumed that the FIDs of BSs are different.

4. Overlapped Communication Environment

(1) Overlapped communication zone

It is necessary to consider influences of overlapped communication zones about the connecting with mobile stations and the performing applications in the case described as Paragraph 1 that communication zones of plural base stations are overlapped. in Table 1 of Paragraph 1, these are classified as case No 13 through 24 .
The connection between mobile stations and base stations in overlapped communication zones is related to the relative position of communication zones and the Traveling Direction of mobile stations.
That is , as Case No 16 and so on, it is assumed occasionally that mobile stations connect the closer base station, their application perform and end continuously, then connect the next base station. In this case, the association of the performed application by the closer base station and the performed application by the next base station depends on the procedure of application. (The Case No16 is ordered application.)
The other side, as Case No 14, it is necessary to consider the accidental nature on time axis about which base stations are selected when a mobile station enter overlapped communication zones (TDMA) at the same time. It is necessary to pay attention to above restrictions in particular , when applications of each communication zones.
In Case No 24 described in Table 1 of Paragraph 1, described as Base station Communication

zones and other base station communication zones are overlapped and different frequency communication zones in same areas are overlapped. In Fid 5 and 6, it is assumed occasionally that depending on how to overlap for both communication zones, connecting to the closer base station and performing the application and end ,then connecting to the next base station. But How to connect depends on Frequency Selection Process of the mobile station mainly when almost same size communication zones described at Fig 2 and 6.
Frequency Selection Process is described in Annex E of this standard, according to above points , it is described focusing the association overlapped communication zones.

(2) Frequency Selection Process in overlapped communication zone

a. Frequency Selection Process

In overlapped communication zones, it is possible to perform a combination with others and a normal application described as Frequency Selection Process in Annex E.
As other procedures, for example, the first procedure is that the mobile station select a channel by detecting AID information, etc in FCMC after scanning each frequency. The Second procedure is that the mobile station focus next frequency group expected by adapting the information of application or setting the priority of frequency selection (including priority channel). The third procedure is that the mobile station manages the priority of frequency selection cyclic by storing the sequence of receive frequency. The fourth procedure is that the mobile station select by comparing both level in zones of base stations.
However, above and other procedures depend on the application or the installation, normal frequency selection process shall be use as precondition, other procedures are out of scope in this standard.

b. Channel changeover

If it is possible for a mobile station to change the frequency channel to the other base station in succession to a transaction with one base station within an overlapped communication zone, a processing procedure in which instructions such as frequency data to be handed over are transmitted from the base station to the mobile station during a transaction based on an application, can be considered. This procedure, however, depends on applications and installation. Therefore, it is not specified in the DSRC protocol stack within the scope of this standard.

c. Priority channel

Designation of the base station frequency is, of course, outside the scope of this standard, but it is desirable to apply a priority channel when forming an overlapped communication zone if it is effective in frequency selection for a mobile station.

d. Number of frequency channels

This standard assumes that an overlapped communication zone is comprised of two communication zones that use one different frequency channel, forming an FDMA environment with two frequencies in total.

Annex C.　WCNC (Call sign) format

(Equipment: No. 9, Article 9 - 4, enforcement: No. 2, Article 6 - 2, Notification No)

1. The configuration of the Wireless Call Number Channel (WCNC; Call sign) shall comply with the following specification.

Each mobile station and test equipment shall have a unique identification number (IDNR).
When a WCNS slot (uplink) is assigned, the mobile station shall immediately send the WCNC shown below within the WCNC transmission window in an appropriate slot shown in Figs. 4.2.4.2.4-1 and 4.2.4.2.4-2. The number of transmission times in one transaction is specified by WTCmax (see section 4.3.3.5.1.2.2.).
When a WCNS slot (downlink) is assigned, the test equipment shall send the WCNC shown below within the WCNC transmission window in an appropriate slot shown in Figs. 4.2.4.2.4-1 and 4.2.4.2.4-2.
The specified WCNC format is shown in Fig. 1.1.1 (ASK system) and Fig. 1.1.2 (π/4 shift QPSK system) below. It consists of the ramp bit (R: π/4 shift QPSK system only), preamble (PR) signal, unique word (UW3), and ID number (IDNR). Details of the format are described in the following. When using the π/4 shift QPSK system, data scrambling shall be performed for the ID number (IDNR) as specified in Section 4.2.6.2.

Note) the Link Address for WCNS assignment assumes that the mobile station uses a unique Link Address.　The group broadcasting address [120] shall be used for the test equipment.

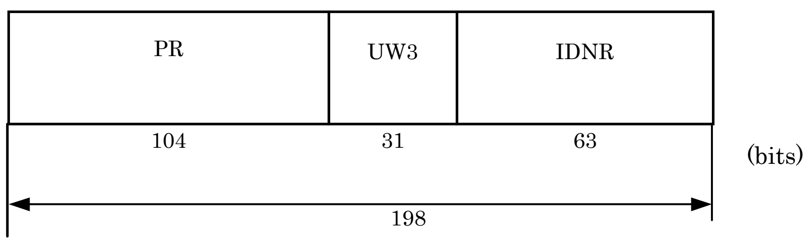
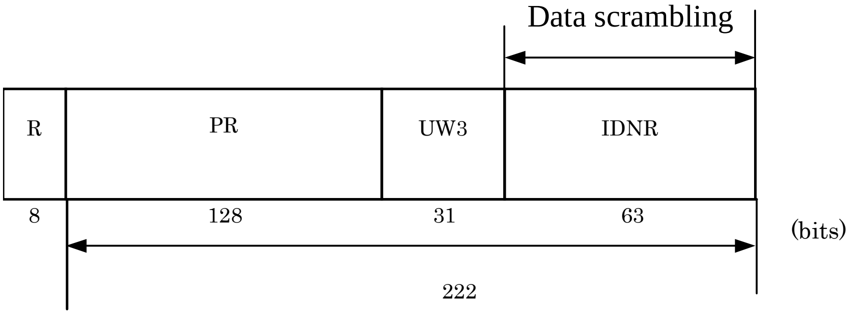


Fig.1.1.1　WCNC Format（ASK system）



Fig,1.1.2　WCNC Format（QPSK system）

1.1 Preamble (PR)

(1) ASK system

A preamble shall be the 104 bits in length as follows. This field shall be transmitted most significant bit (MSB) first in expressed sequence.

MSB　　　　　　　　LSB
[101010101010 ------ 1010]

(2) π/4 shift QPSK system

A preamble shall be the 128 bits in length as follows. This field shall be transmitted most significant bit (MSB) first in expressed sequence.

MSB　　　　　　　　LSB
[1001 1001 ------ 1001]

1.2 Unique Word (UW3)

(1) ASK system

It is used for the TDMA Frame Synchronization. It shall be the configuration with 31 bit M sequence code as follows and transmit most significant bit (MSB) first in expressed sequence.

MSB　　　　　　　　　　　　　　　　　　LSB
[0 0 0 1 1 0 1 1 1 0 1 0 1 0 0 0 0 1 0 0 1 0 1 1 0 0 1 1 1 1 1]

(2) π/4 shift QPSK system

It is used for the TDMA Frame Synchronization. It shall be the configuration with 31 bit M sequence code as follows and transmit most significant bit (MSB) first in expressed sequence.

MSB　　　　　　　　　　　　　　　　　　LSB
[0 0 0 1 1 0 1 1 1 0 1 0 1 0 0 0 0 1 0 0 1 0 1 1 0 0 1 1 1 1 1]

1.3 ID Number (IDNR)

The IDNR consists of ID name and Error Correcting Code. The configuration shall be as follows:

[a_{62}, a_{61}, a_{60}, a_{59}, a_{58}, a_{57}, a_{56}, a_{55}, a_{54}, a_{53}, a_{52}, a_{51}, a_{50}, a_{49}, a_{48}, a_{47}, a_{46}, a_{45}, a_{44}, a_{43}, a_{42}, a_{41}, a_{40}, a_{39}, a_{38}, a_{37}, a_{36}, a_{35}, a_{34}, a_{33}, a_{32}, a_{31}, a_{30}, a_{29}, a_{28}, a_{27}, a_{26}, a_{25}, a_{24}, a_{23}, a_{22}, a_{21}, a_{20}, a_{19}, a_{18}, a_{17}, a_{16}, a_{15}, a_{14}, a_{13}, a_{12}, a_{10}, a_9, a_8, a_7, a_6, a_5, a_4, a_3, a_2, a_1, a_0]

From a_{62} through a_0, they shall be the factors of the following polynomial's term from the 62 nd through the 0 th on the finite field which has the order of 2.

$$X^{12} * (\sum_{i=0}^{50} b_i X^i) + R(X)$$

Where from b_0 through b_{47}, they shall be corresponded to each digit from 1st through the 48th of ID name, which is converted from number of 12 digits into binary numeral according to Table 1.1 and from b_{48} through b_{50}, they shall be zeros.

In addition, R (X) shall be a residue polynomial when

$$X^{12} * (\sum_{i=0}^{50} b_i X^i) \text{ is divided by } (X^{12} + X^{10} + X^8 + X^5 + X^4 + X^3 + 1).$$

Table 1.1 Conversion Table of ID name into Binary Numeral

Number of ID name	1	2	3	4	5	6	7	8	9	0
Binary Numeral	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100

Note) An IDNR shall be transmitted in the specified order from the coefficient of the 62nd term.

Annex D. Encryption Key

Encryption Key is used for an initial value of a shift register for scramble and the key length is 2 octets (16 bits).

Encryption Key is generated according to the link address (LID) provided by association procedures between the base station and the mobile station. It shall be translated LID using the same translation table, which is previously prepared in the base station or the mobile station.

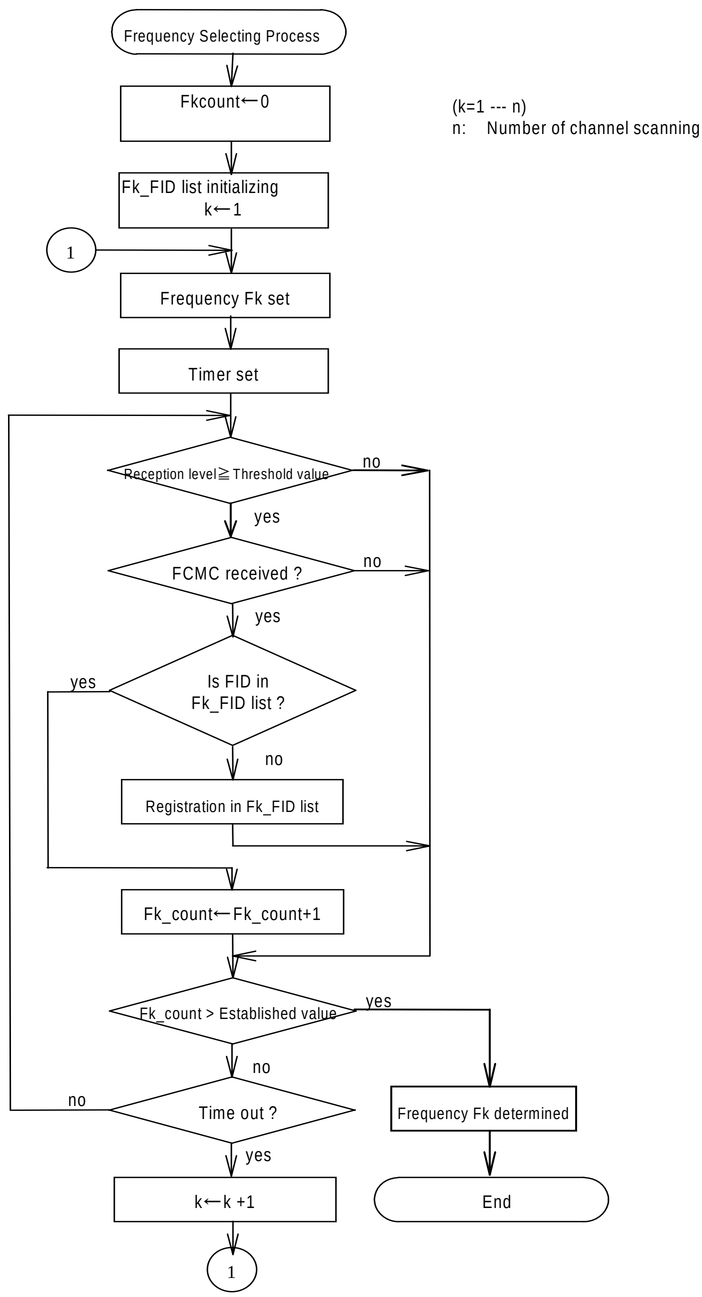
Generation of the translation table shall comply with the following:

(1) It shall be used the portion of 2 octets on LSB side of the LID shown in Fig. 4.2.4.2.1.8.2 (including the extender).
Specifically, S0 in Fig. 4.2.6.2.1 corresponds to bit 1 of the first octet, and S15 corresponds to bit 8 of the second octet. (Between S0 and S15, correspond sequentially)
(2) If the LID is a Private Link Address, the bit is shifted “1” to “0” or “0” to “1”, and used as a Encryption Key
(3) Encryption Key of Broadcast Address shall be “0000 0000 0000 0000”.
(4) The encryption key of group broadcast address shall be "0000 0000 0000 0000"

Annex E. Frequency Selection Procedures [Informative]

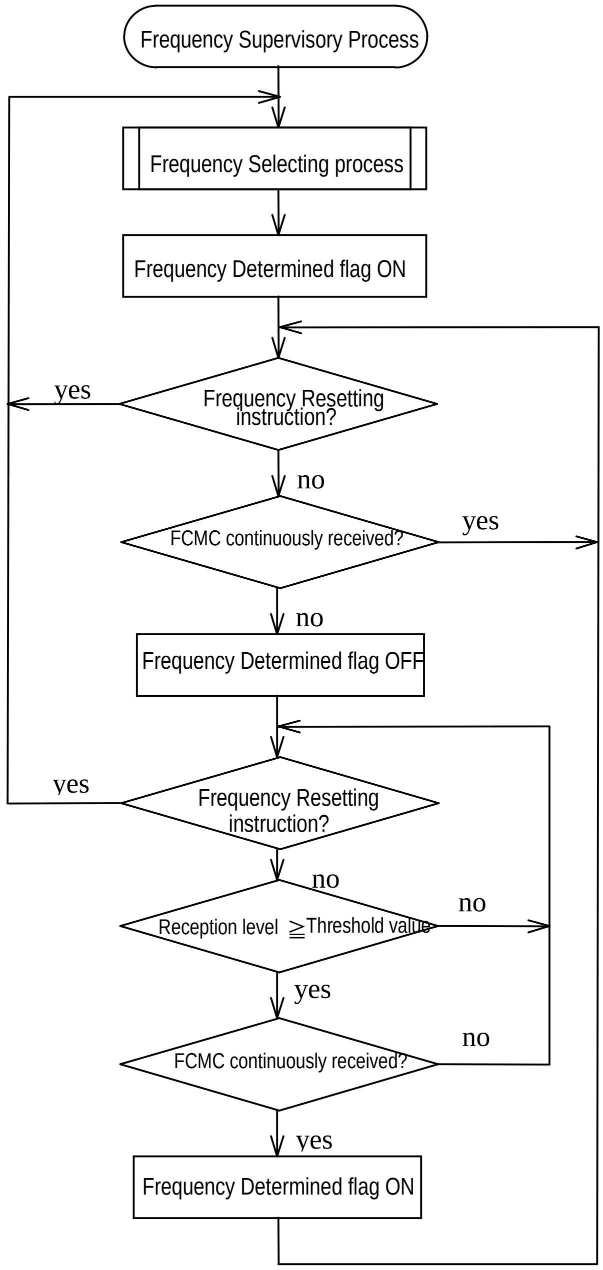
1. Frequency Selection Procedures

Frequency Selection Procedures is shown for reference. A FCMC reception is regarded a reception time of a FCMC which is identified correct ones by the CRC inspection. Fk_FID list is used for logging of FID received by the array structure.



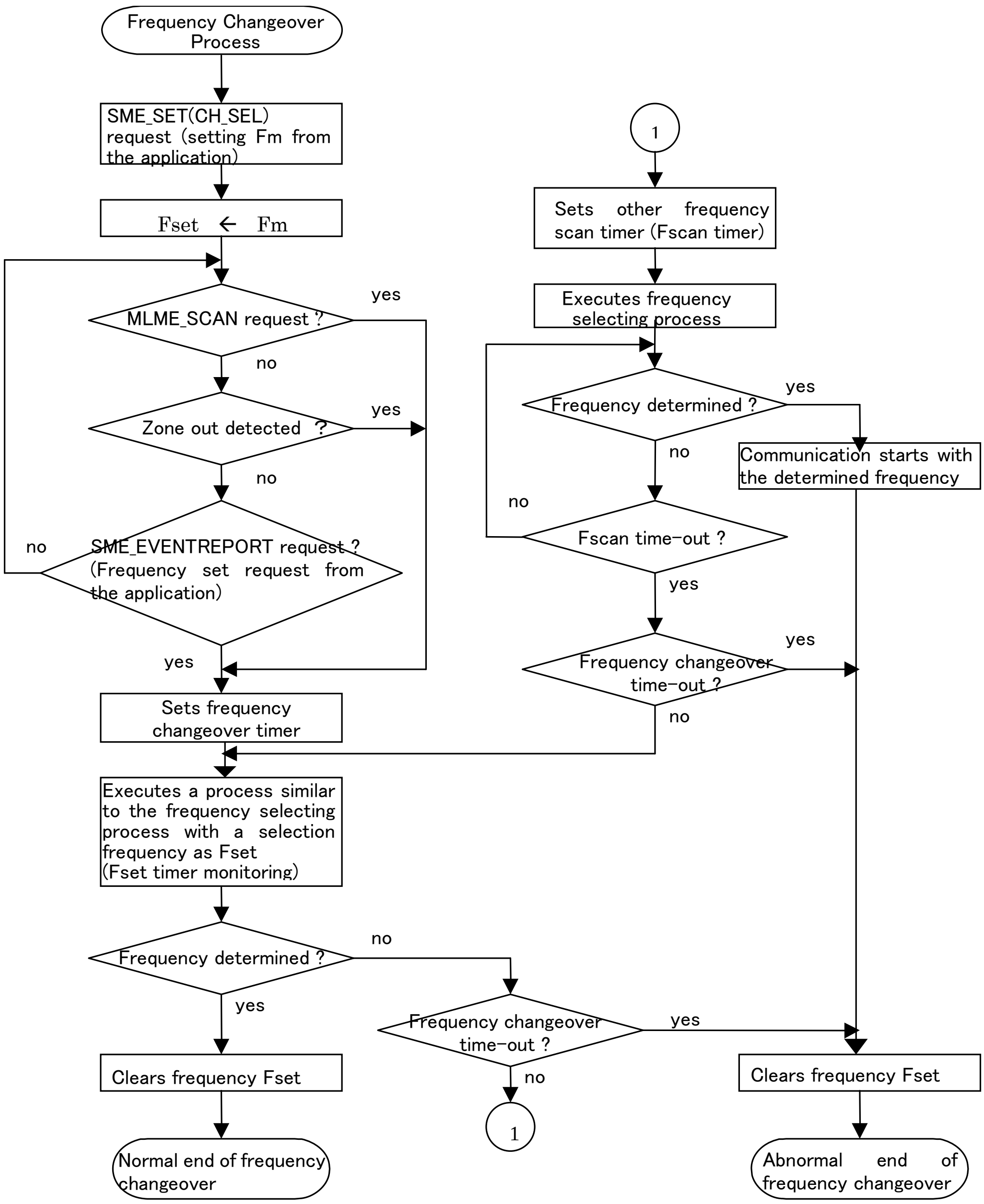
2. Frequency Supervisory Procedures

Frequency Supervisory Procedures is **s**hown in the following figure. This supervisory procedures is not necessarily to be an independent function module.



3. Frequency Changeover Procedures

The flow of frequency changeover process carried out by frequency setting from an application is shown below. This process is an application-based optional feature and sets a specific frequency obtained from the application format data through the system management entity (SME). In addition, this process is a functional module independent from the frequency selection/monitoring processes, and does not depend on any other processes.



Annex F. Layer 2 (MAC) SDL diagram [Informative]

The following symbols and abbreviations are used in these descriptions. The symbols, their meanings and complete descriptions of their application methods are in ITU-T Z-Series recommendations.


Process


Procedure call

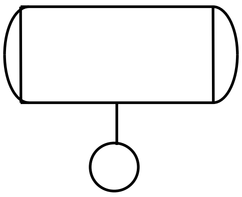

Signal reception within the **MAC sublayer**

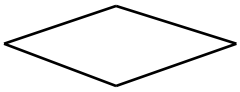

Signal transmission within the **MAC sublayer**

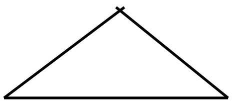

Primitive Reception
(Left: Direction of LLC sublayer,
Right: Direction of the layer 1)


Primitive transmission
(Left: Direction of LLC sublayer
Right: Direction of the Layer 1)


State


Procedure definition


Judgement


Selection

Note) All binary numbers described in the SDL diagram are in the order from MSB to LSB.

1. SDL Diagram of MAC Sub-Layer

Only SDL diagram of the MAC sublayer is described in this chapter. The LLC sublayer is described in the state transition list.

1.1 Overview of State Machines

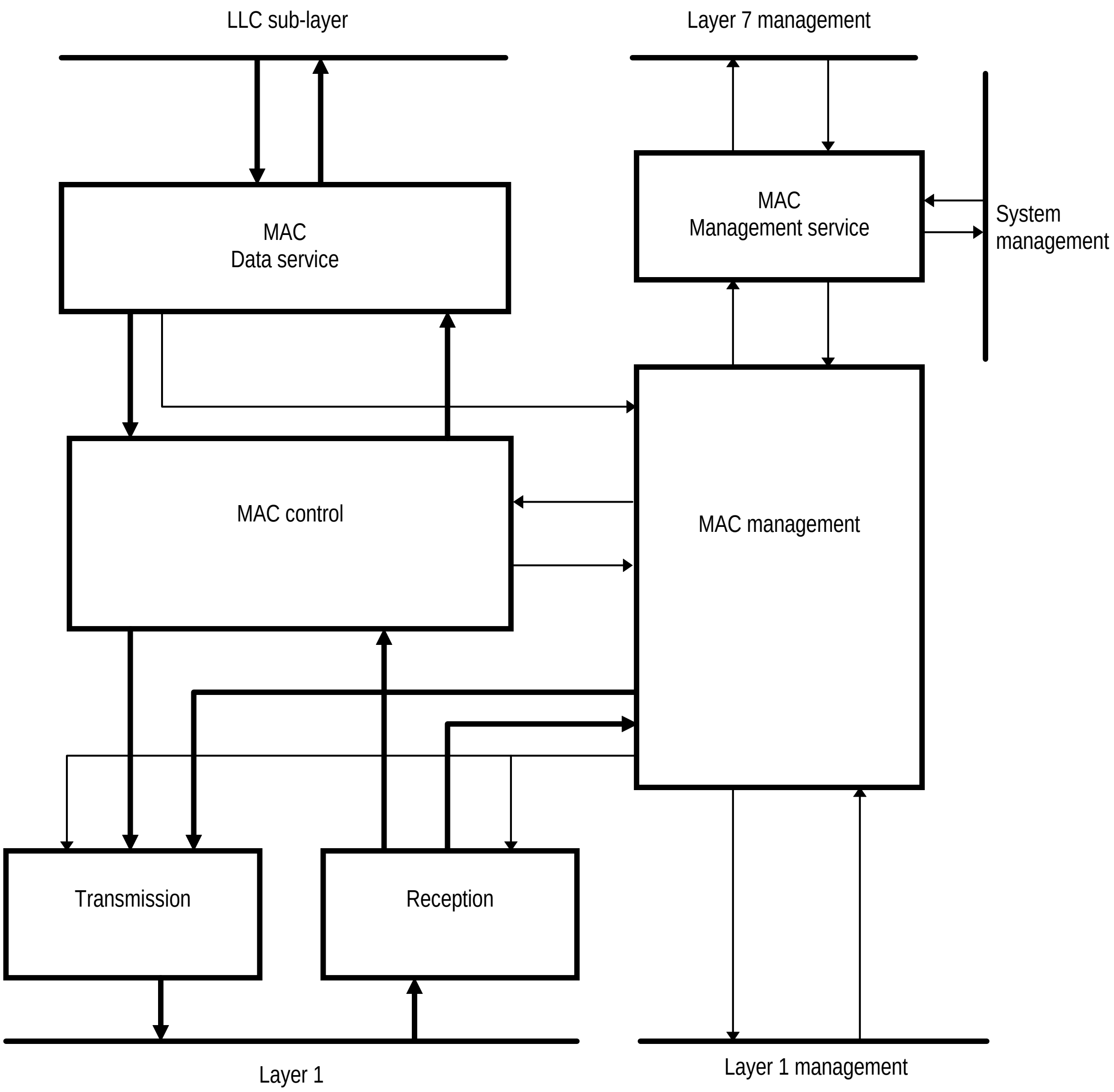
MAC operation is described in six communication state machines. They operate simultaneously. If there are differences between terms used in this subclause and previous subclauses, those in previous subclauses take precedence. Fig. F-1 shows the relation between those state machines. In the figure, a bold arrow line shows a transfer path for data frames and fragments and also for control signals and status data. A slim arrow line is used for transfer of control signals and status data only.

(1)MAC Data Service State Machine
Provides LLC sublayer with the MAC data service interface.
(2)MAC Management Service State Machine
Provides MAC sublayer management entity (MACLME) or system management entity (SME) with the MAC management service interface.
(3)MAC Control State Machine
Provides adjustment function to transfer frames and fragments via Layer 1. Provides data segmentation/desegmentation.
(4)MAC Management State Machine
Provides MAC management functions such as synchronizing management and association. Bears major responsibility for maintenance and management of the MAC MIB (Management Information Base).
(5)Transmission State Machine
Transfers frames for transmission at the physical channel of Layer 1 and performs CRC generation.
(6)Reception State Machine
Checks validity, CRC and double reception of receive frames from Layer 1.

Note) The description in this appendix does not take the $\pi/4$ shift QPSK system into consideration except for the PDU's maximum transfer size (MSIZE). To carry out the $\pi/4$ shift QPSK system processing, it is necessary to add the processing procedure (data scrambling/decoding and error correction encoding/decoding shown in Section 4.2.4) specified for Layer 1.

Scrambling described in this appendix is a simplified encryption scrambling specified in Section 4.2.6.1.
In case of the $\pi/4$ shift QPSK system, UW2 used in attached figures F-9, F-12 (RMRV2), F-34 (OMTR2), and F-37 (OMRV3) shall be replaced with UW2B, and likewise, UW2 in F-10, F-12 (RMRV4), F-34 (OMTR3), F-35, and F-37 (OMRV4) with UW2A.

1.2 Outline of MAC Sub-Layer State Machine

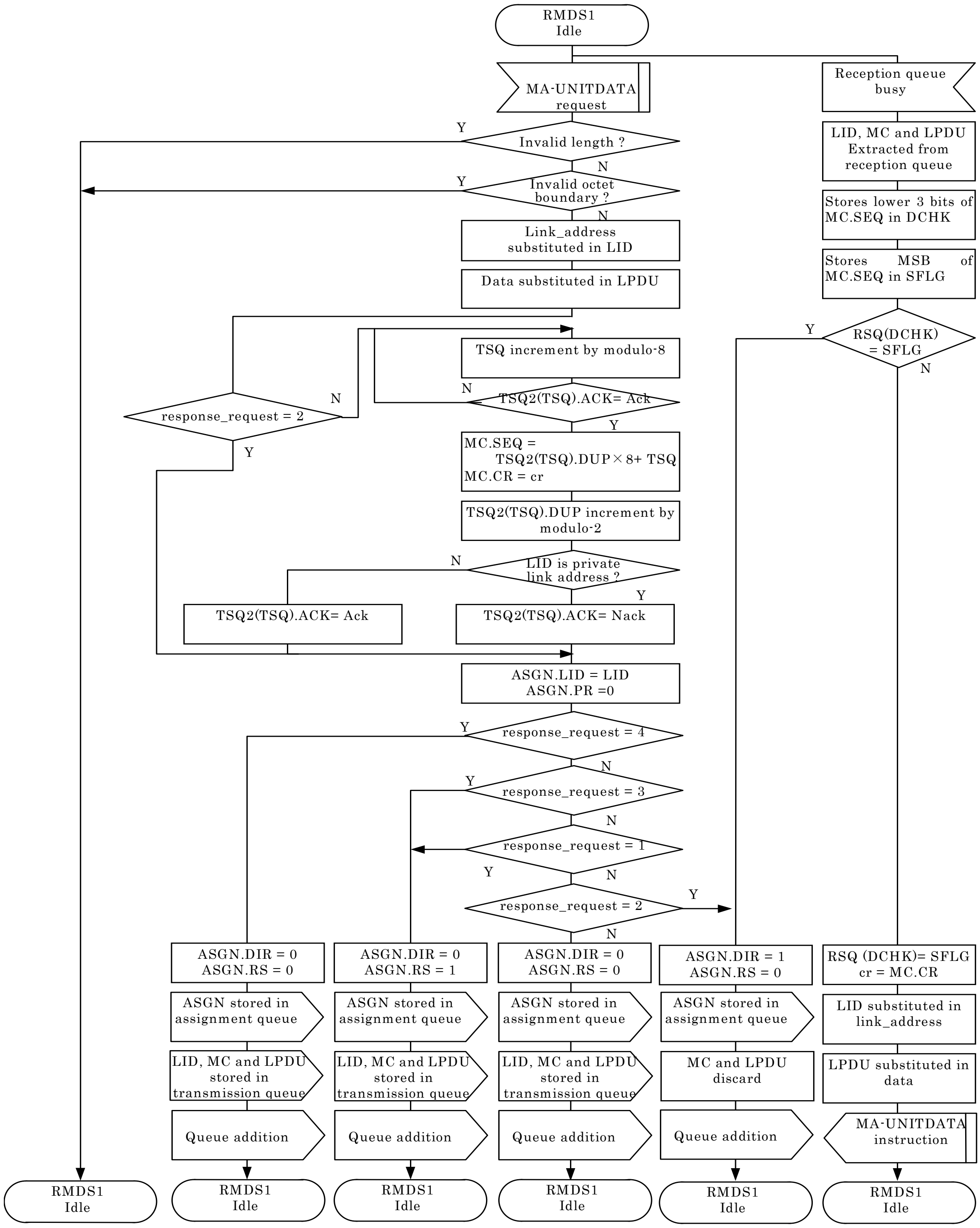


Attached Fig. F-1　Outline of State Machine

2. SDL Diagram of State Machine

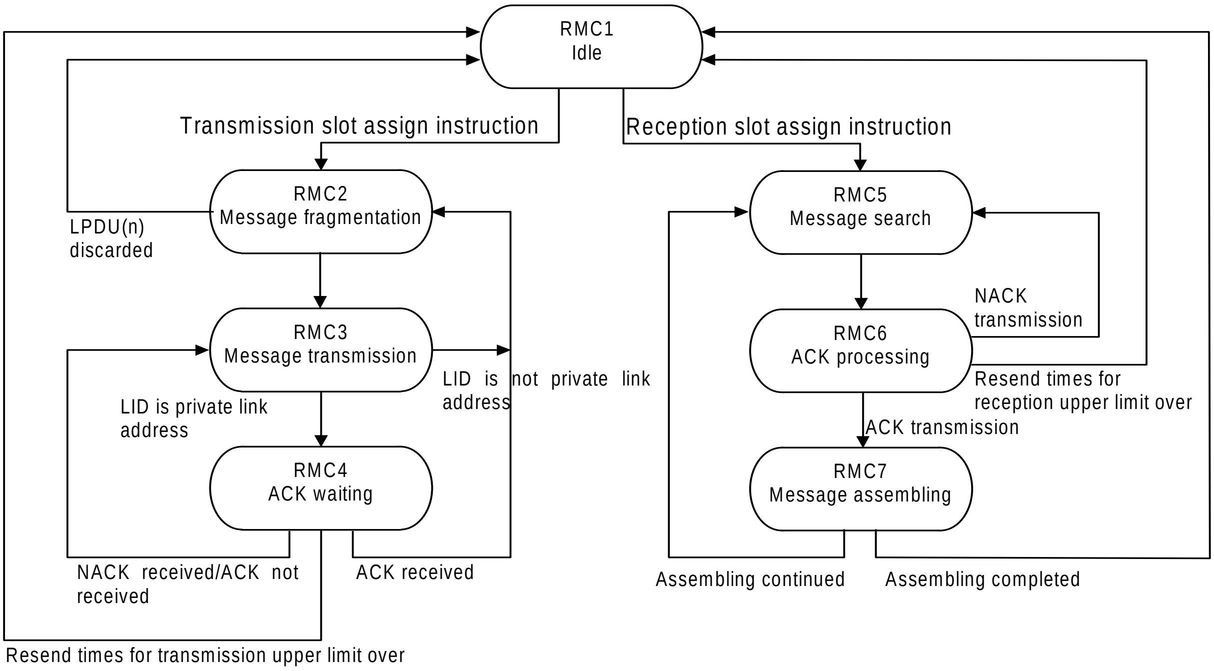
2.1 SDL Diagram of State Machine at Base Station

2.1.1 MAC Data Service State Machine

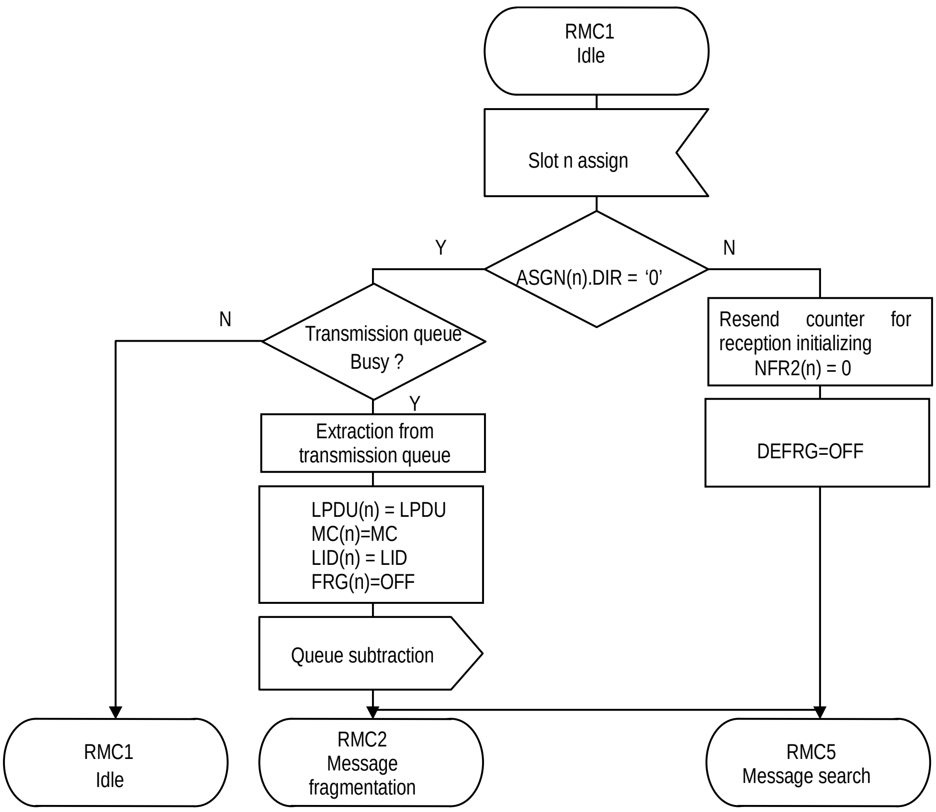


Attached Fig. F-2 SDL Diagram of the layer 2 MAC sublayer (Base Station)

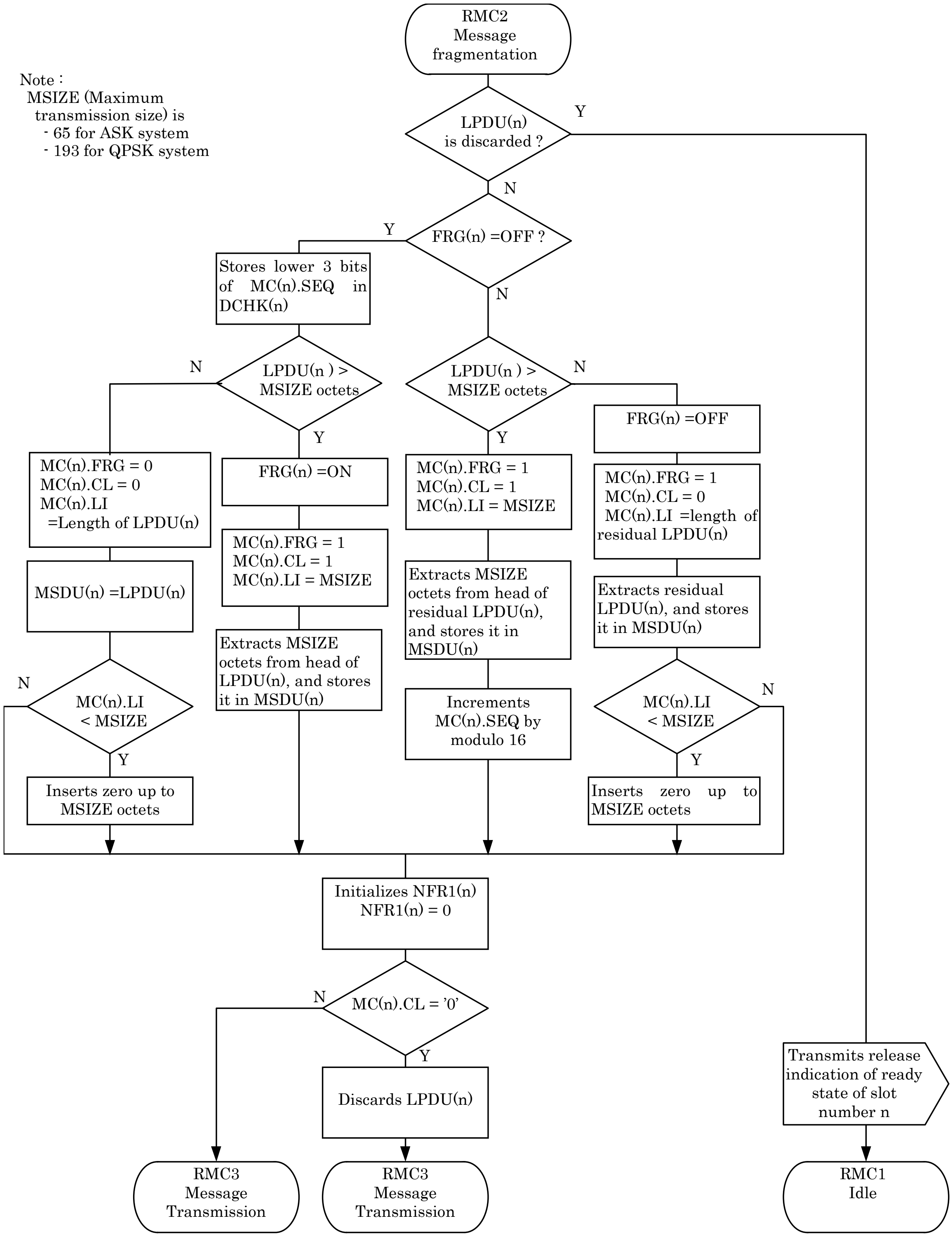
2.1.2 MAC Control State Machine



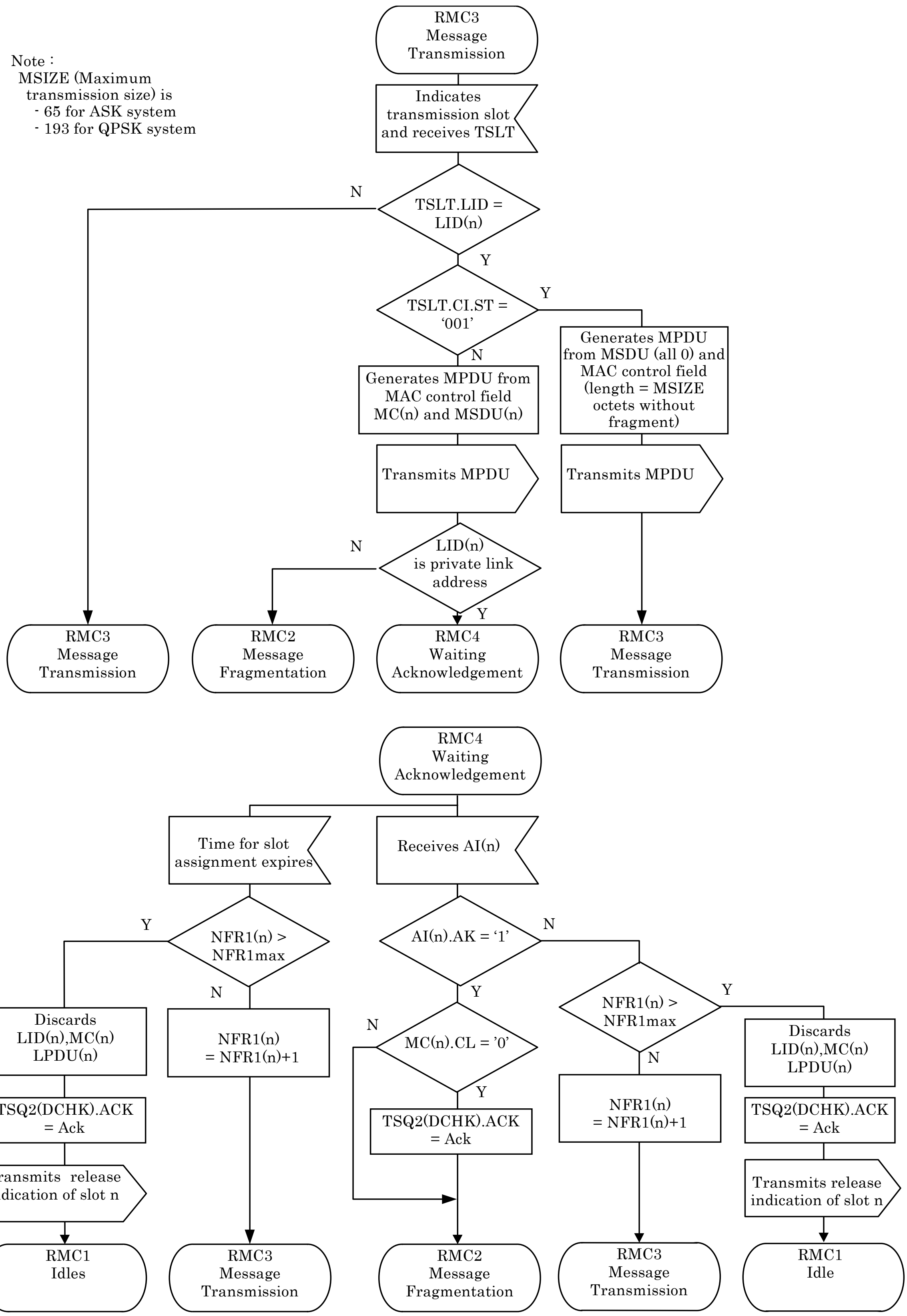
Attached Fig. F-3 Outline of MAC Control State Machine (Base Station)



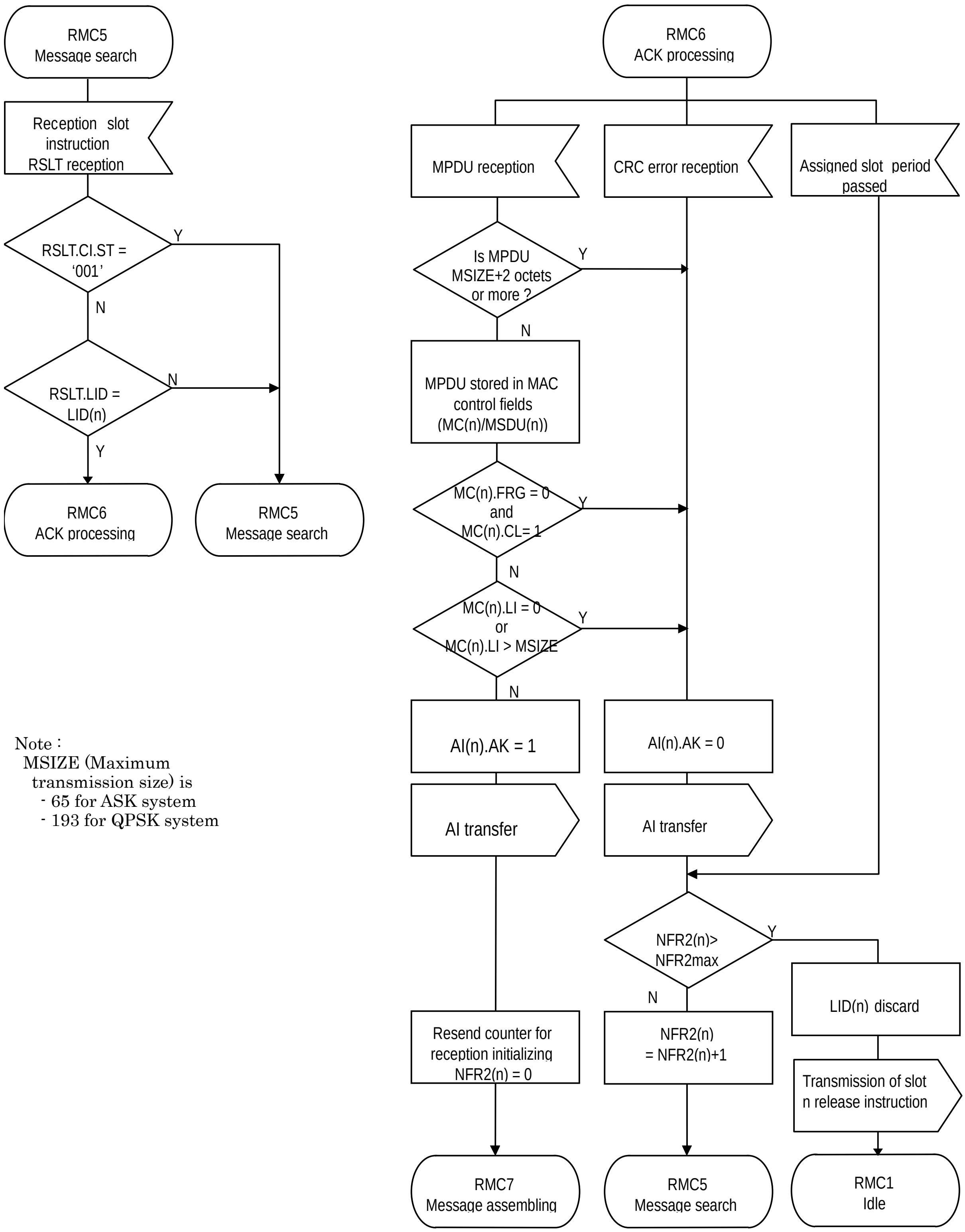
Attached Fig. F-4 SDL Diagram of the layer 2 MAC sublayer (Base Station)



Attached Fig. F-5 SDL Diagram of the layer 2 MAC sublayer (Base Station)

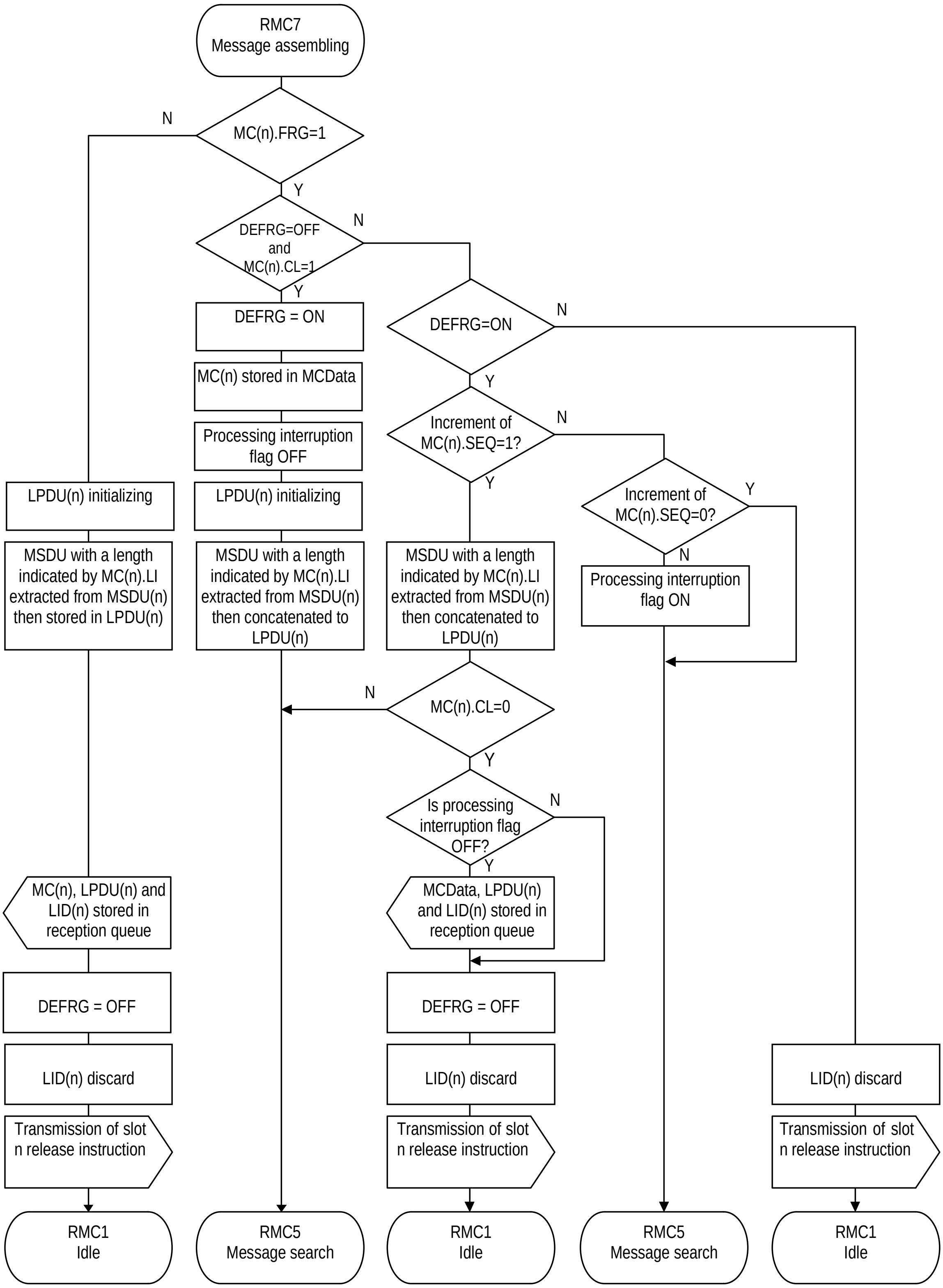


Attached Fig. F-6 SDL Diagram of the layer 2 MAC sublayer (Base Station)



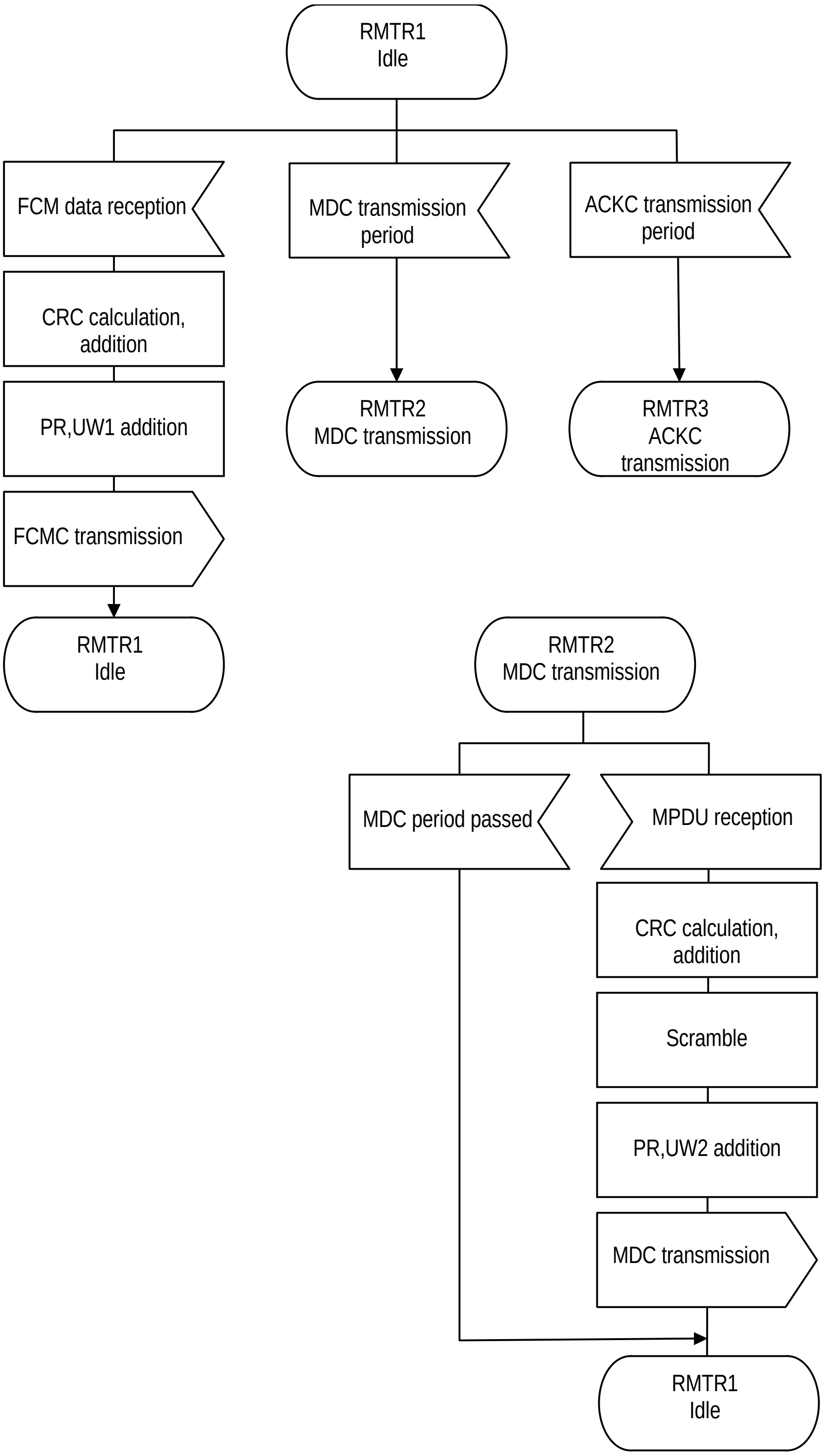
Note：
MSIZE (Maximum transmission size) is
- 65 for ASK system
- 193 for QPSK system

Attached Fig. F-7　SDL Diagram of the layer 2 MAC sublayer (Base Station)

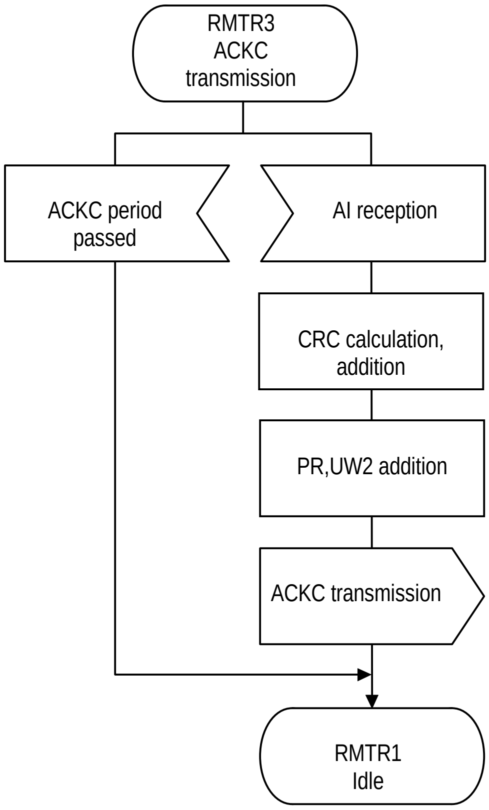


Attached Fig. F-8 SDL Diagram of the layer 2 MAC sublayer (Base Station)

2.1.3 Transmission Machine

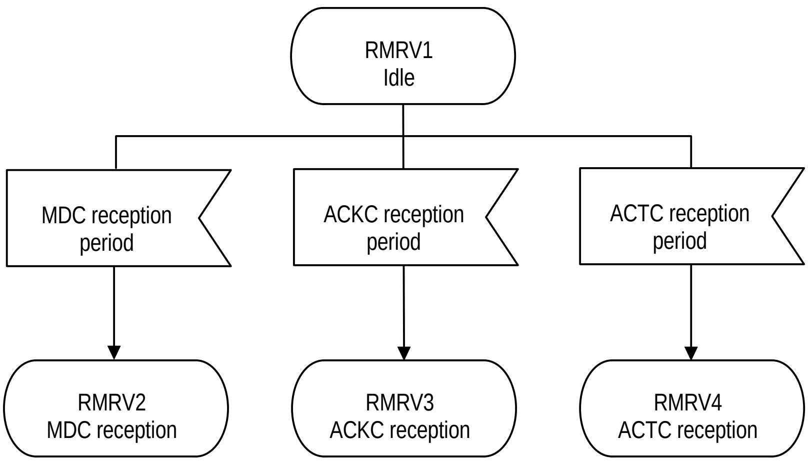


Attached Fig. F-9 SDL Diagram of the layer 2 MAC sublayer (Base Station)

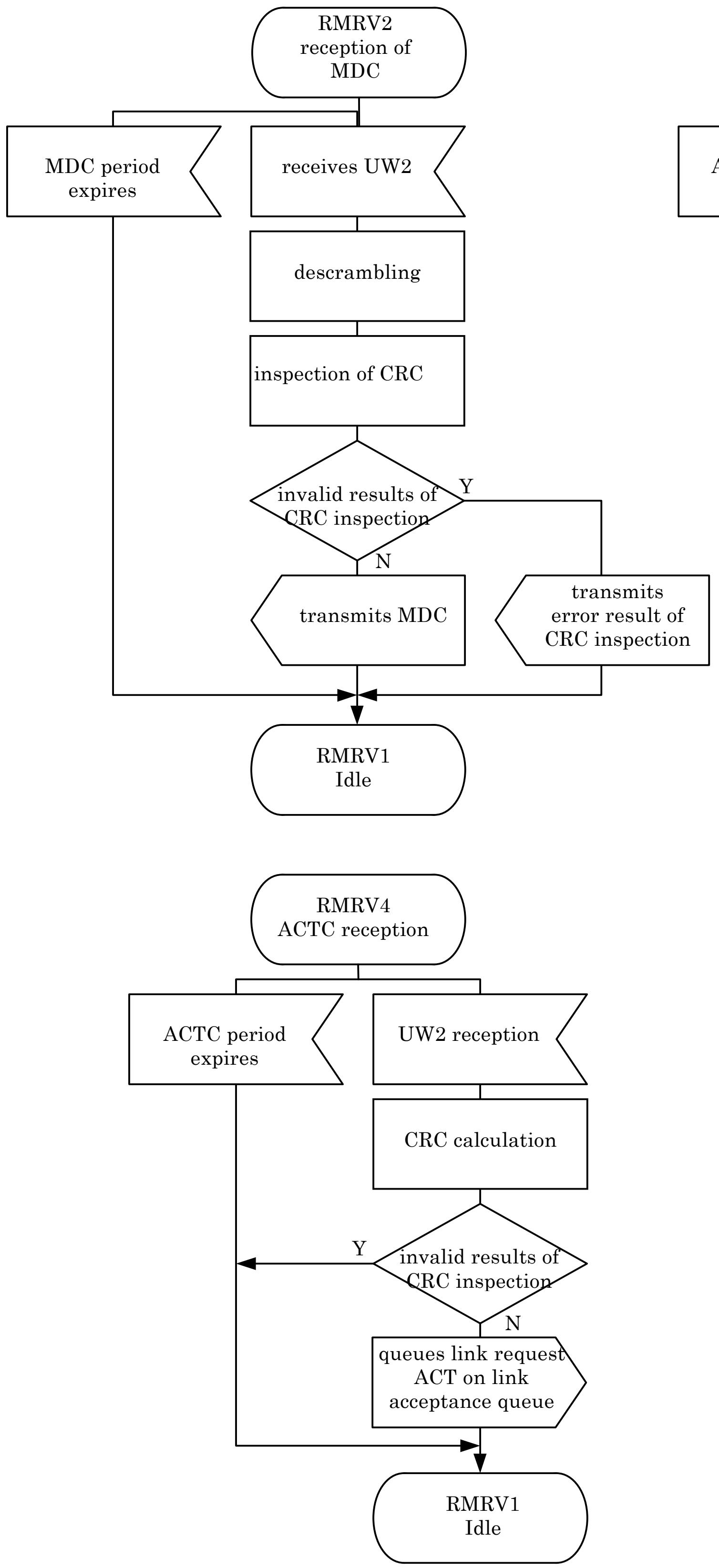


Attached Fig. F-10 SDL Diagram of the layer 2 MAC sublayer (Base Station)

2.1.4 Reception State Machine

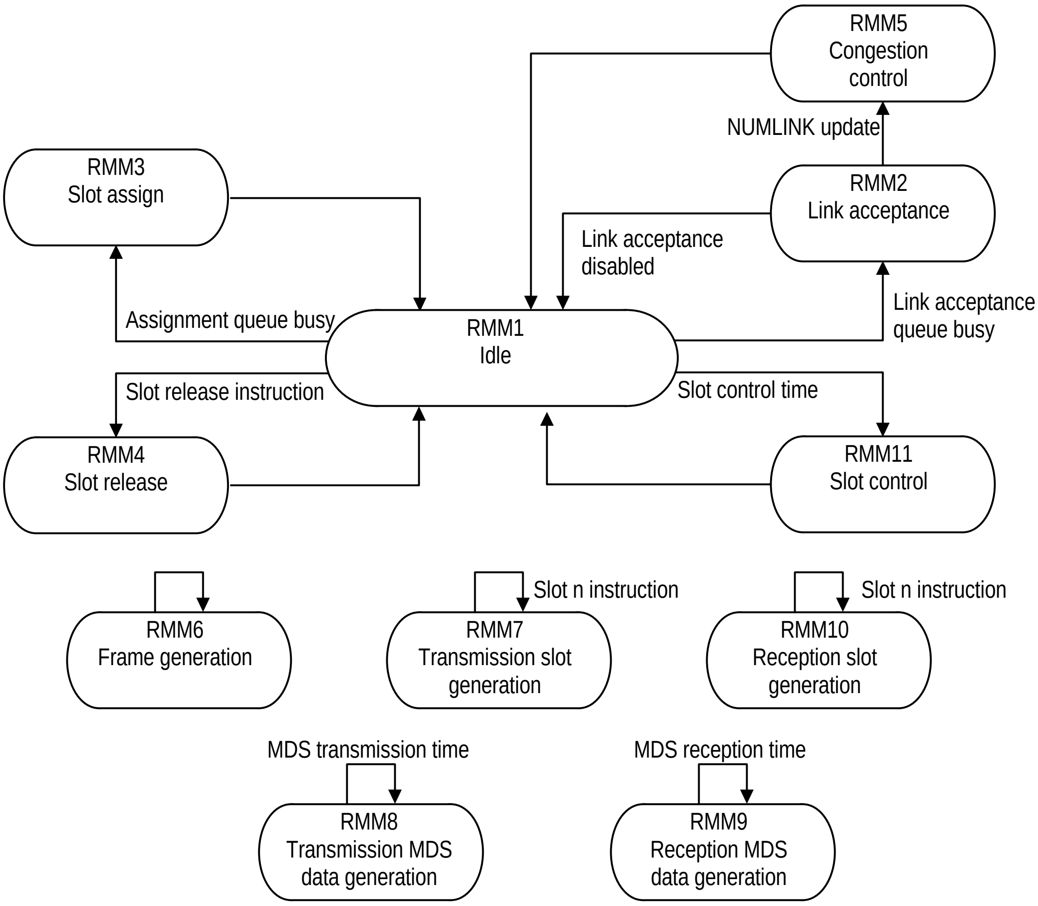


Attached Fig. F-11 SDL Diagram of the layer 2 MAC sublayer (Base Station)

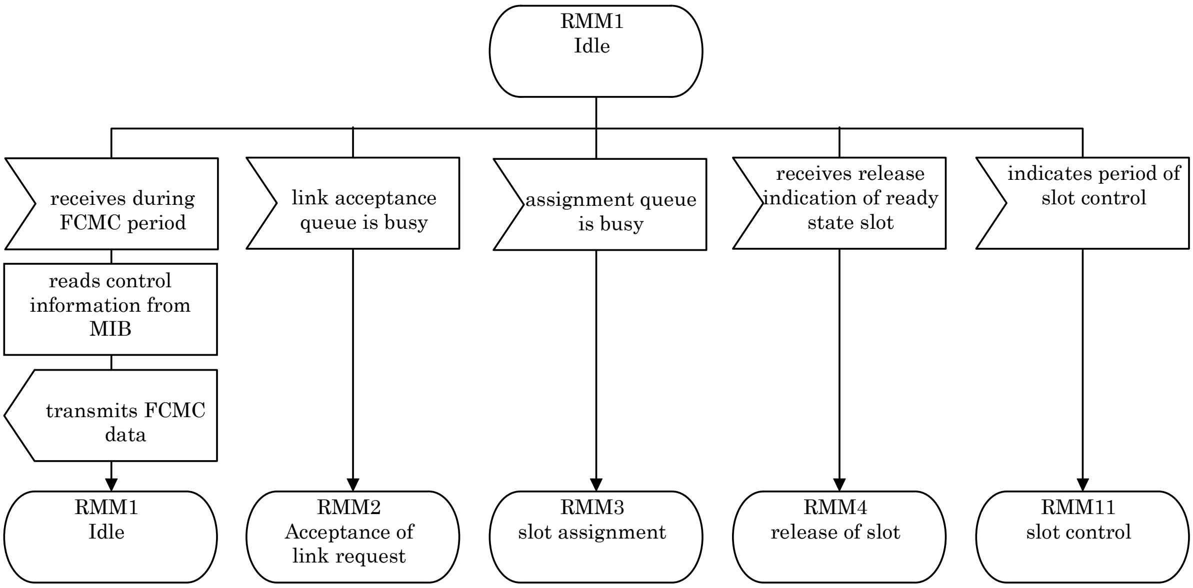


Attached Fig. F-12　SDL Diagram of the layer 2 MAC sublayer (Base Station)

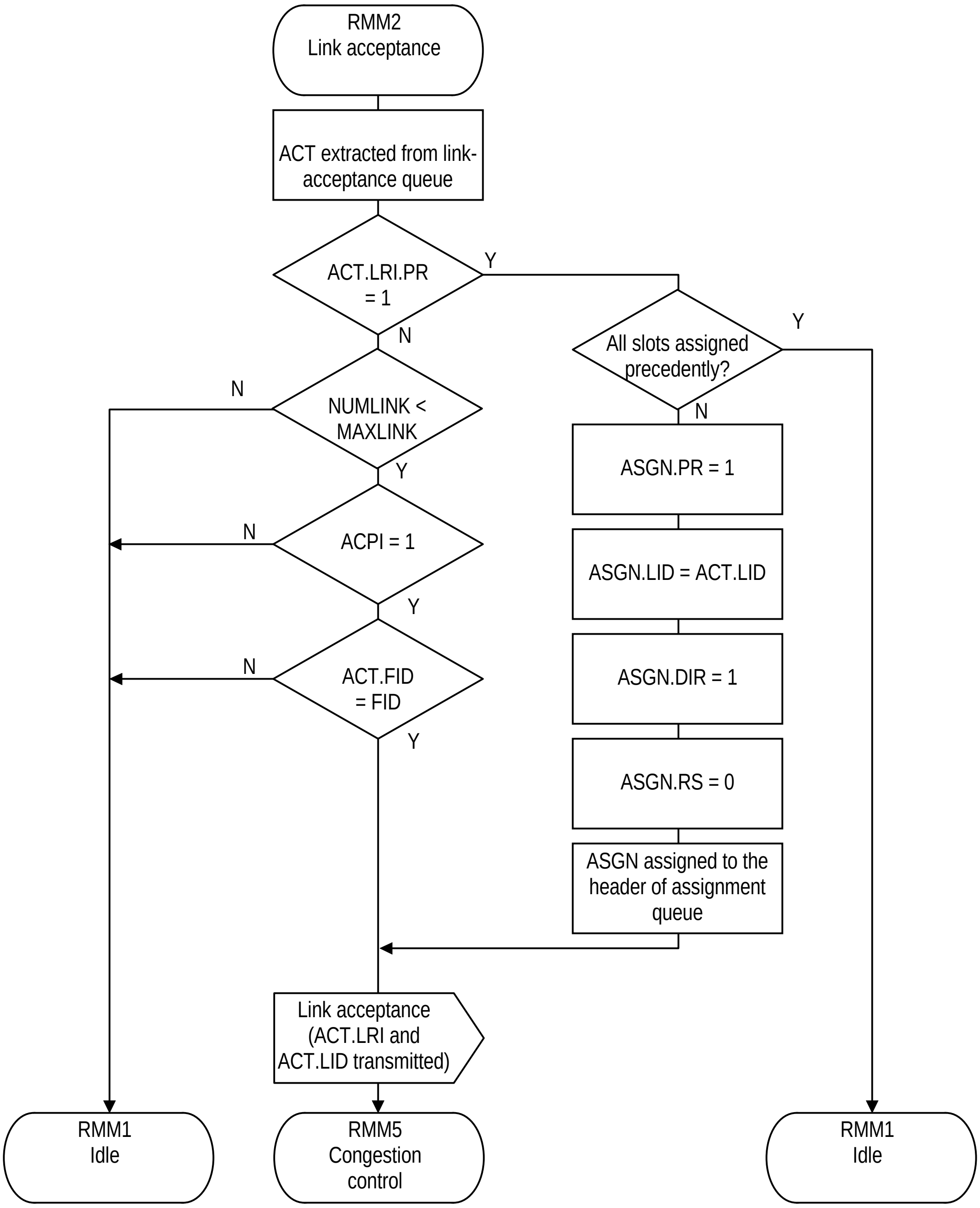
2.1.5 MAC Management State Machine



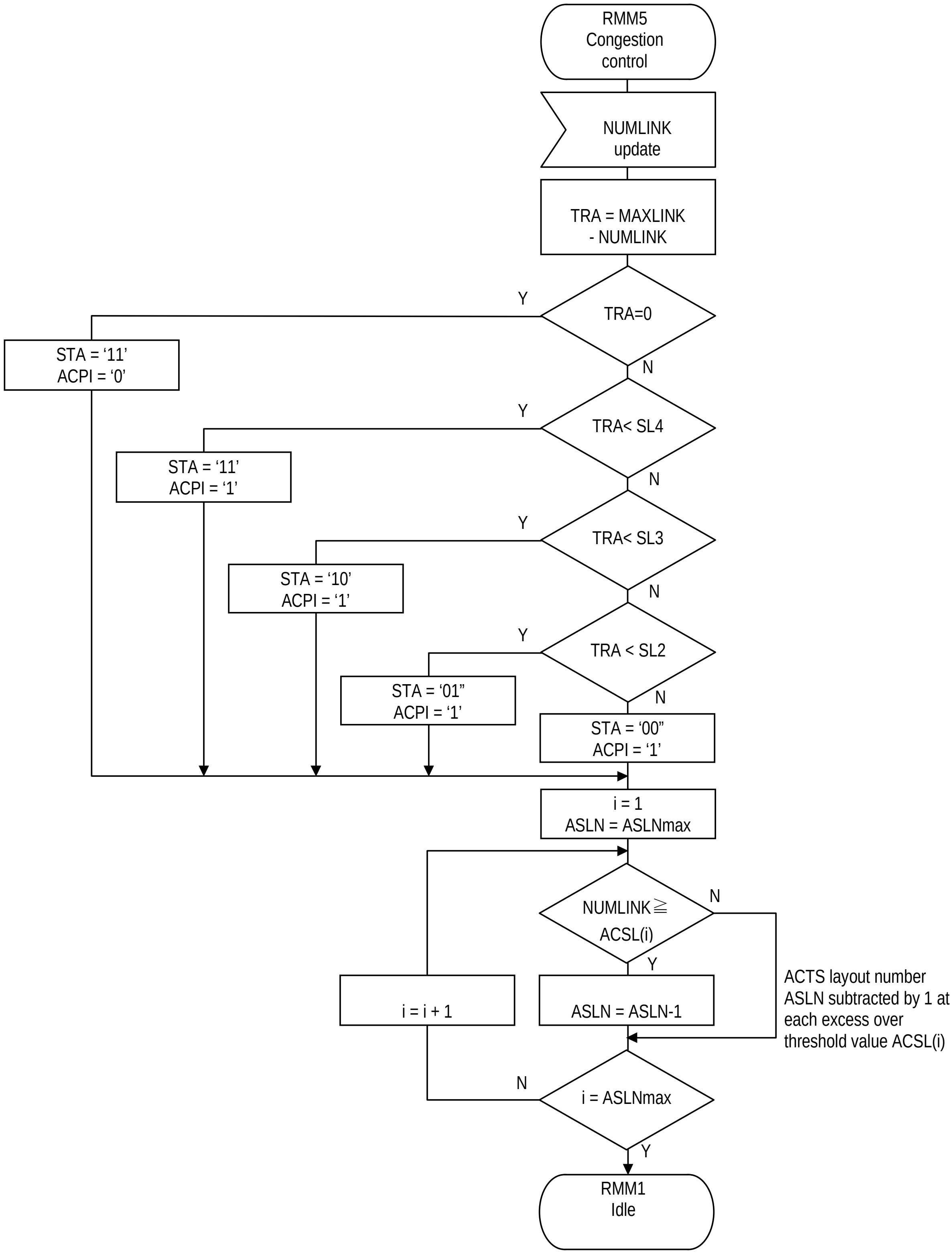
Attached Fig. F-13　SDL Diagram of the layer 2 MAC sublayer (Base Station)



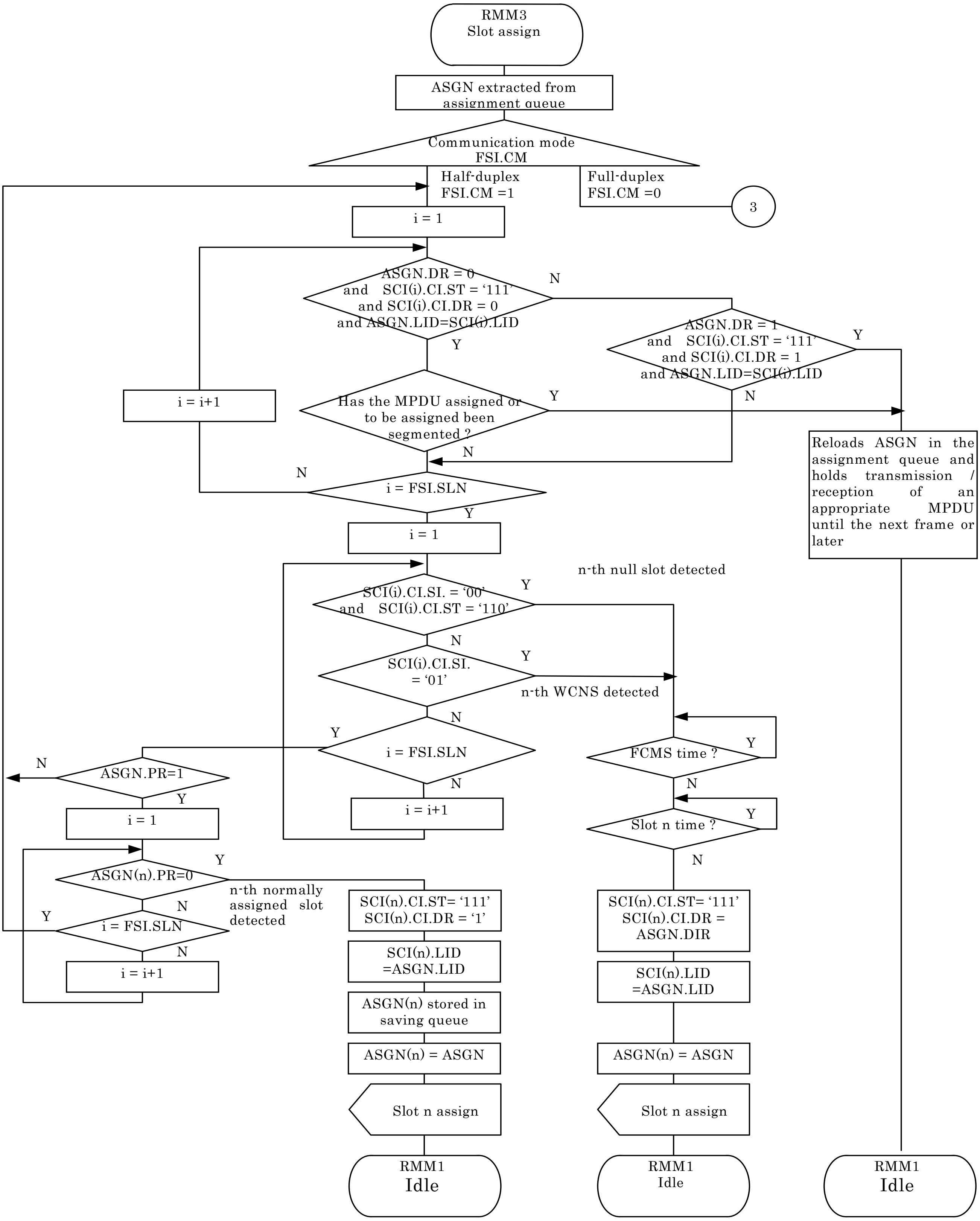
Attached Fig. F-14　SDL Diagram of the layer 2 MAC sublayer (Base Station)



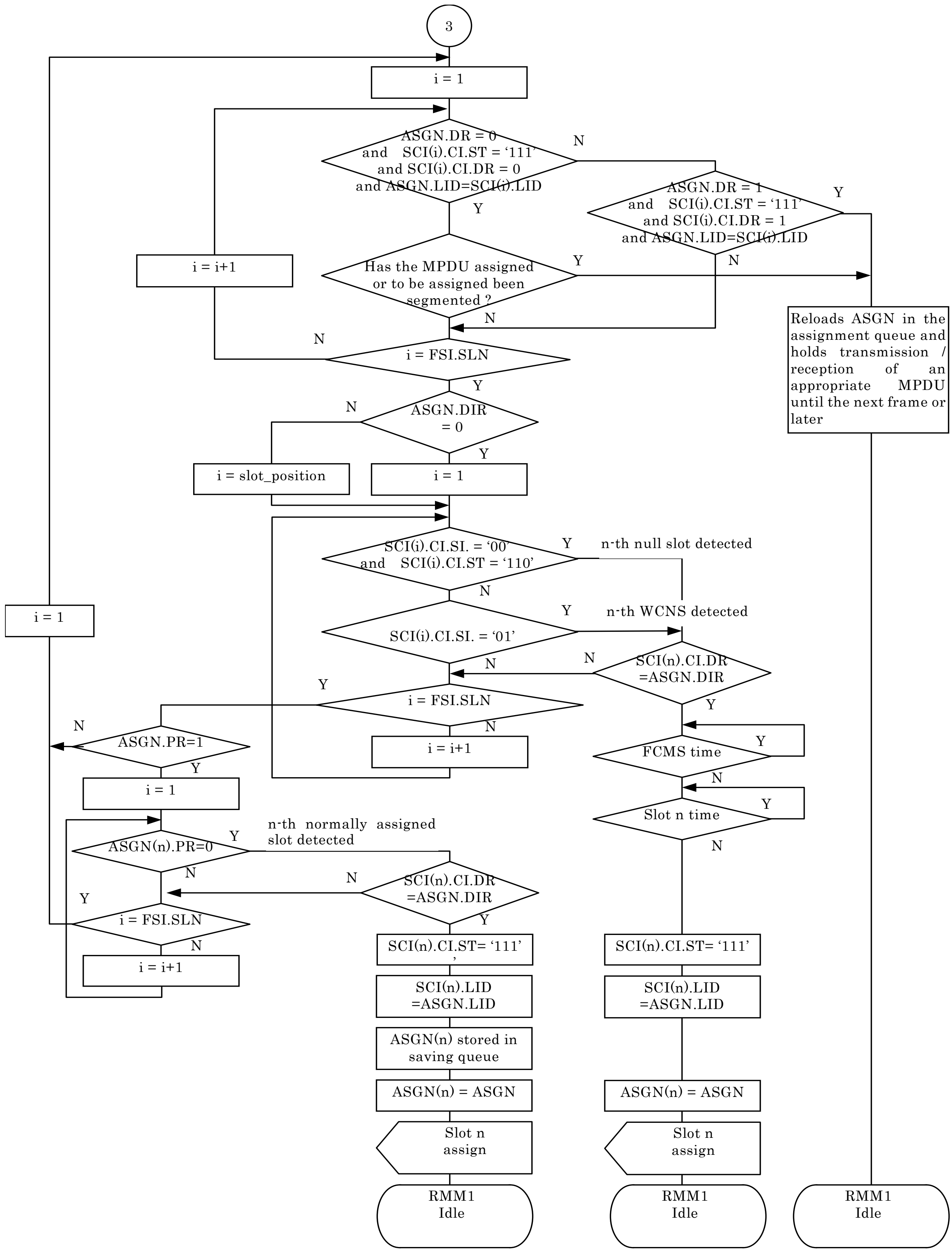
Attached Fig. F-15 SDL Diagram of the layer 2 MAC sublayer (Base Station)



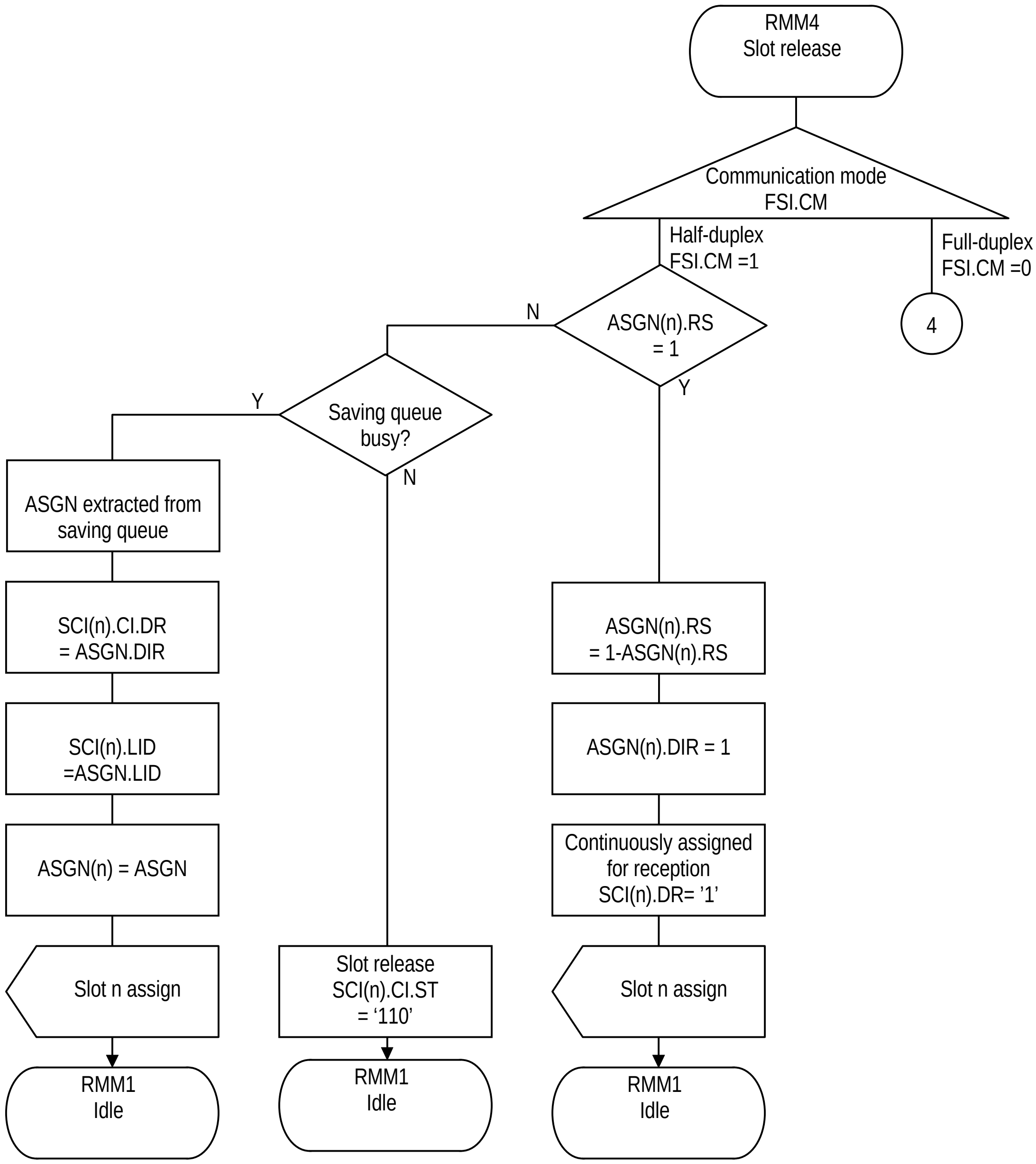
Attached Fig. F-16 SDL Diagram of the layer 2 MAC sublayer (Base Station)



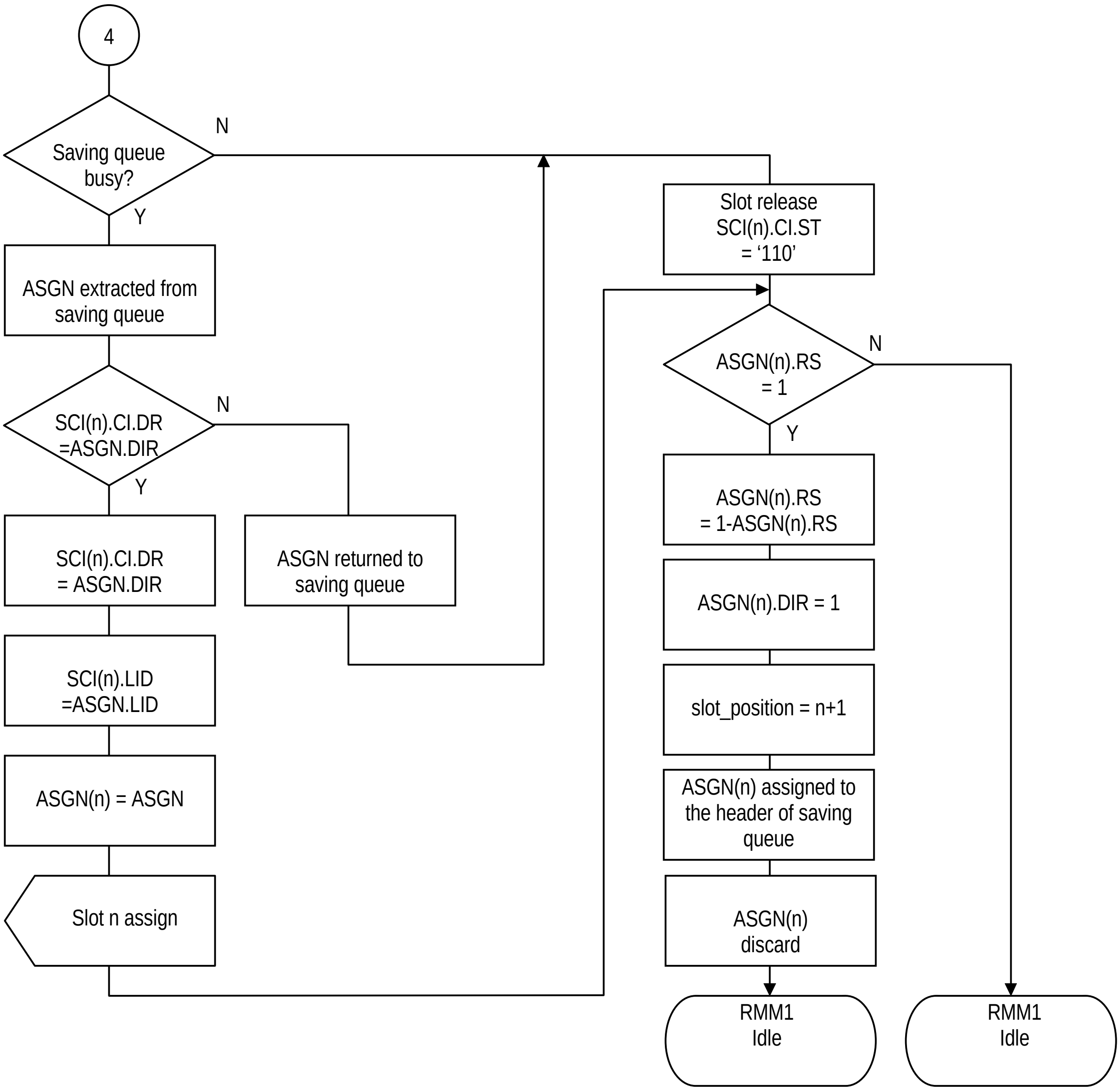
Attached Fig. F-17 SDL Diagram of the layer 2 MAC sublayer (Base Station)



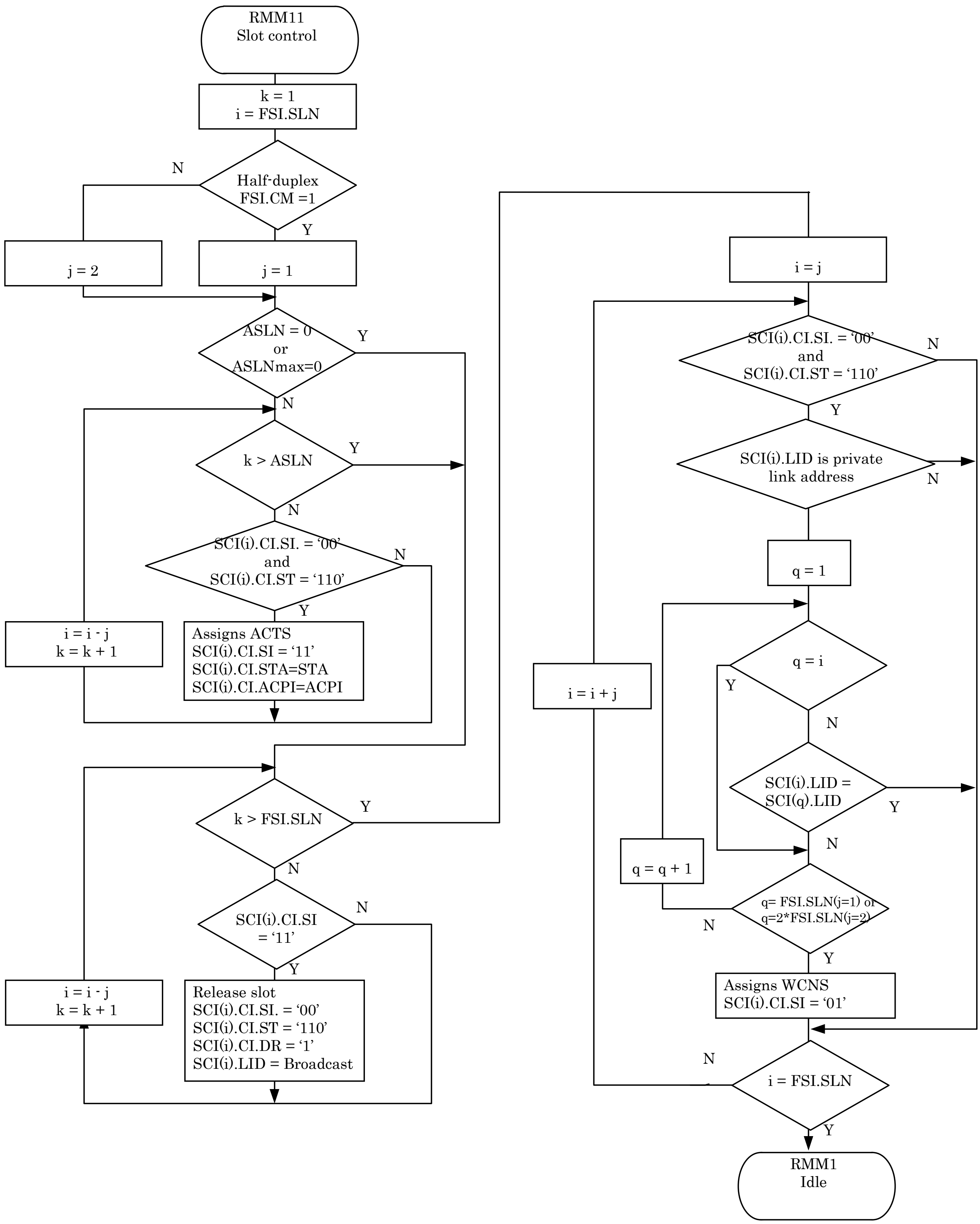
Attached Fig. F-18 SDL Diagram of the layer 2 MAC sublayer (Base Station)



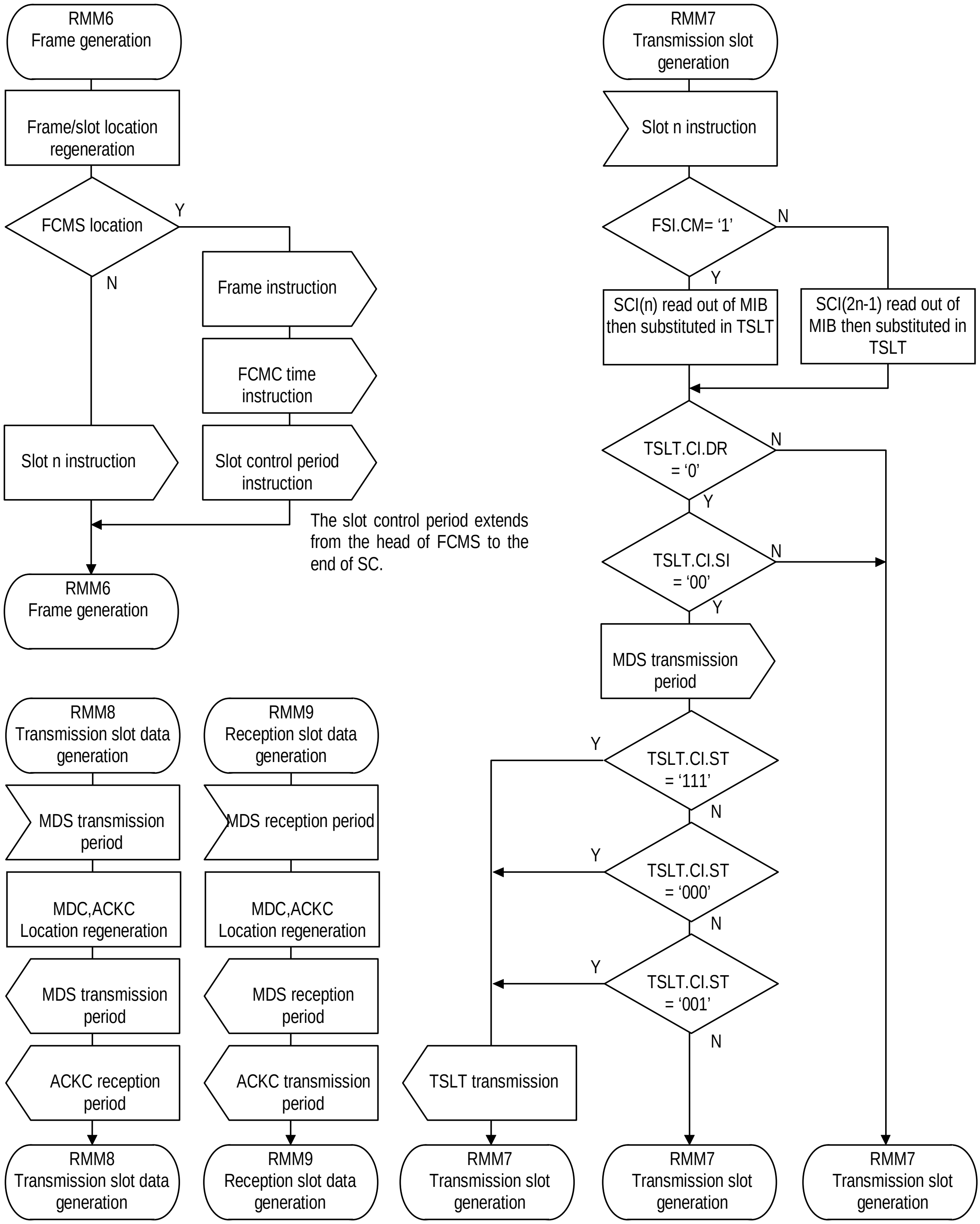
Attached Fig. F-19　SDL Diagram of the layer 2 MAC sublayer (Base Station)



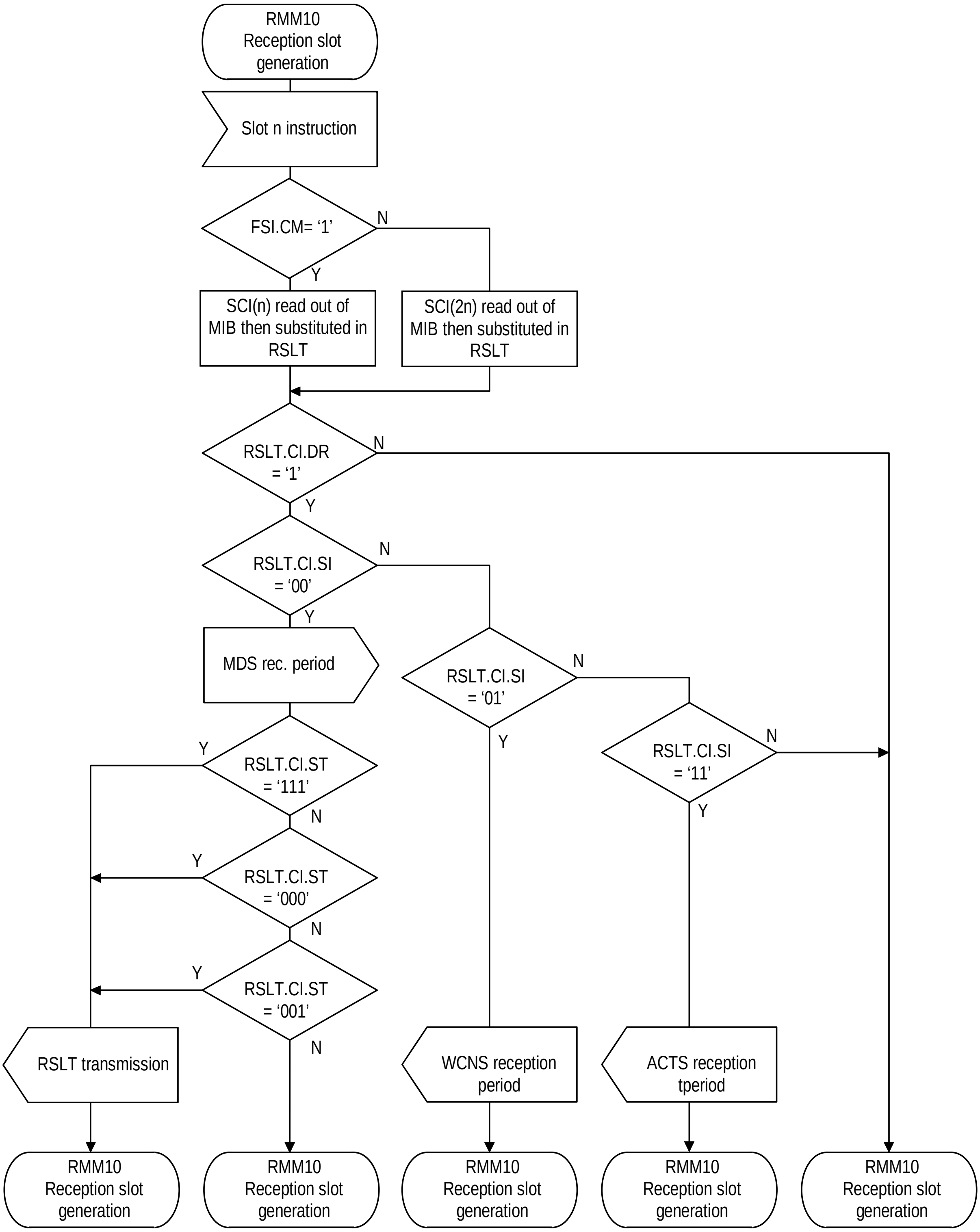
Attached Fig. F-20　SDL Diagram of the layer 2 MAC sublayer (Base Station)



Attached Fig. F-21 SDL Diagram of the layer 2 MAC sublayer (Base Station)

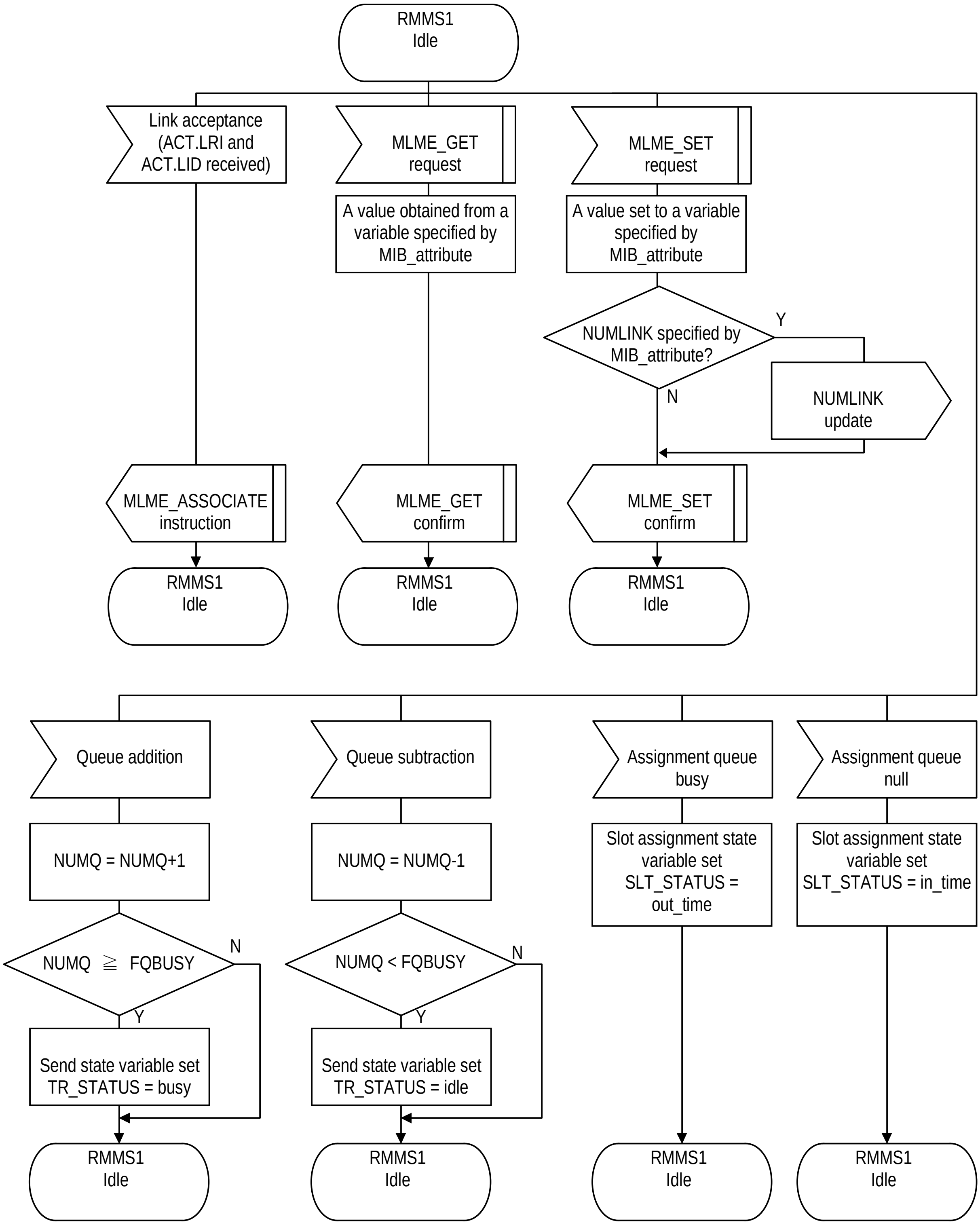


Attached Fig. F-22 SDL Diagram of the layer 2 MAC sublayer (Base Station)



Attached Fig. F-23 SDL Diagram of the layer 2 MAC sublayer (Base Station)

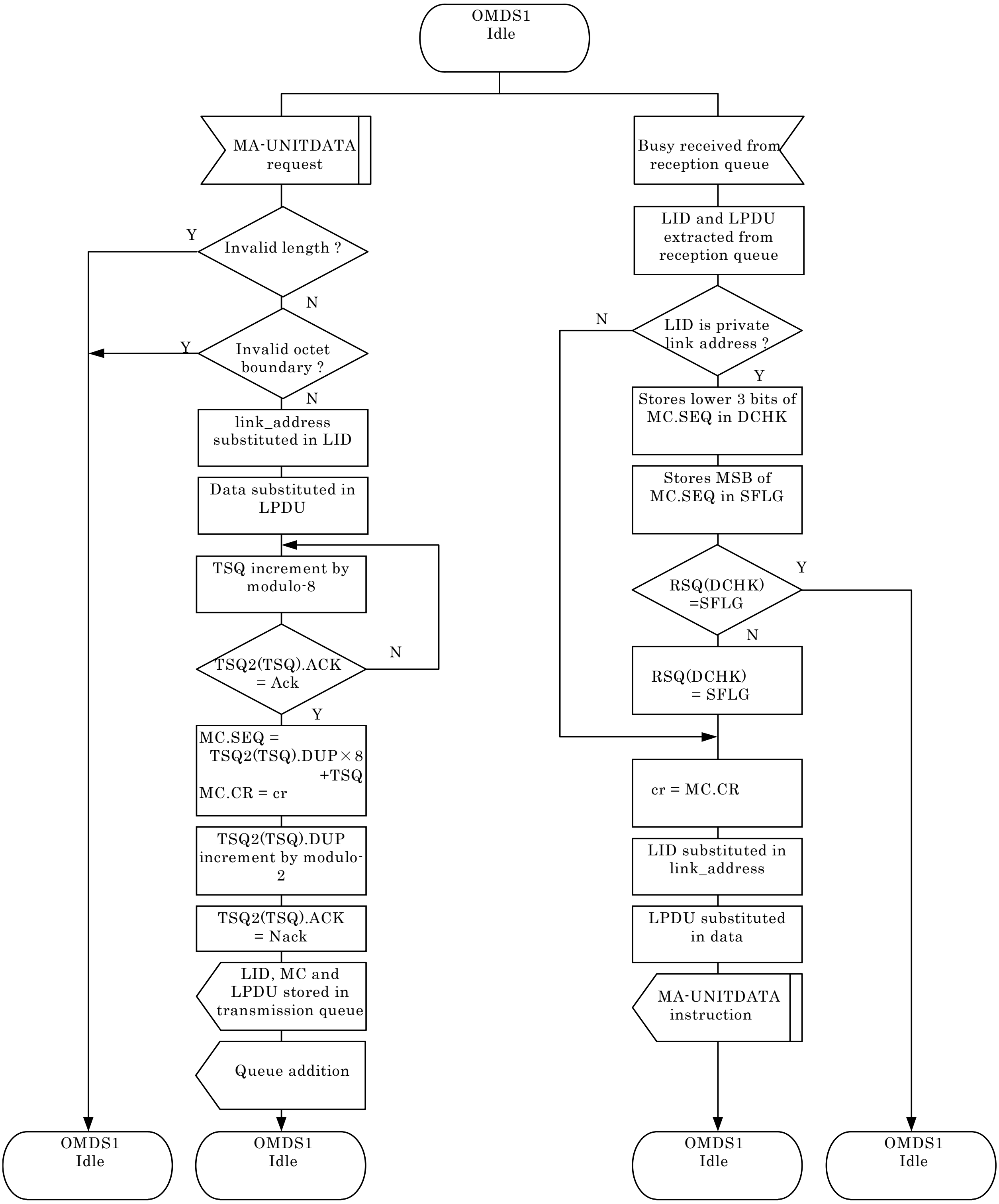
2.1.6 MAC Management Service State Machine



Attached Fig. F-24 SDL Diagram of Layer 2 MAC Sublayer (Base Station)

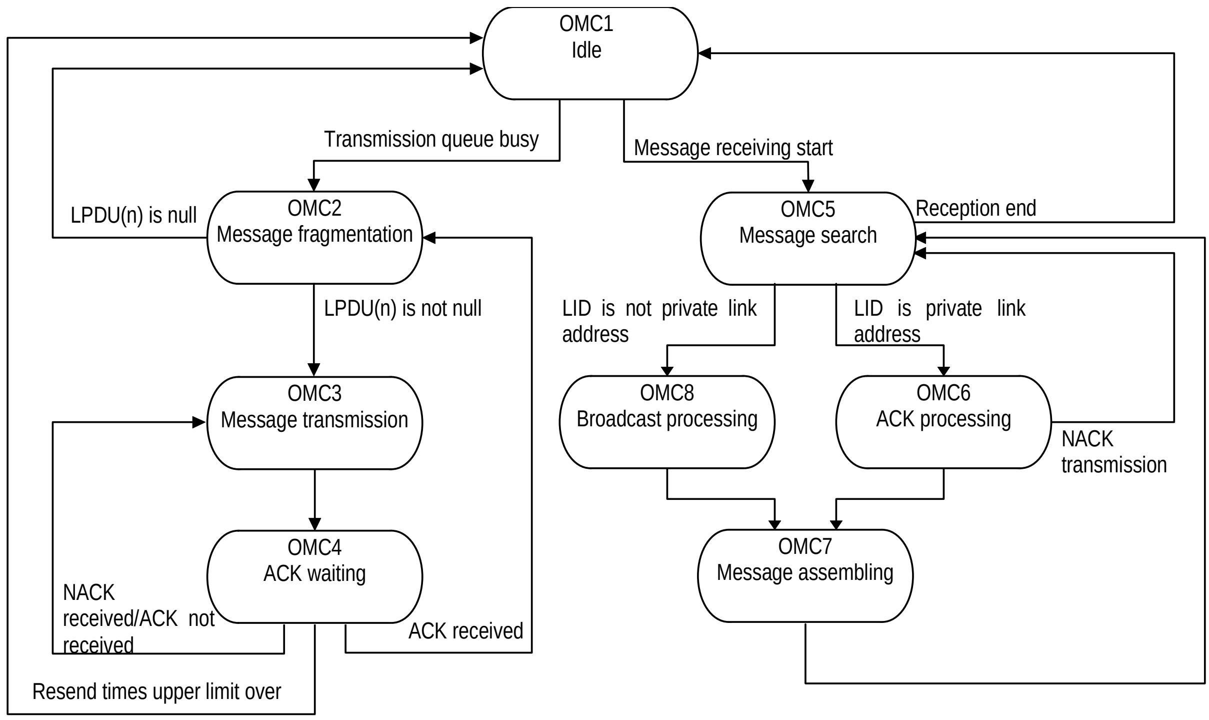
2.2 MAC Control Procedures at Mobile Stations

2.2.1 MAC Data Service State Machine

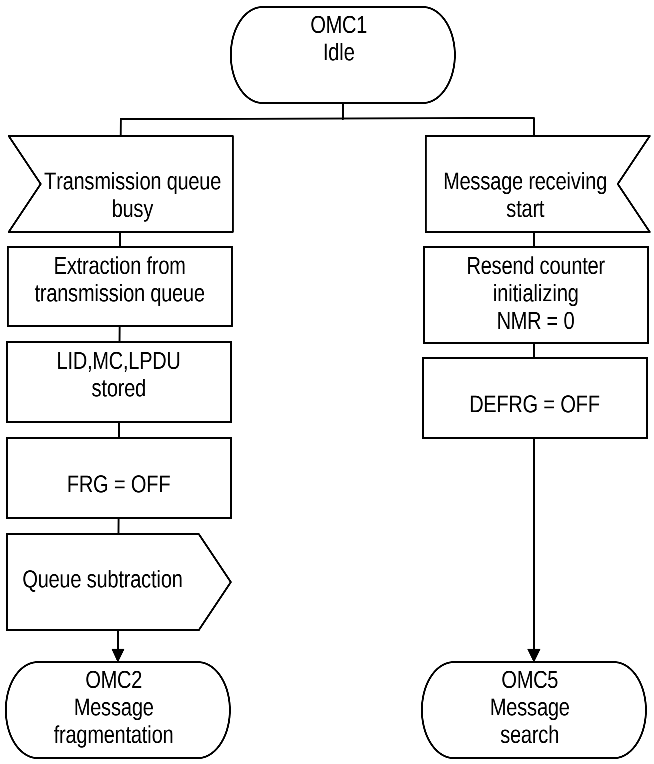


Attached Fig. F-25 SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)

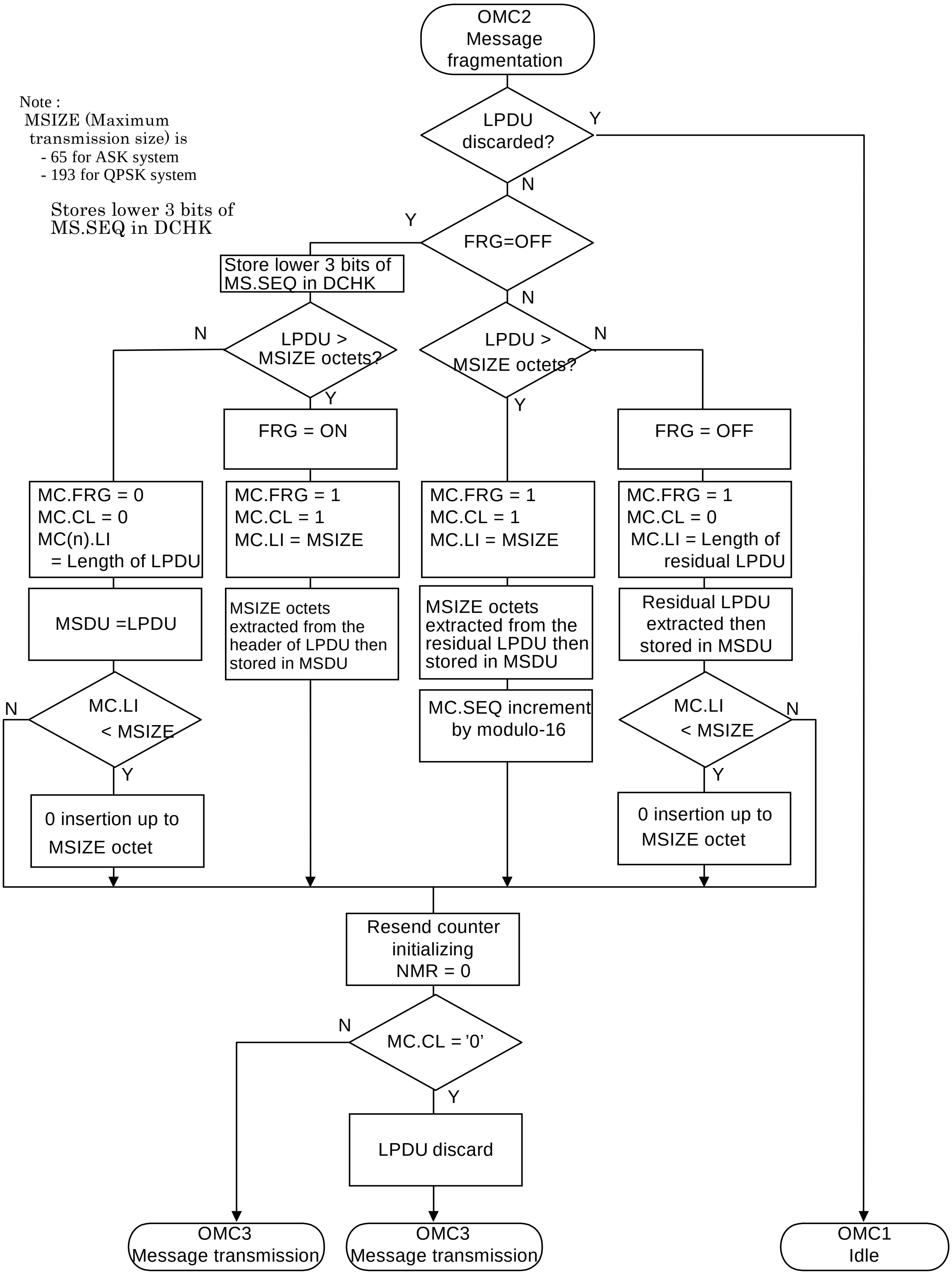
2.2.2 MAC Control State Machine



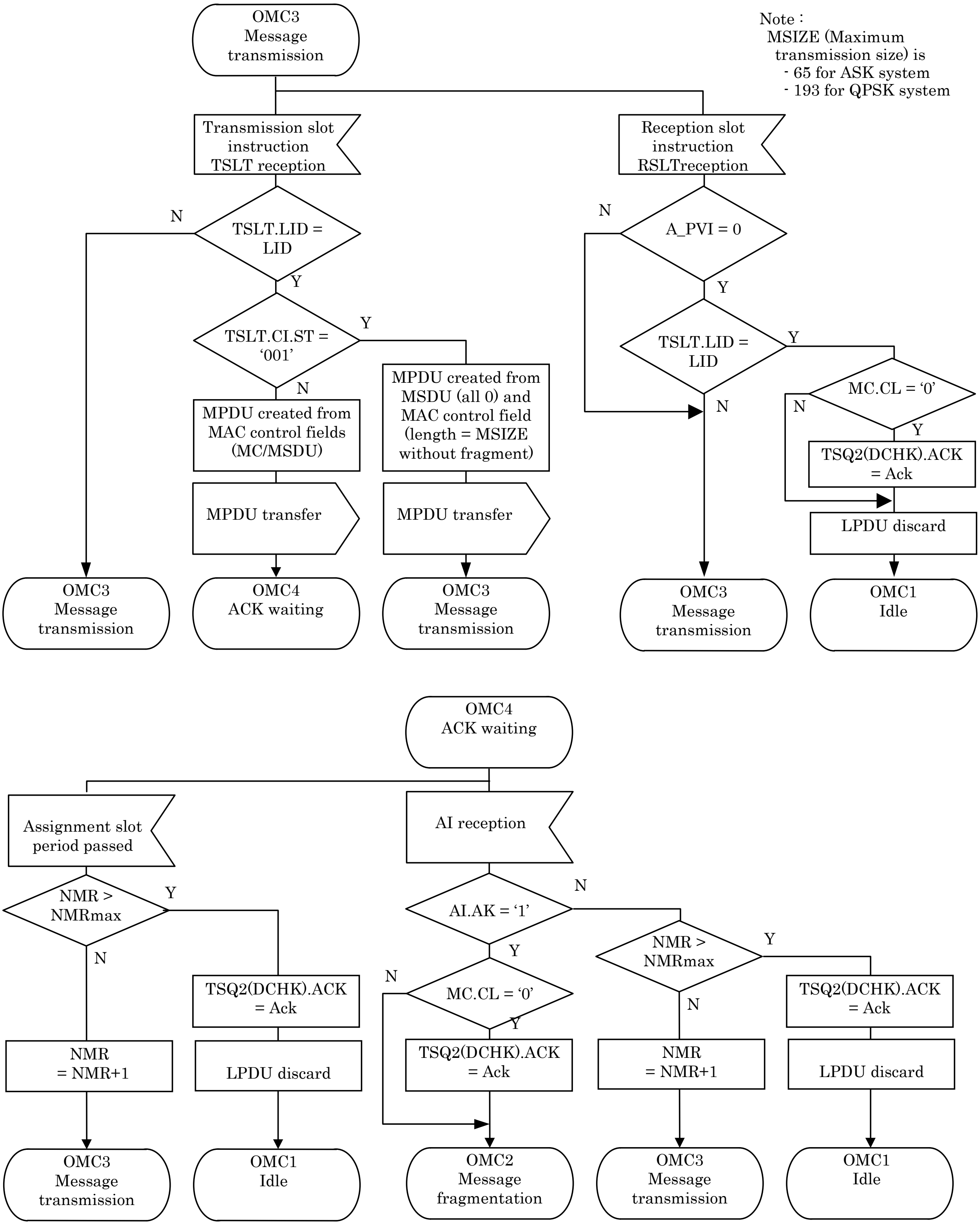
Attached Fig. F-26 Outline of MAC Control State Machine (Mobile Station)



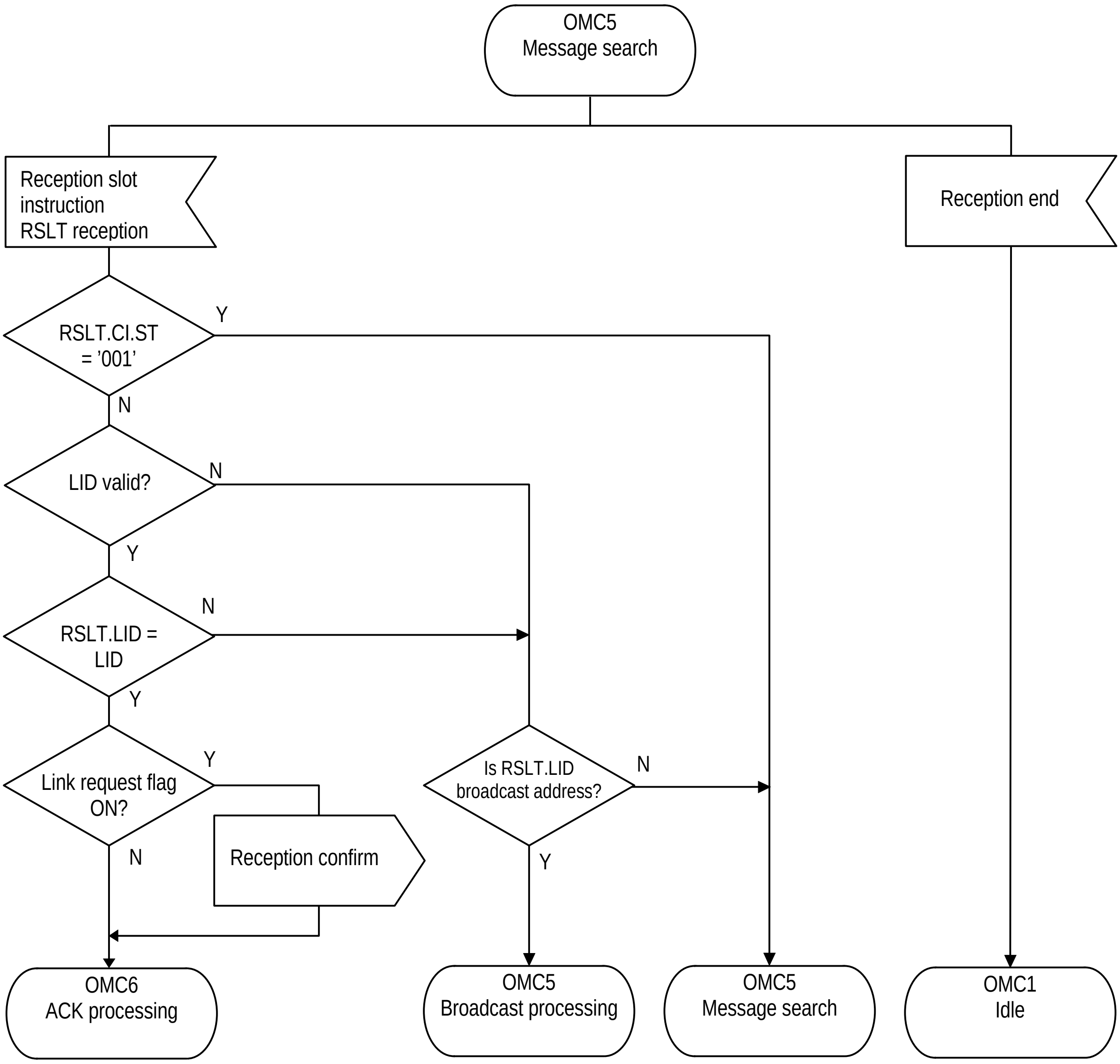
Attached Fig. F-27 SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)



Attached Fig. F-28 SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)

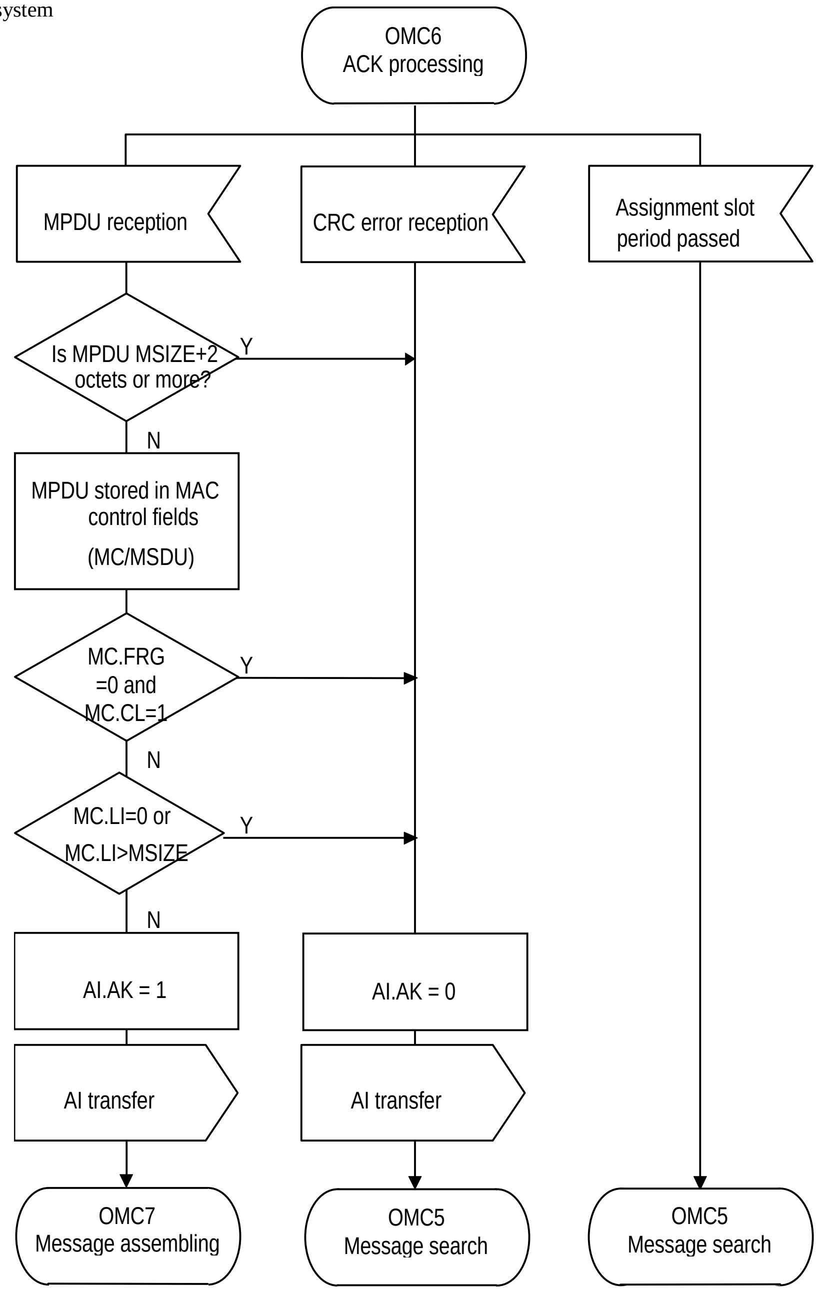


Attached Fig. F-29　SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)

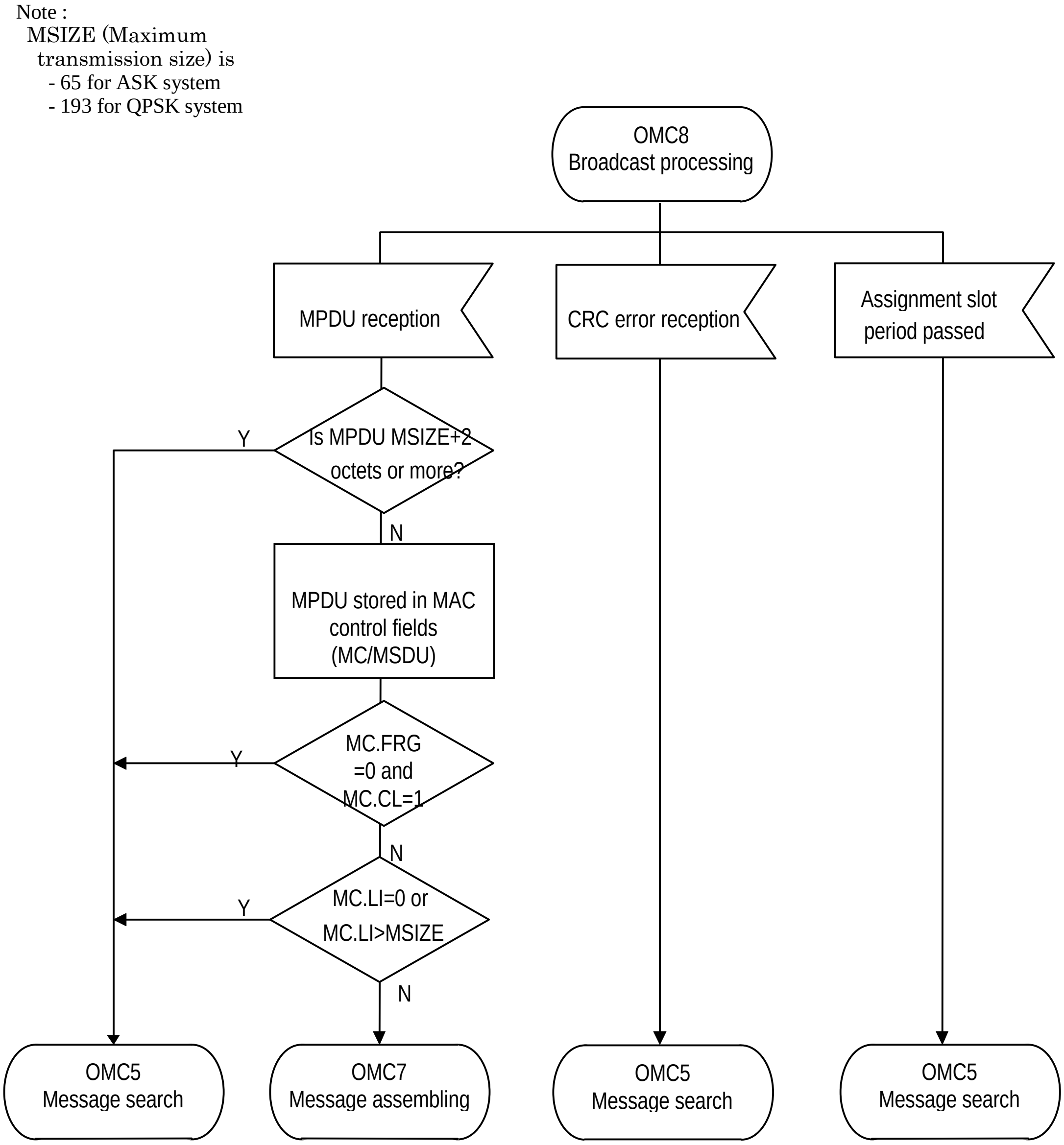


Attached Fig. F-30 SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)

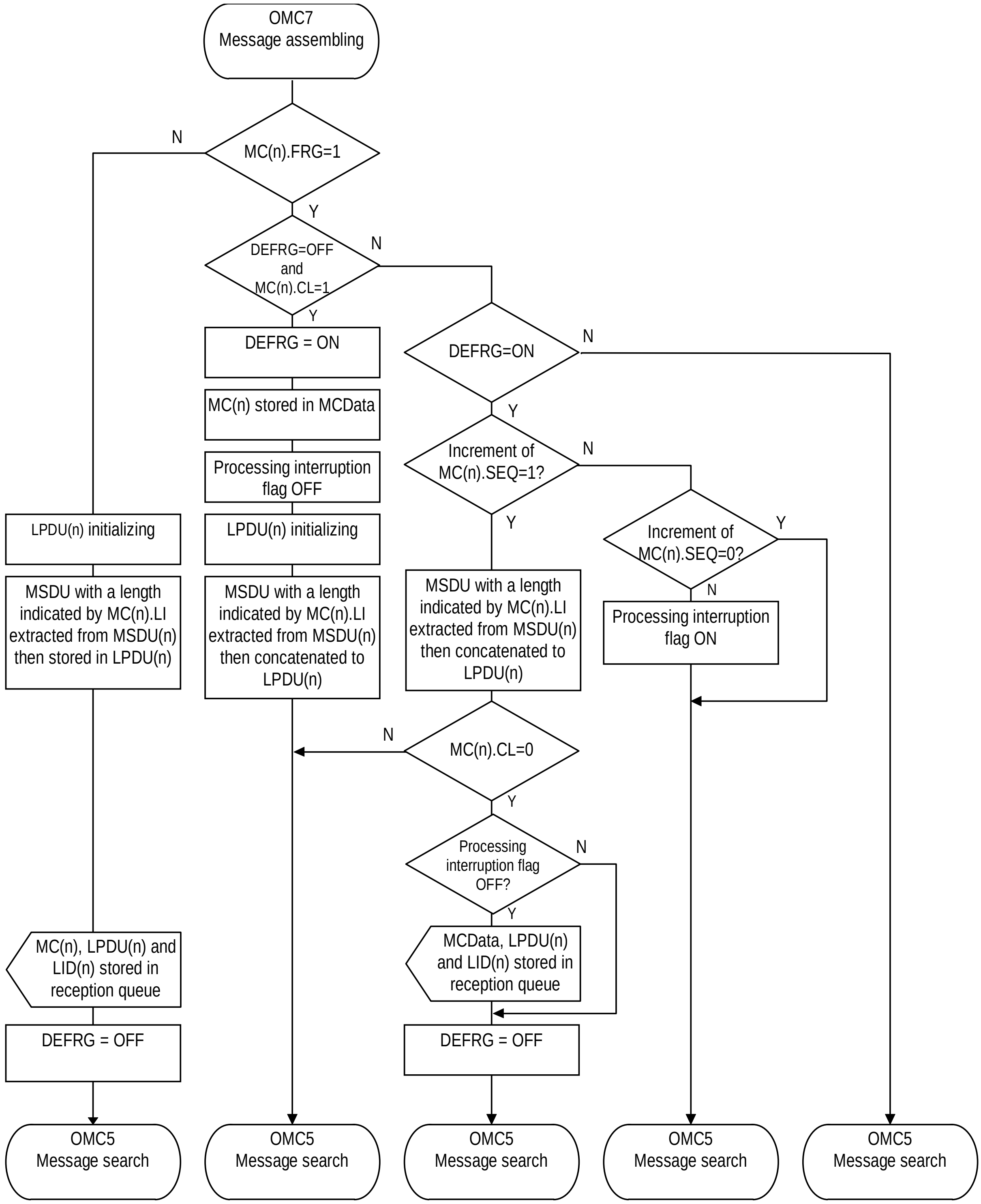
Note :
MSIZE (Maximum
transmission size) is
- 65 for ASK system
- 193 for QPSK system



Attached Fig. F-31 SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)

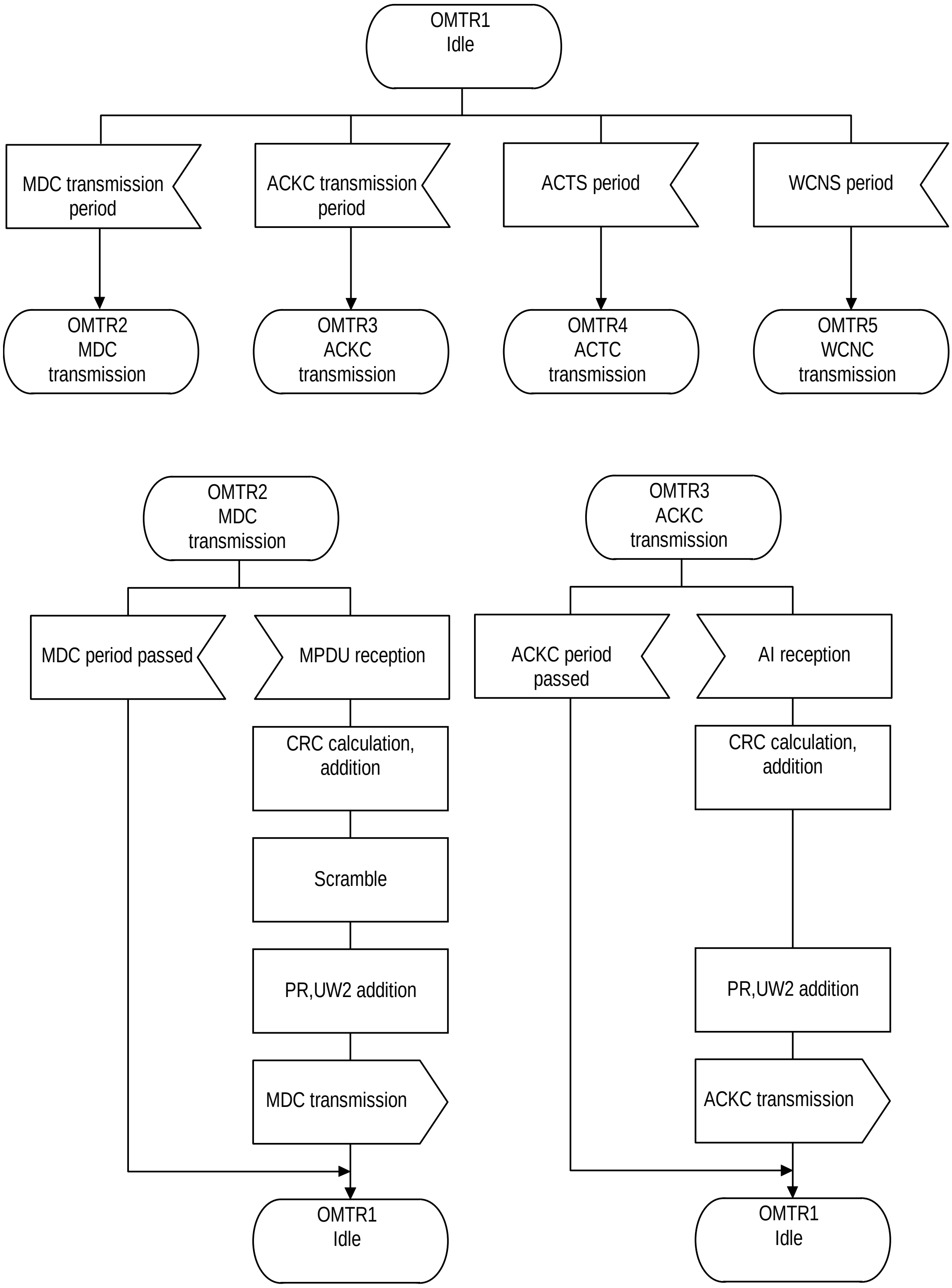


Attached Fig. F-32　SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)

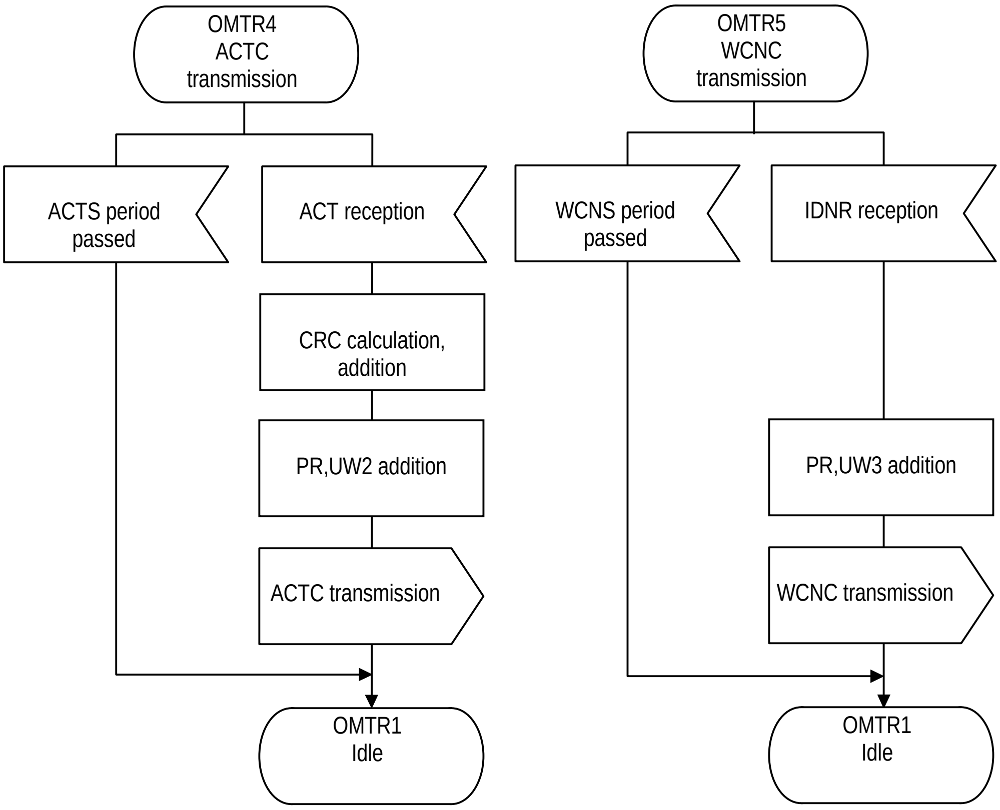


Attached Fig. F-33　SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)

2.2.3 Transmission State Machine

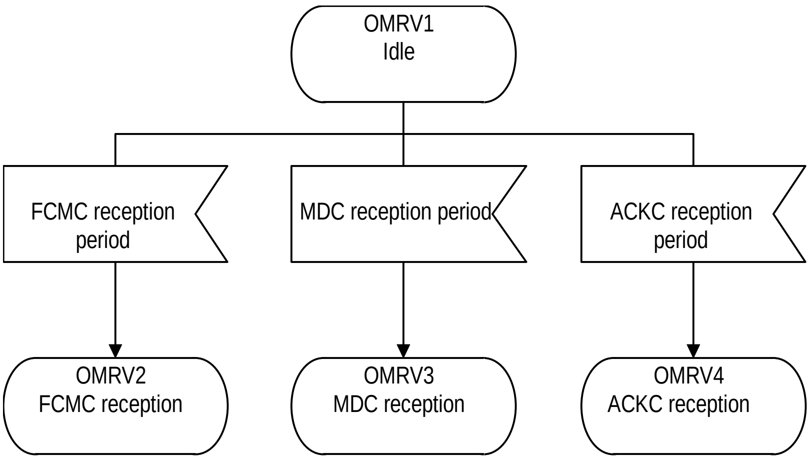


Attached Fig. F-34 SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)

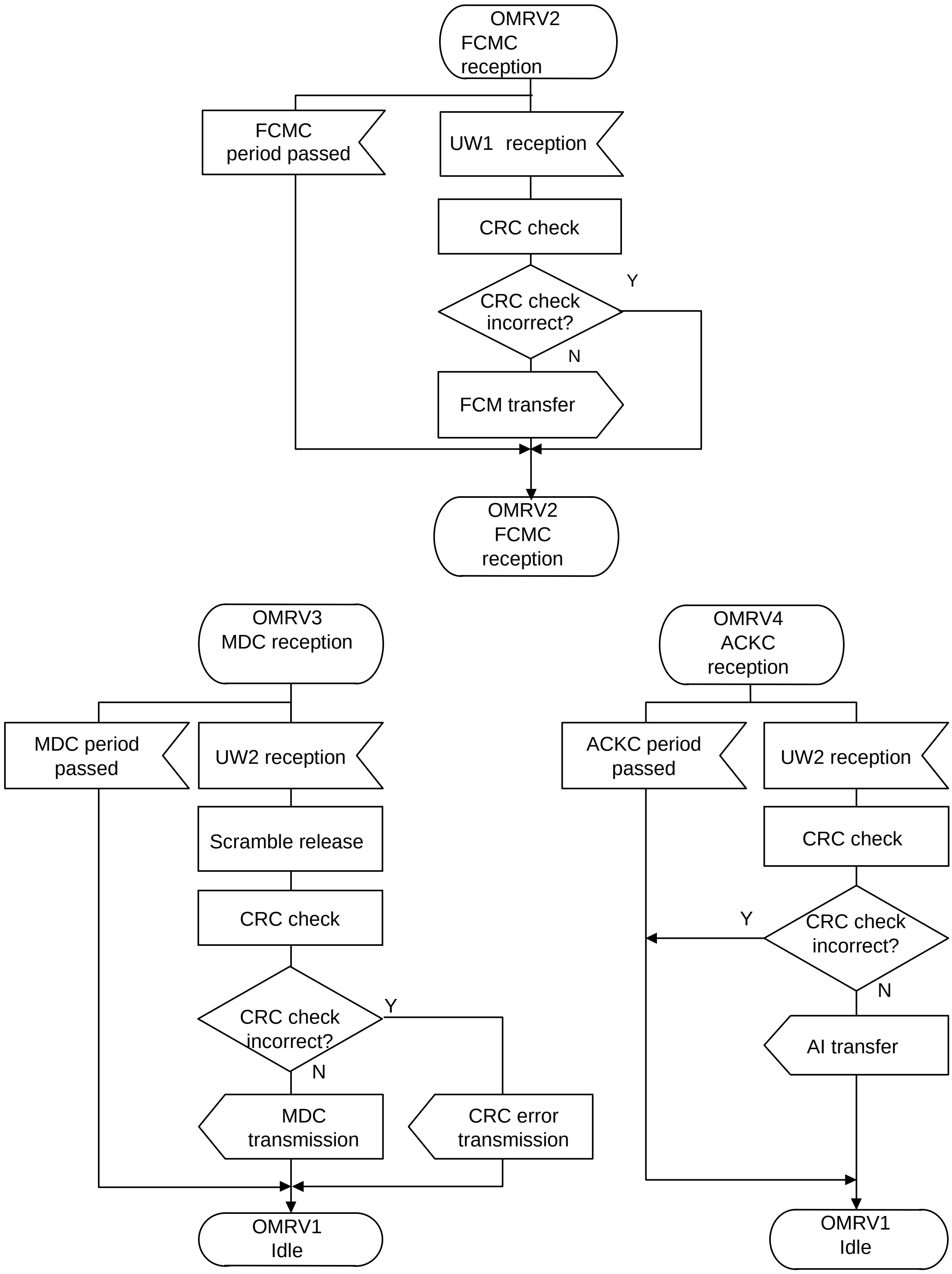


Attached Fig. F-35　SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)

2.2.4 Reception State Machine

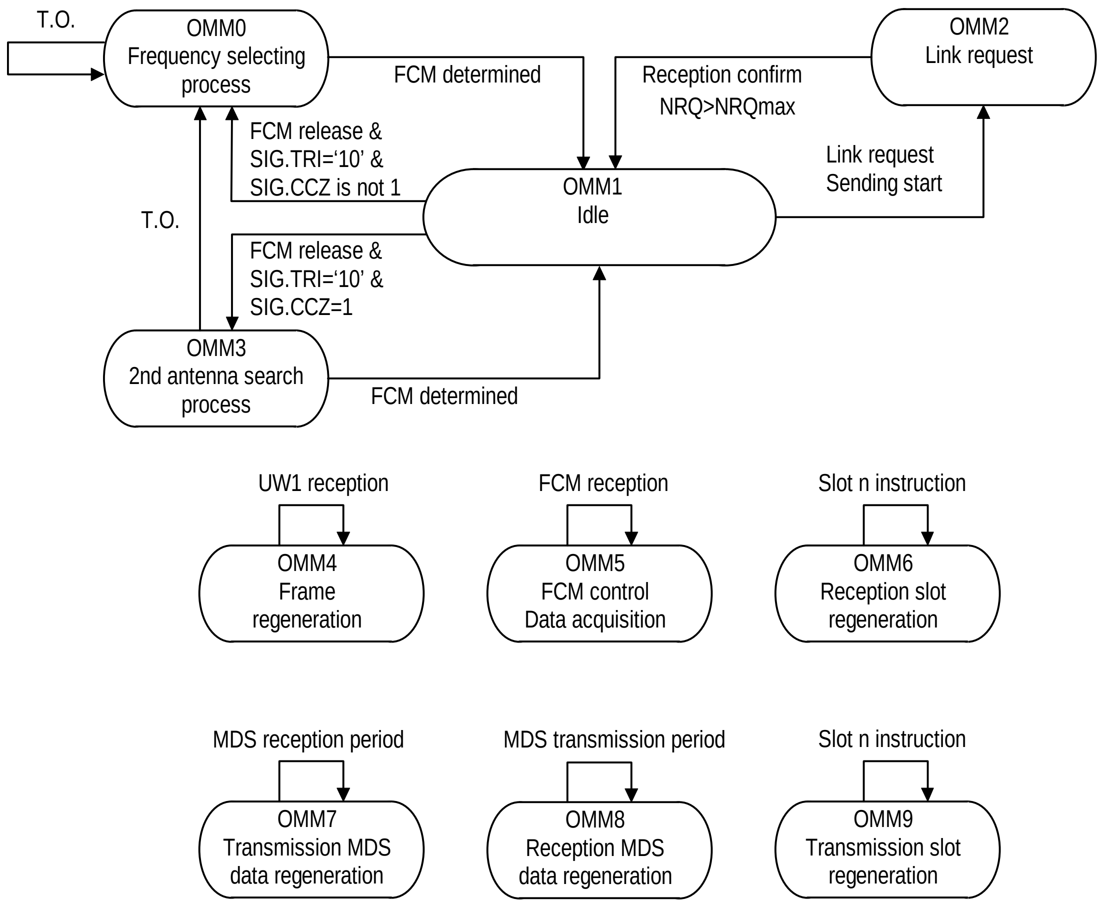


Attached Fig. F-36　SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)

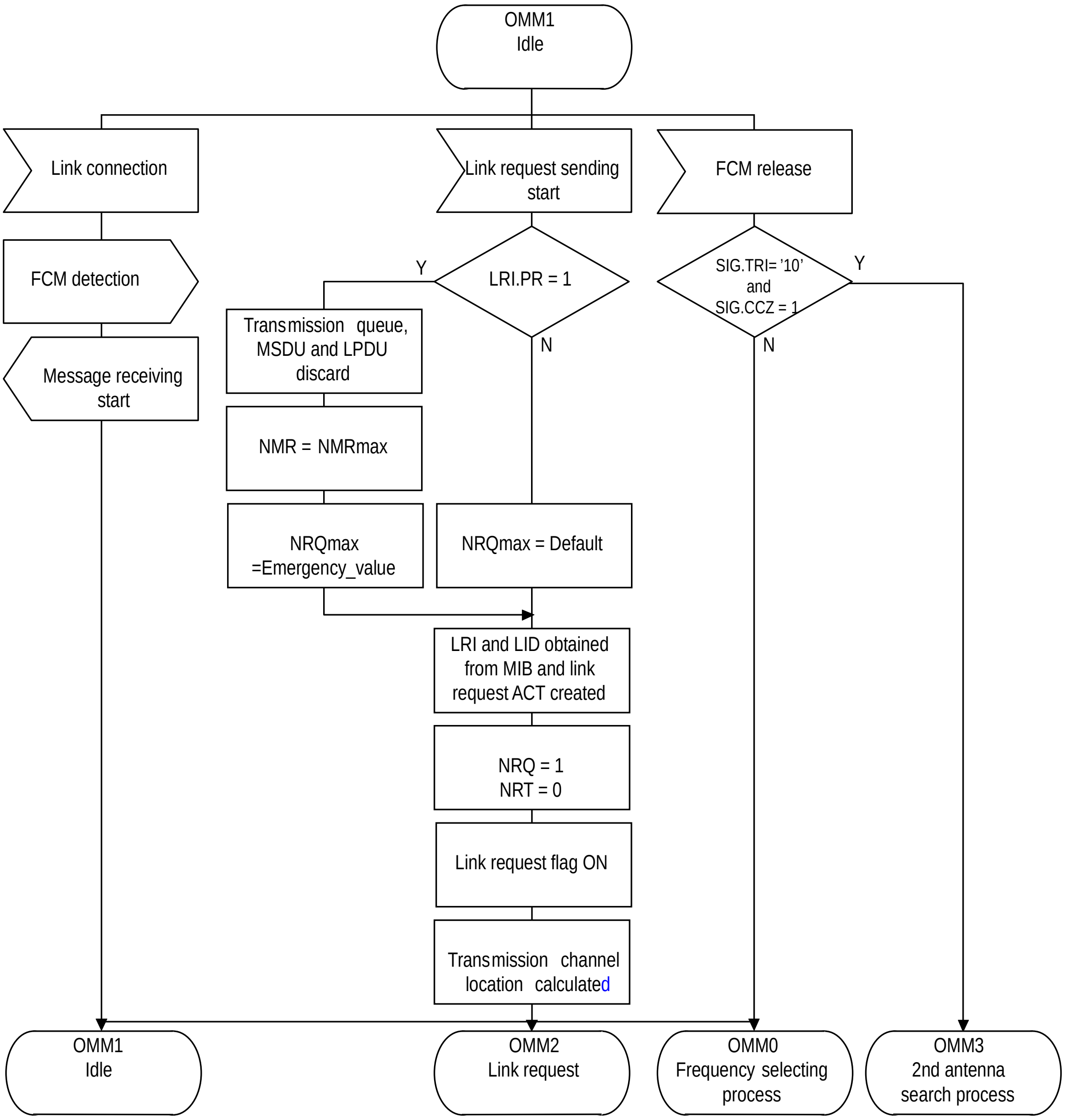


Attached Fig. F-37 SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)

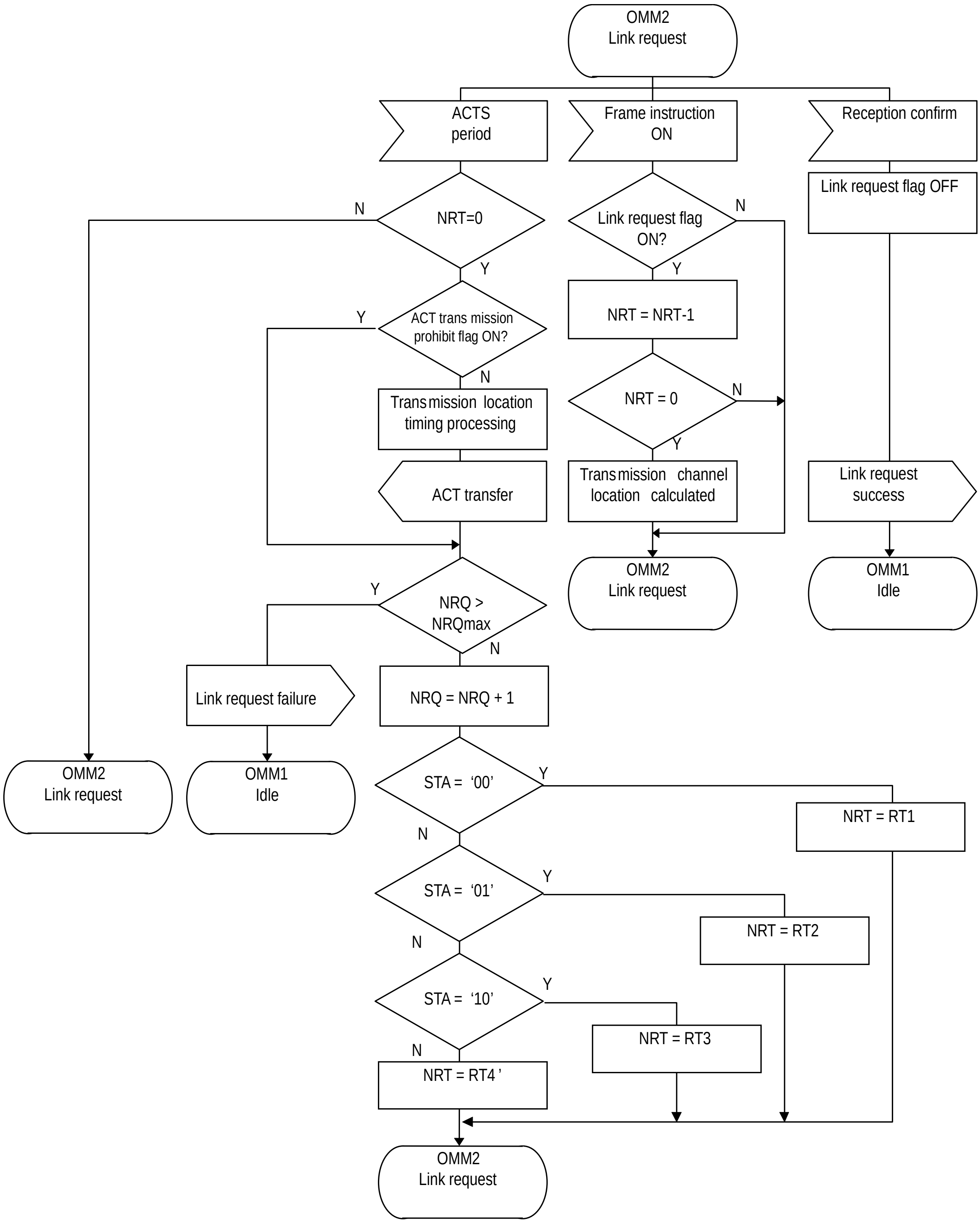
2.2.5 MAC Management State Machine



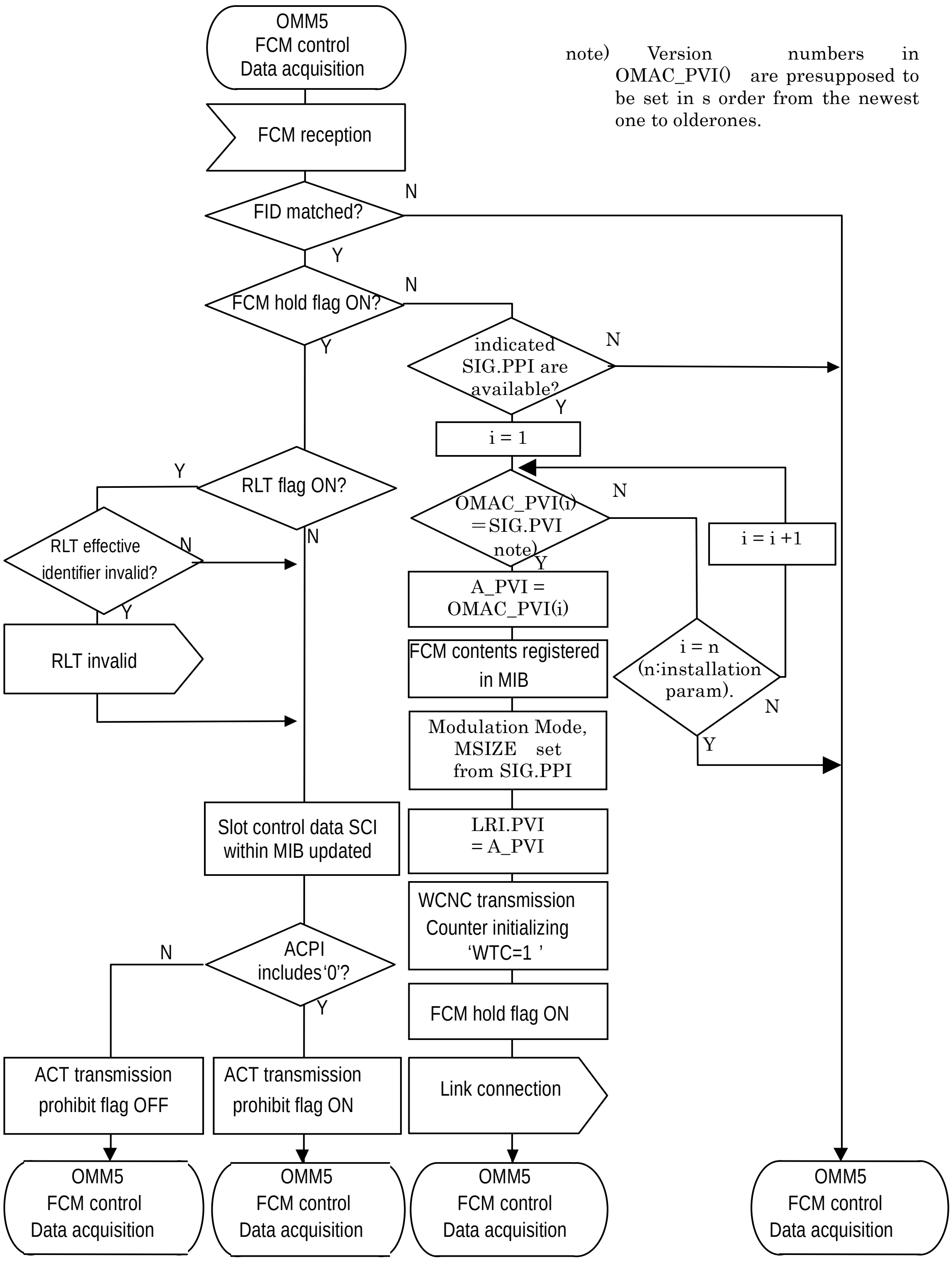
Attached Fig. F-38 SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)



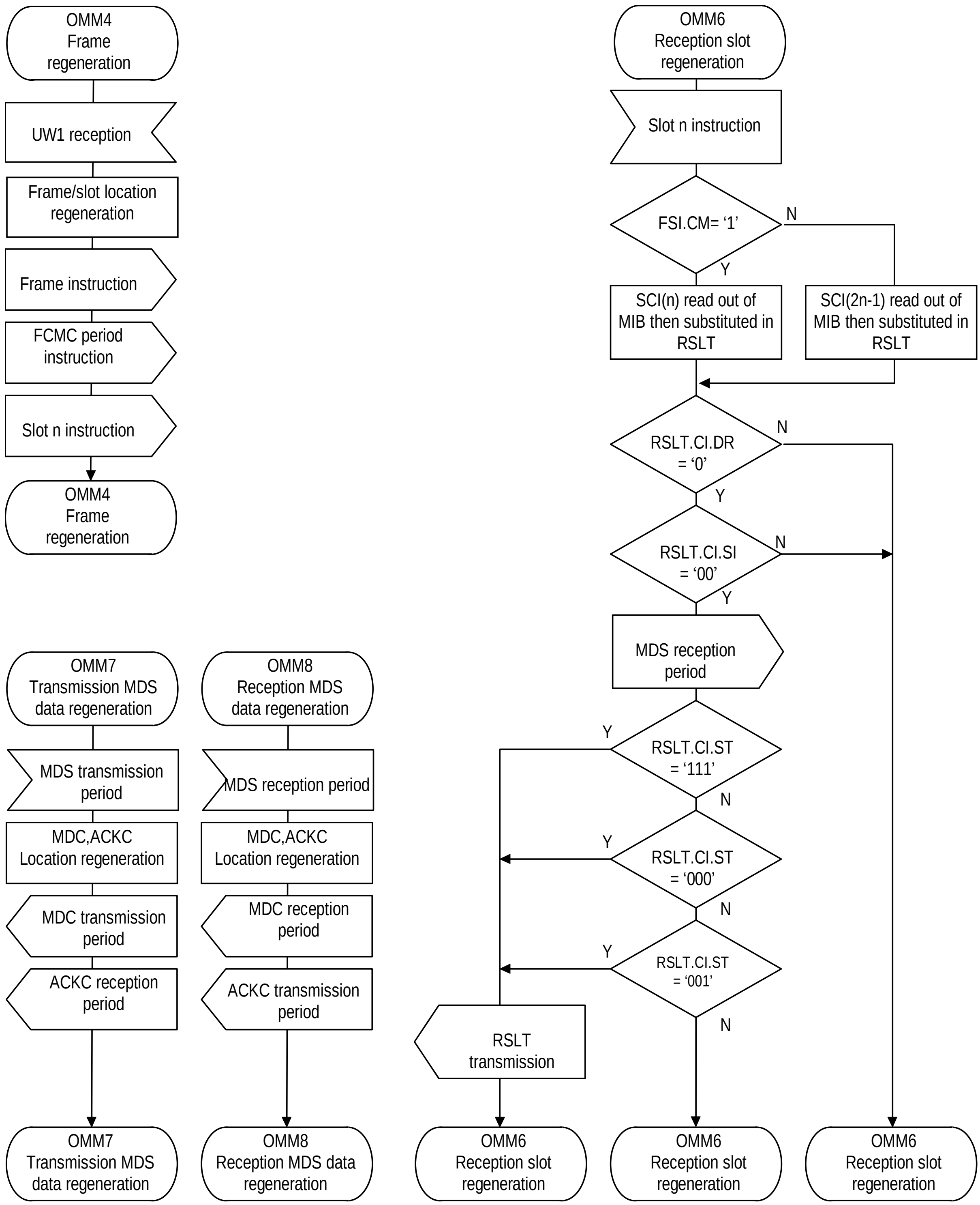
Attached Fig. F-39 SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)



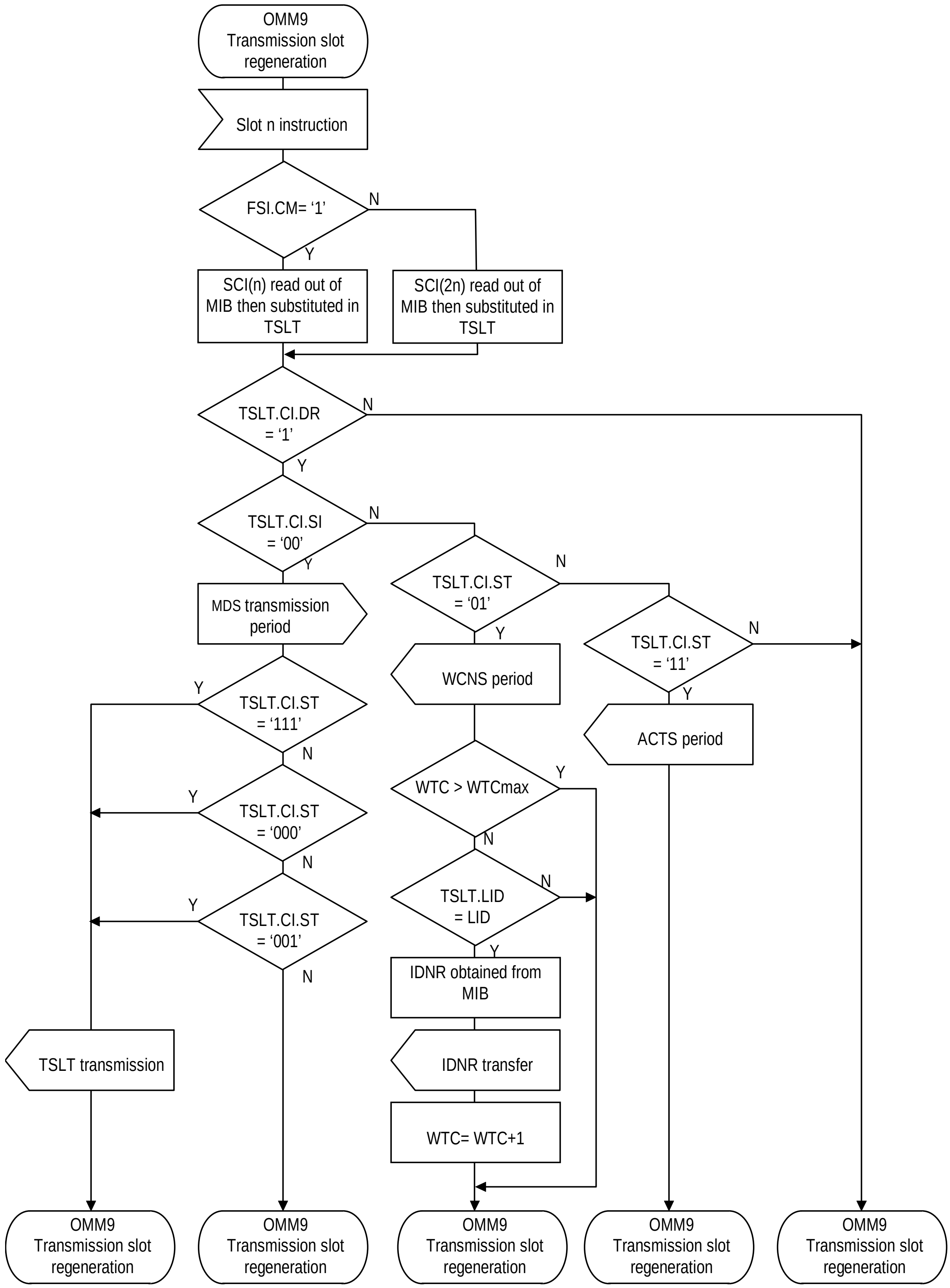
Attached Fig. F-40 SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)



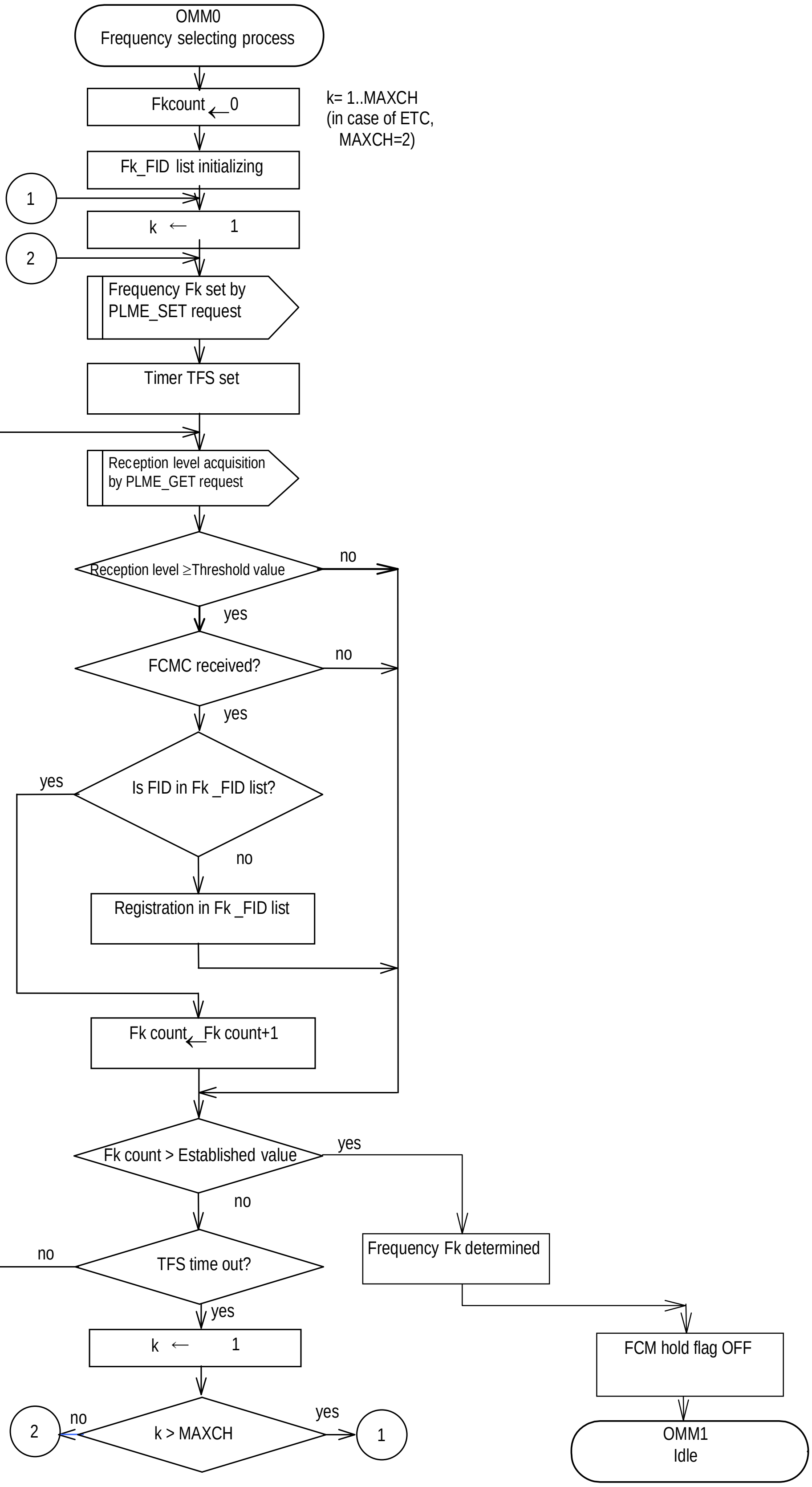
Attached Fig. F-41 SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)



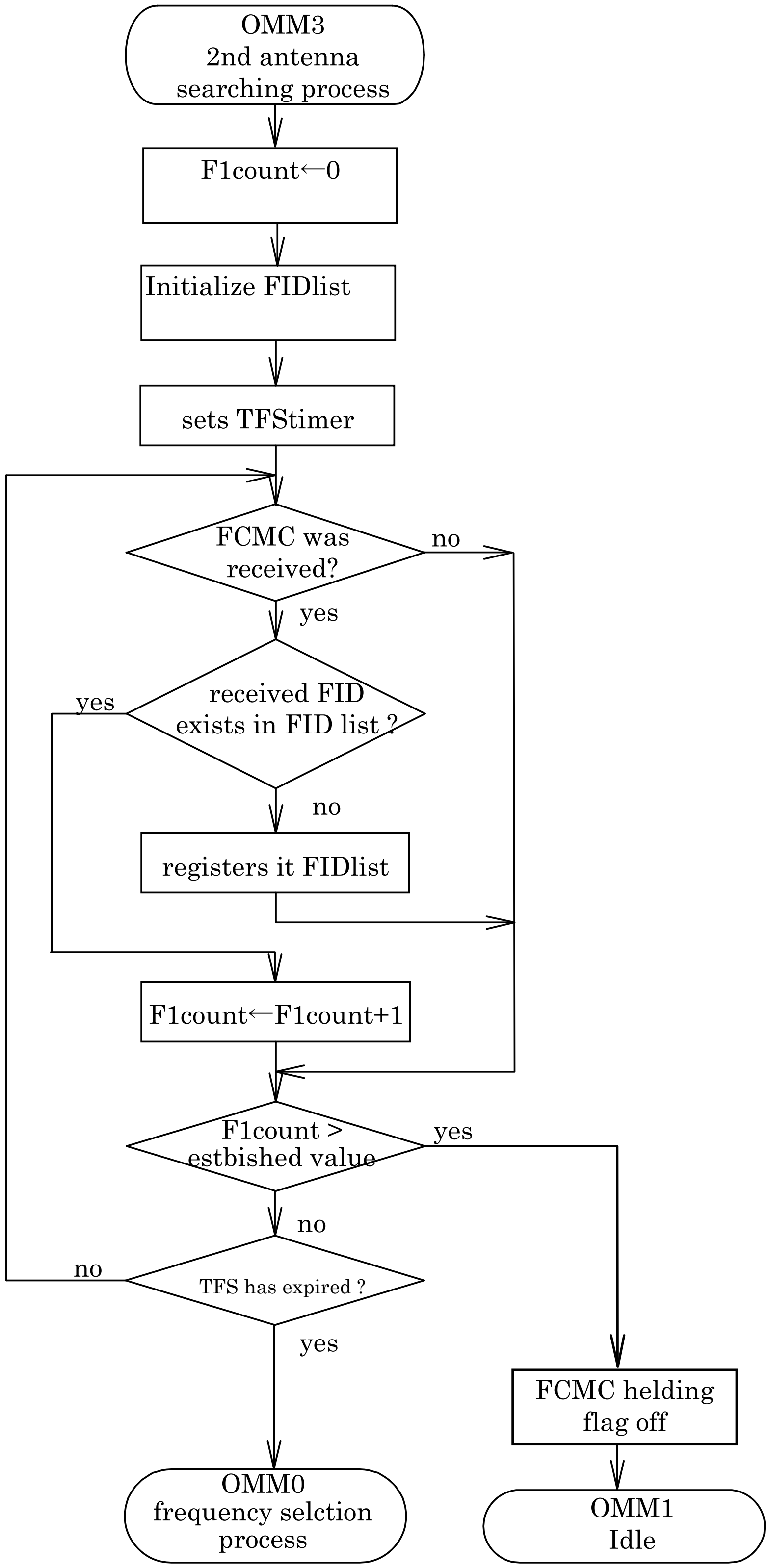
Attached Fig. F-42 SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)



Attached Fig. F-43 SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)

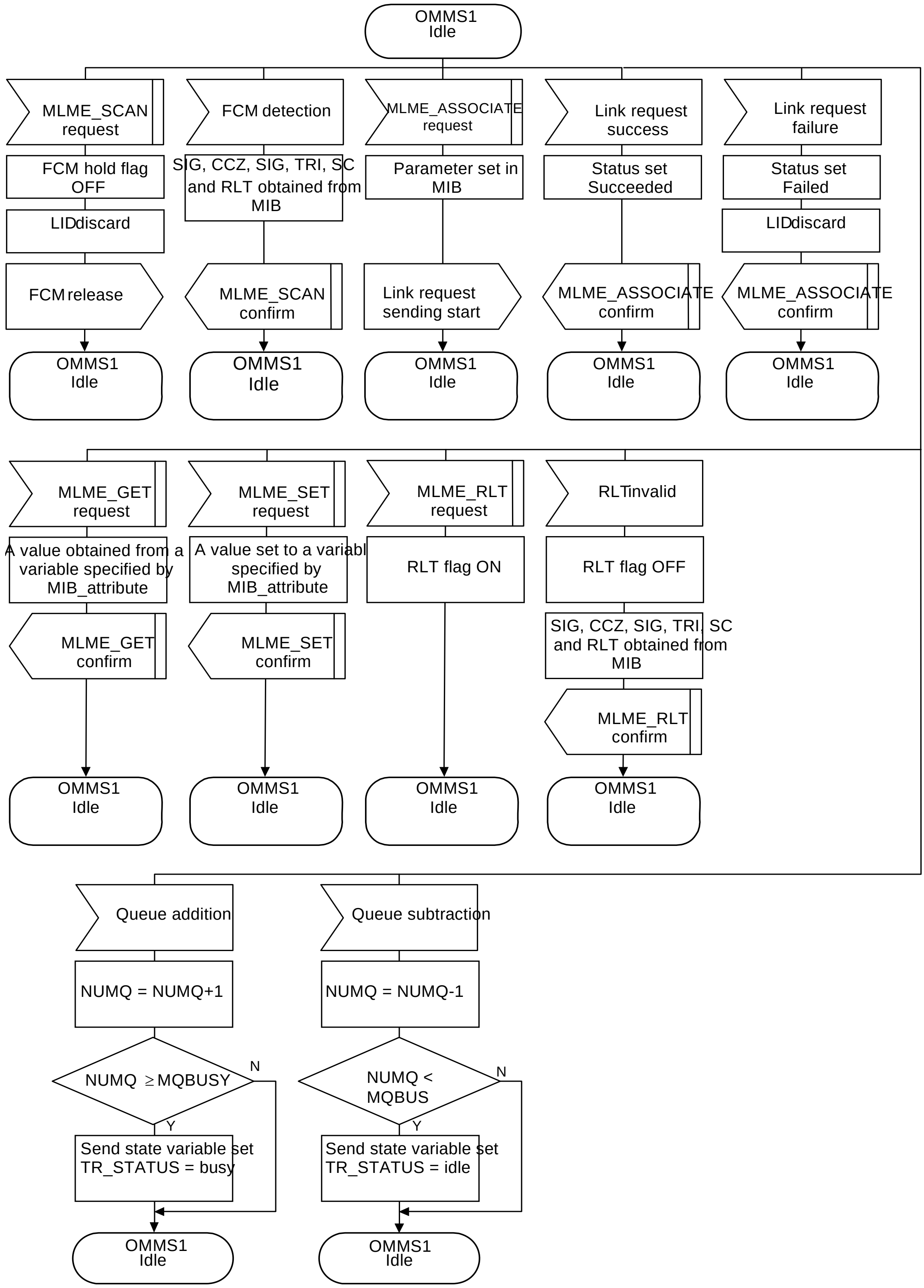


Attached Fig. F-44 SDL Diagram of the layer 2 MAC Sublayer (Mobile Station)



Attached Fig. F-45　SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)

2.2.6 MAC Management State Machine



Attached Fig. F-46 SDL Diagram of Layer 2 MAC Sublayer (Mobile Station)

Annex G. Layer 7 SDL diagram **[Informative]**

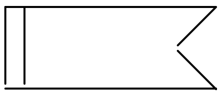
The following symbols and abbreviations are used in these descriptions. The symbols, their meanings and complete descriptions of their application methods are in ITU-T Z-Series recommendations.

Process

Procedure call

Signal reception within the layer 7

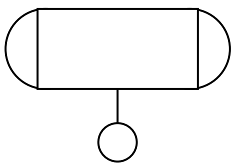
Signal transmission within the layer 7



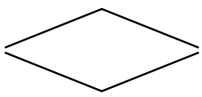
Signal transmission within the layer 7
(Left: Direction of Application,
Right: Direction of the layer 2)

Primitive transmission between layers
(Left: Direction of Application,
Right: Direction of the Layer 2)

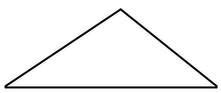
State



Procedure definition



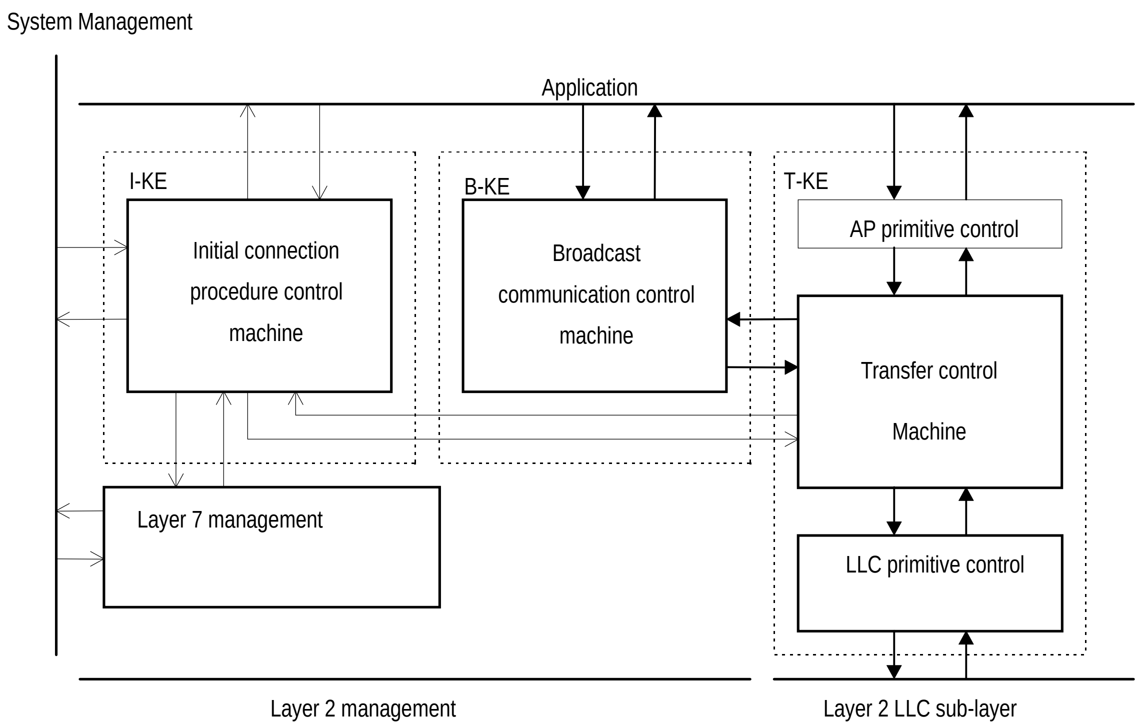
Judgment



Selection

1. Overview

SDL diagrams of The layer 7 are shown in the following figures . Fig. 1 illustrates the outline of state machines of the layer 7.

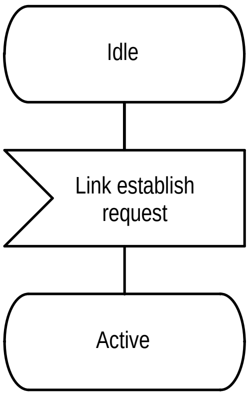


Attached Fig. 1 Outline of State Machines of the layer 7

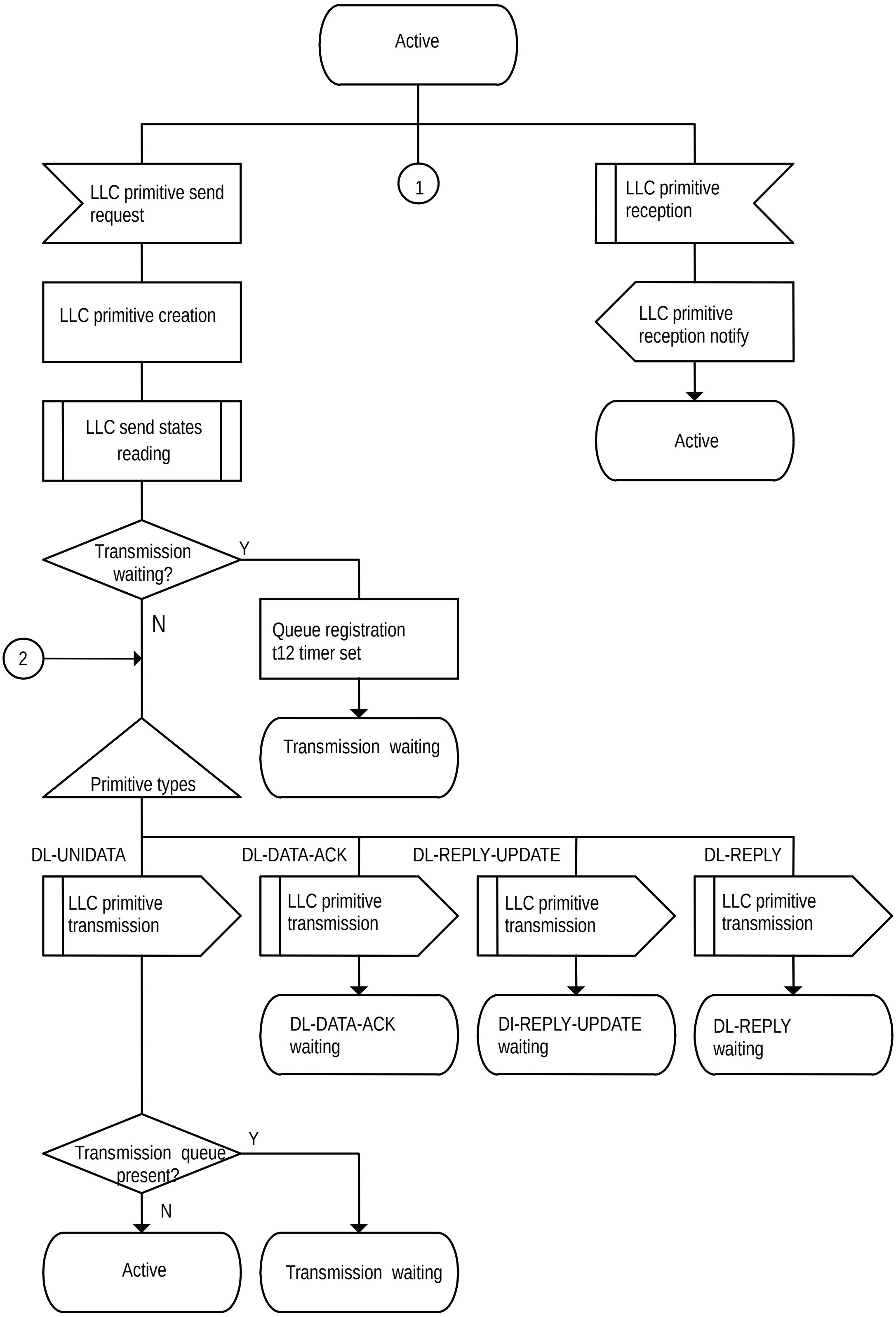
Note) At least one KE is used. However either one of I-KE or B-KE may not be used. There are two cases for T-KE; one is that T-KE manages plural EIDs, and another one is that T-KE manages one EID. This SDL diagram describes the second case. In the same manner, it also describes the case that one I-KE in the base stations manages one mobile station.

2. Transfer Control Machine (T-KE)

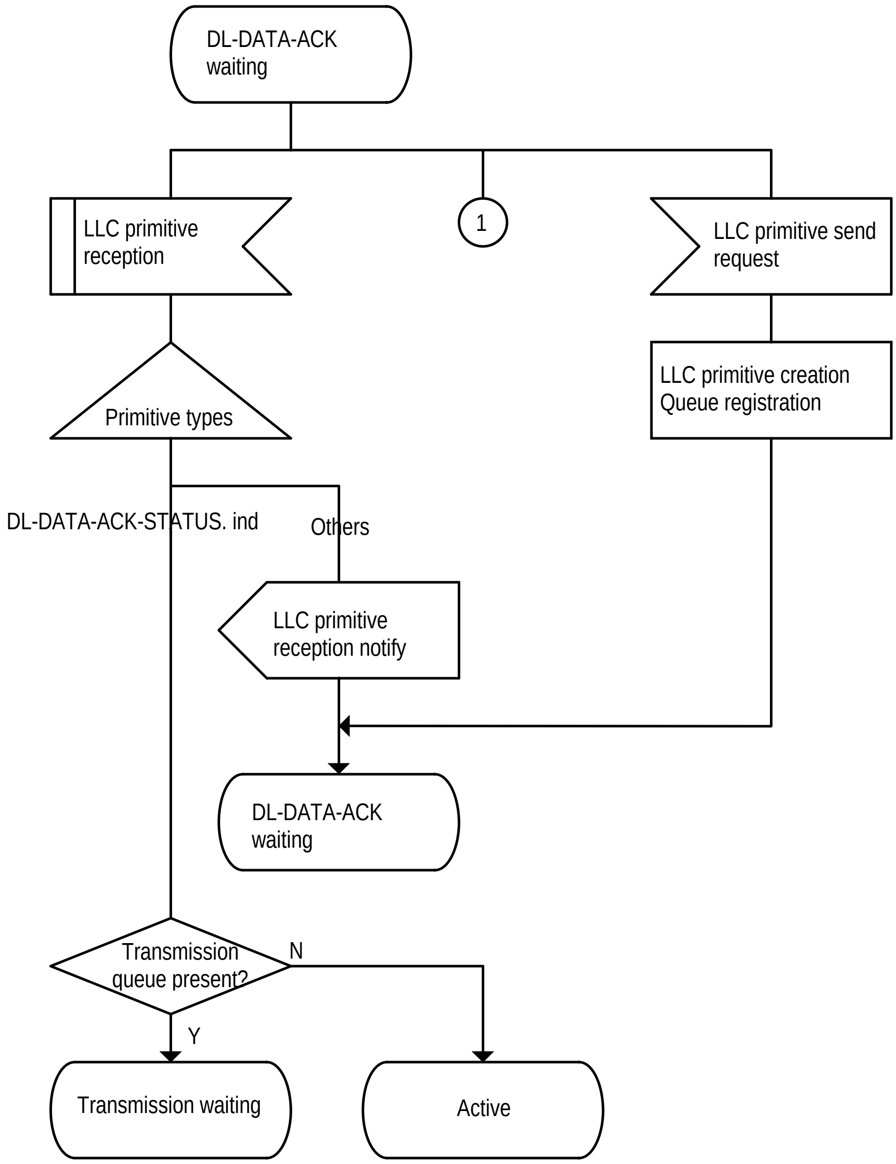
2.1 LLC Primitive Control



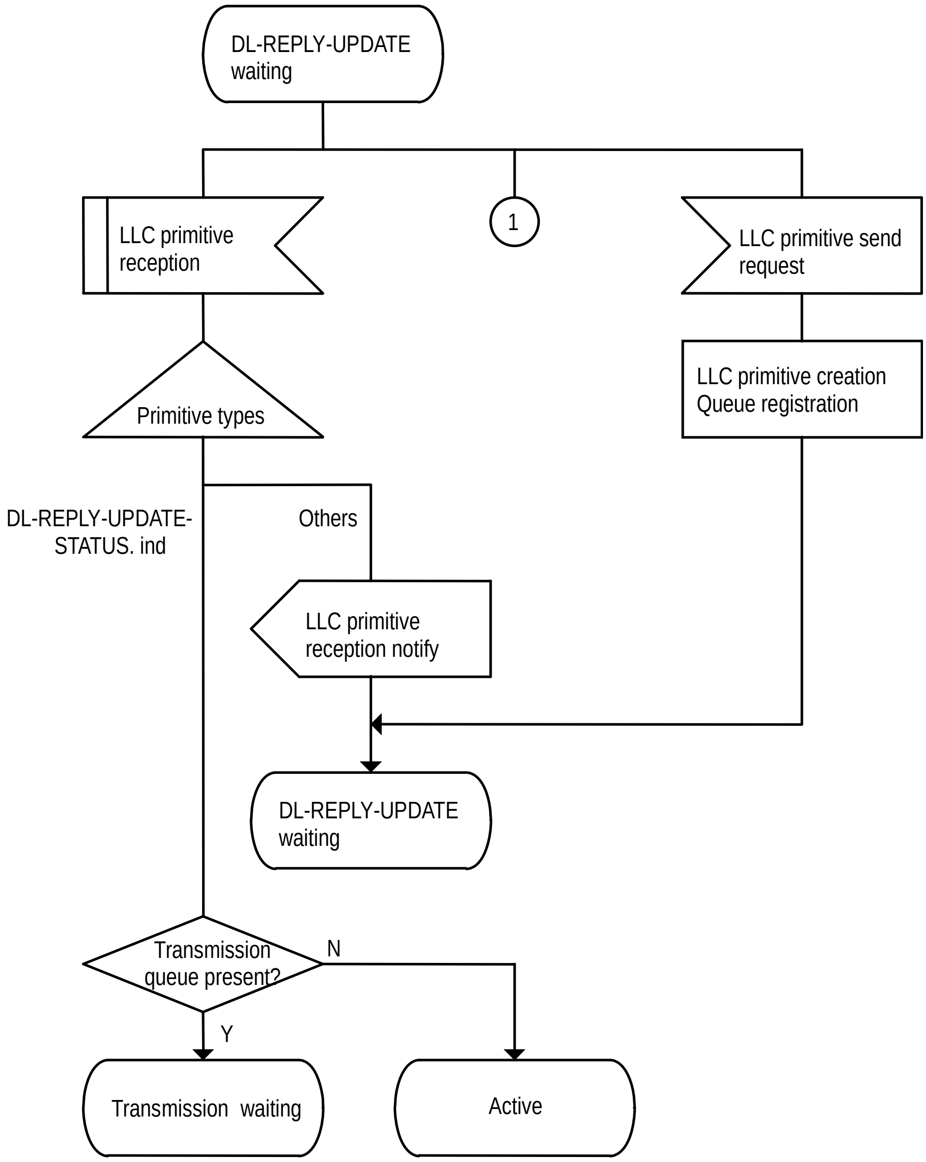
Attached Fig. G-1 SDL Diagram of the layer 7



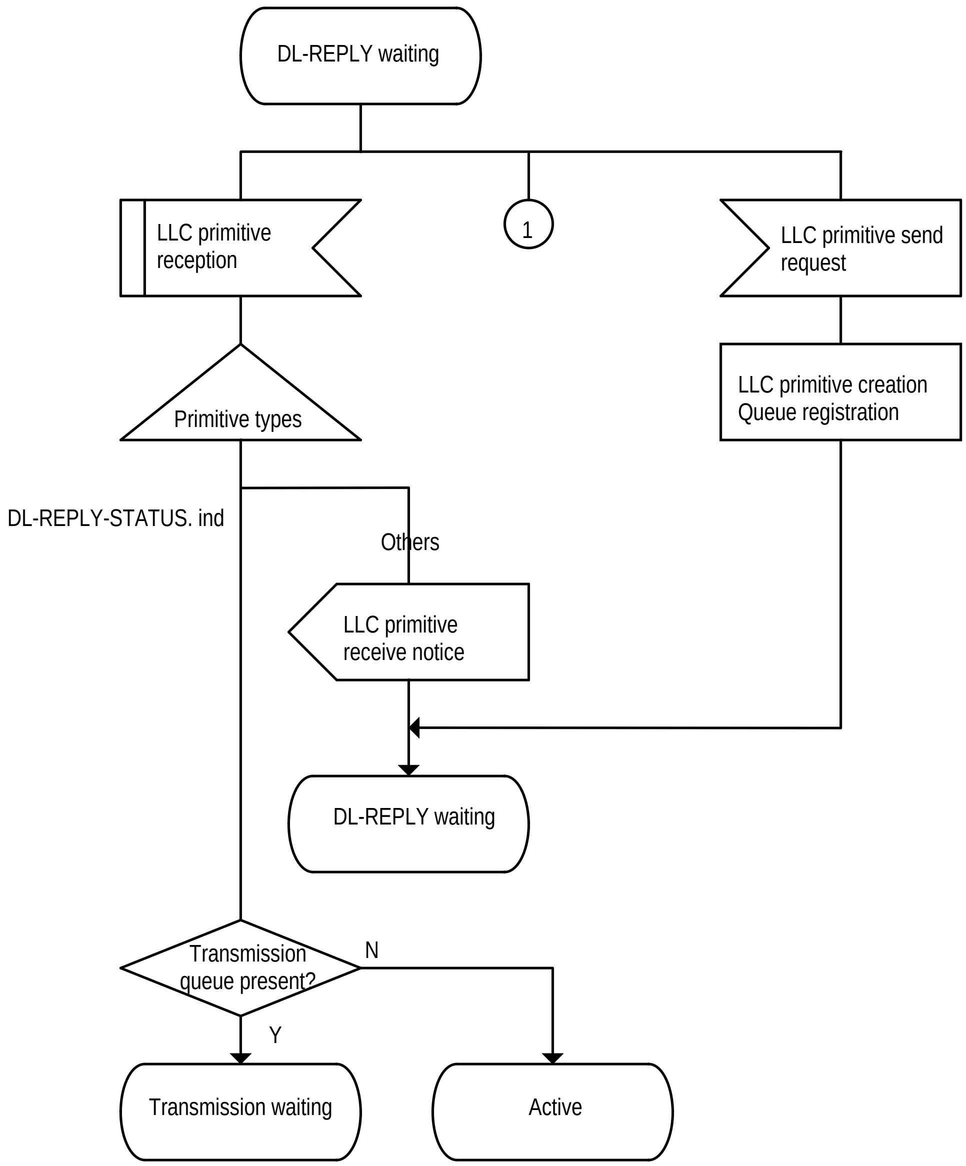
Attached Fig. G-2　SDL Diagram of the layer 7



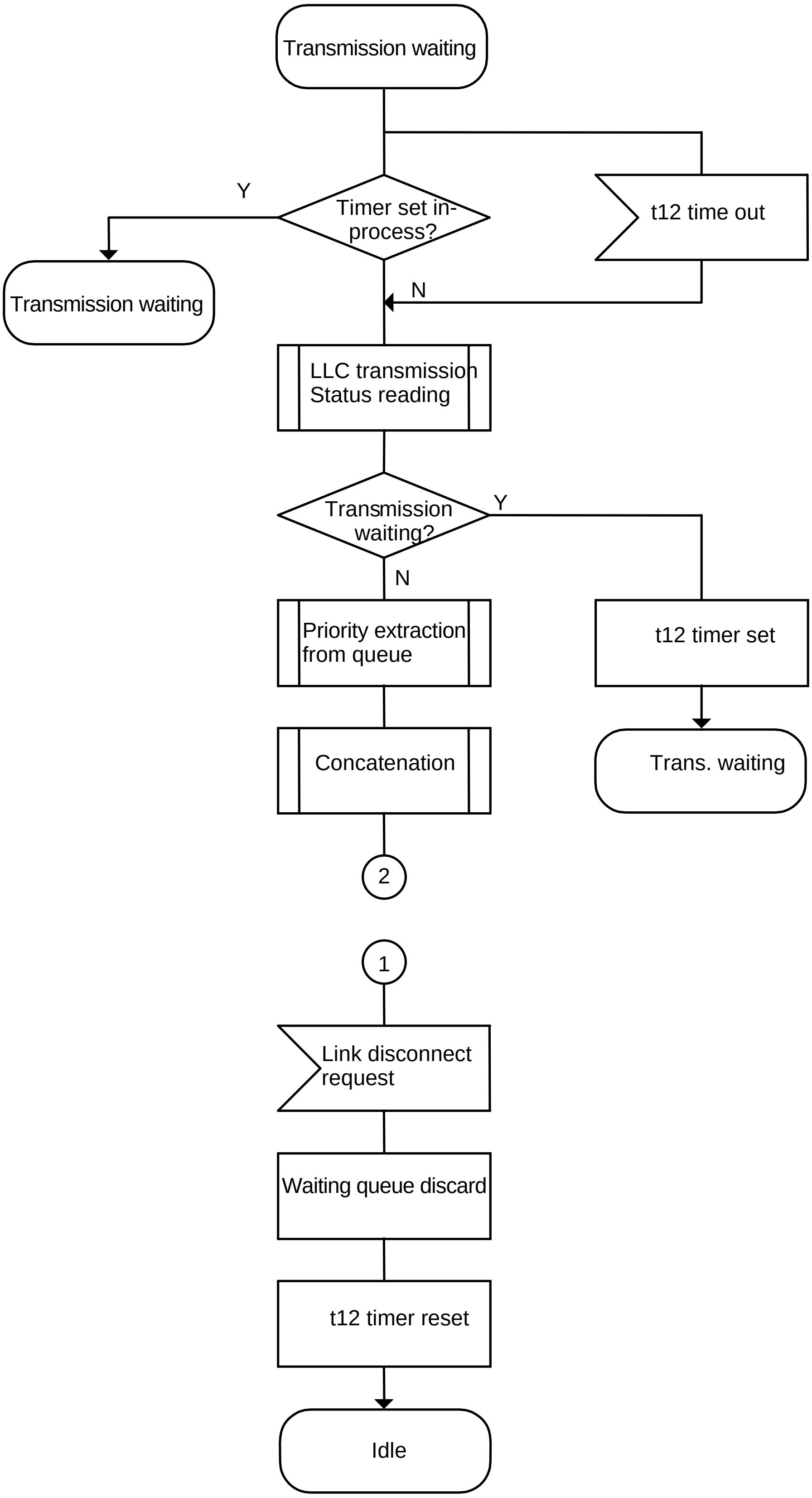
Attached Fig. G-3　SDL Diagram of the layer 7



Attached Fig. G-4 SDL Diagram of the layer 7

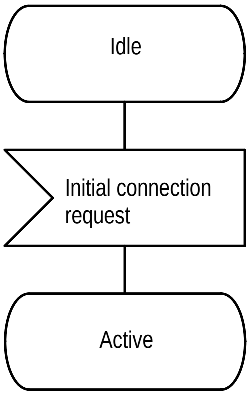


Attached Fig. G-5　SDL Diagram of the layer 7

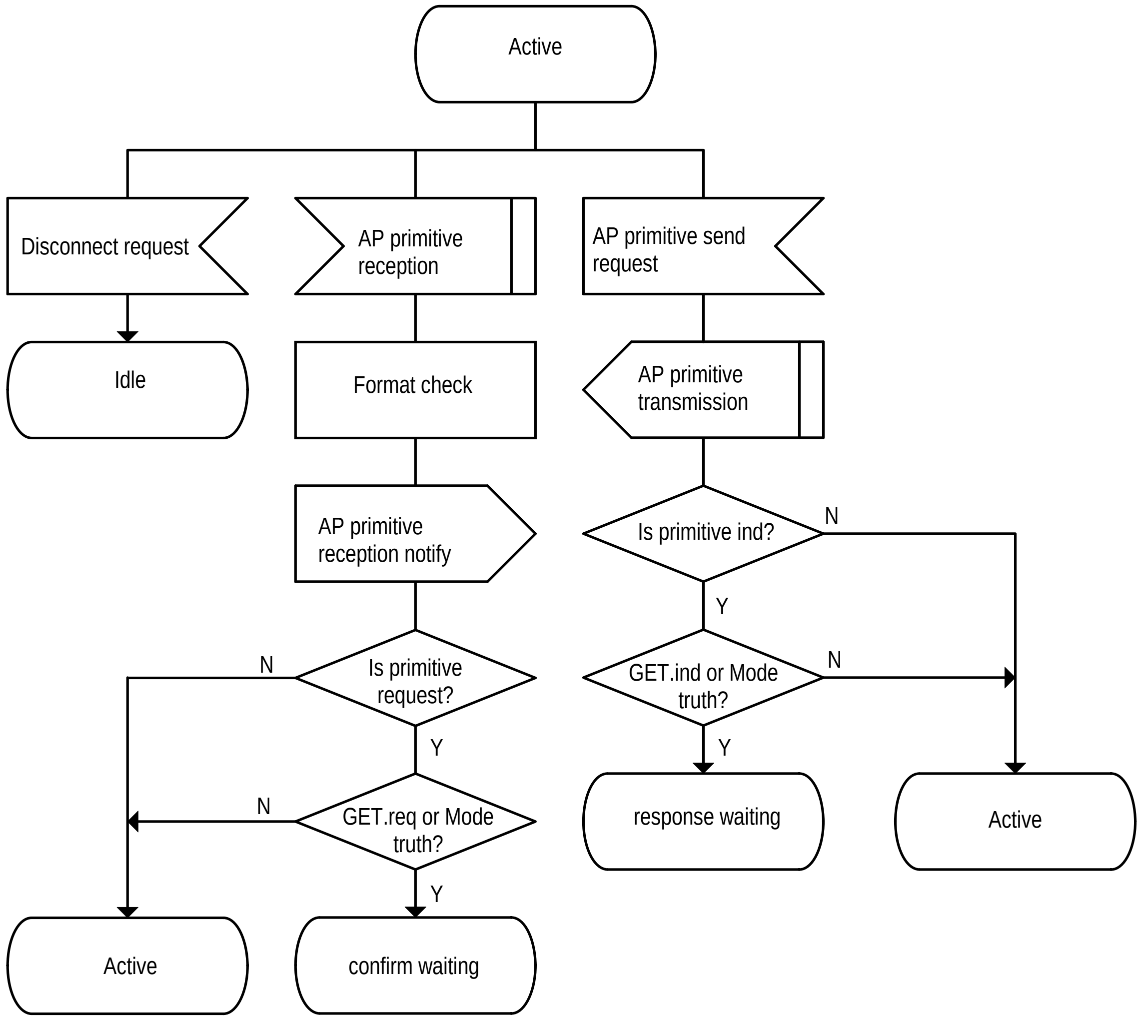


Attached Fig. G-6　SDL Diagram of the layer 7

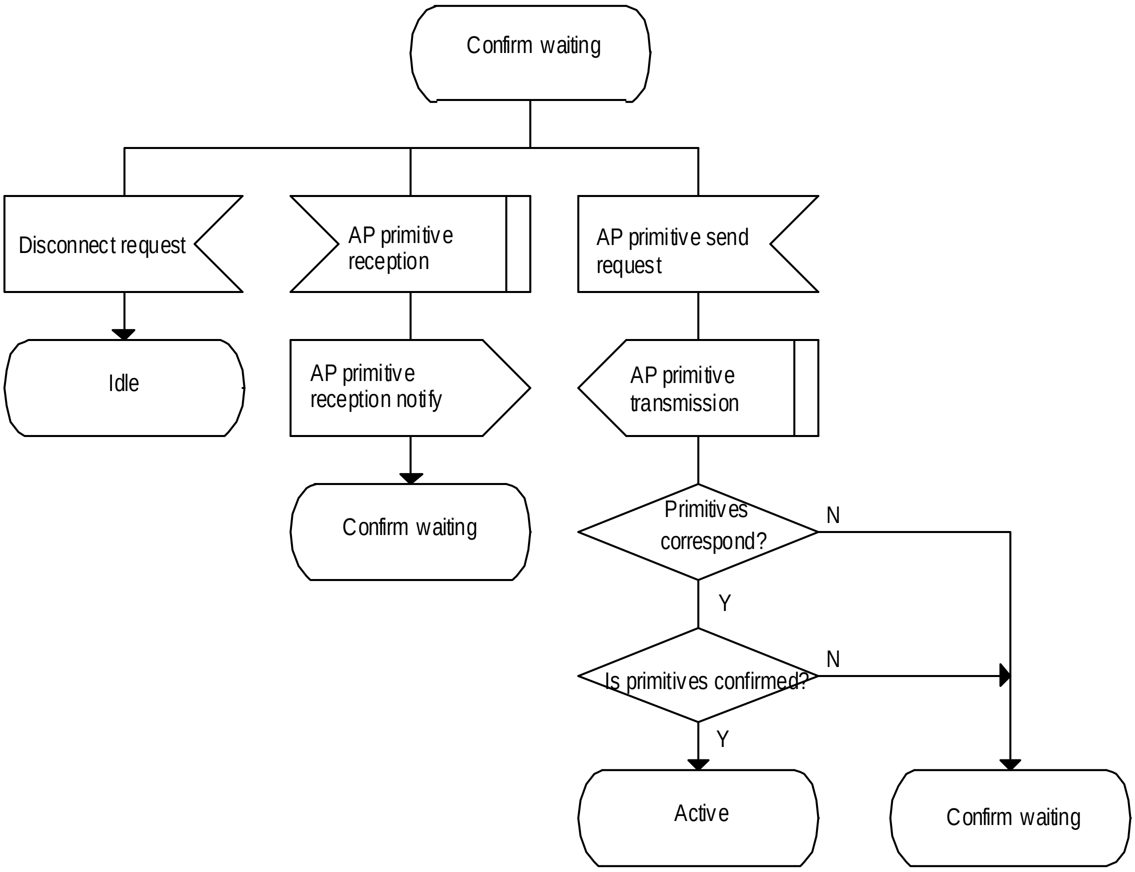
2.2 AP Primitive Control (T-KE)



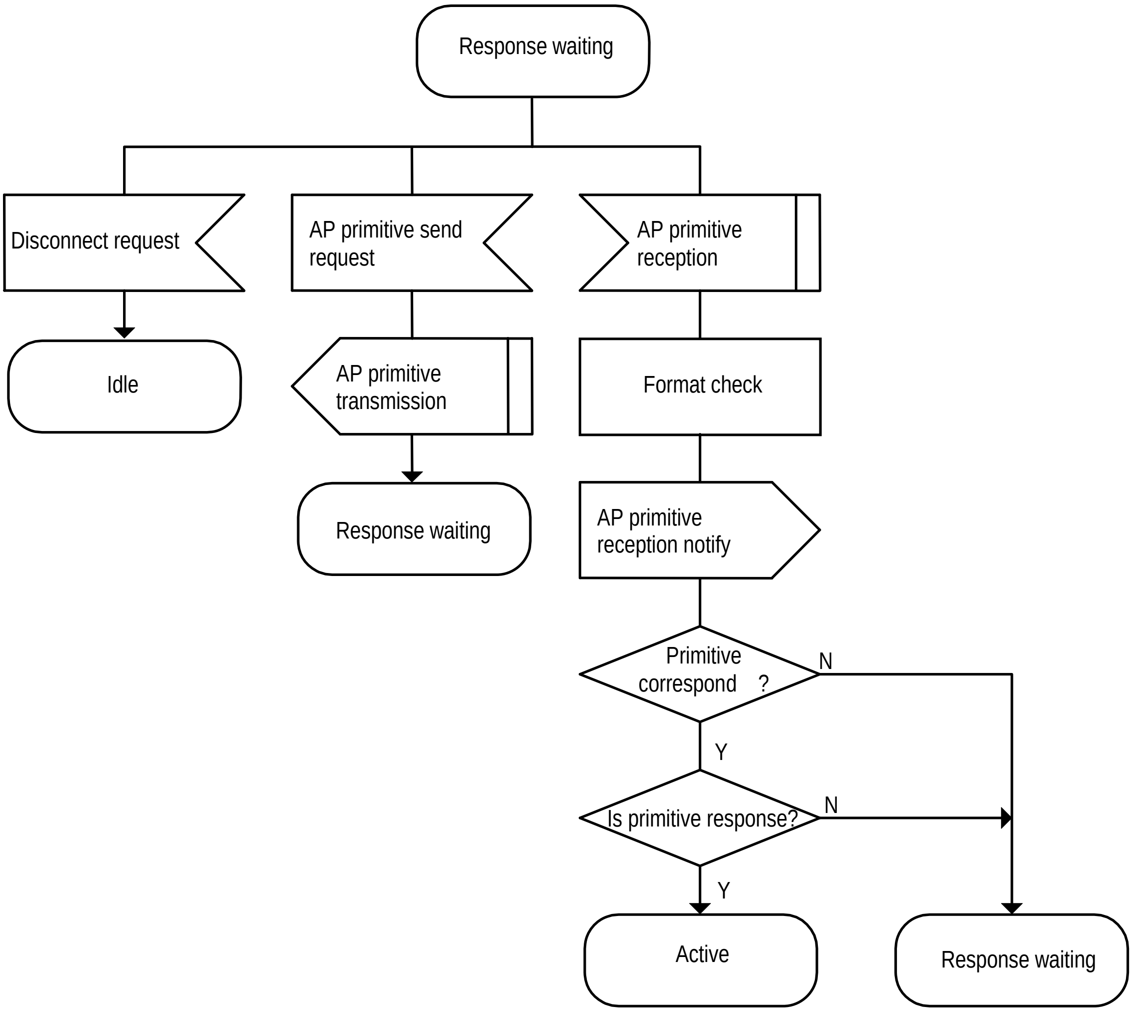
Attached Fig. G-7 SDL Diagram of the layer 7



Attached Fig. G-8 SDL Diagram of the layer 7

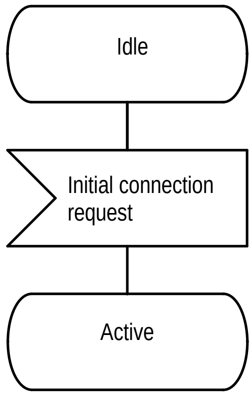


Attached Fig. G-9　SDL Diagram of the layer 7

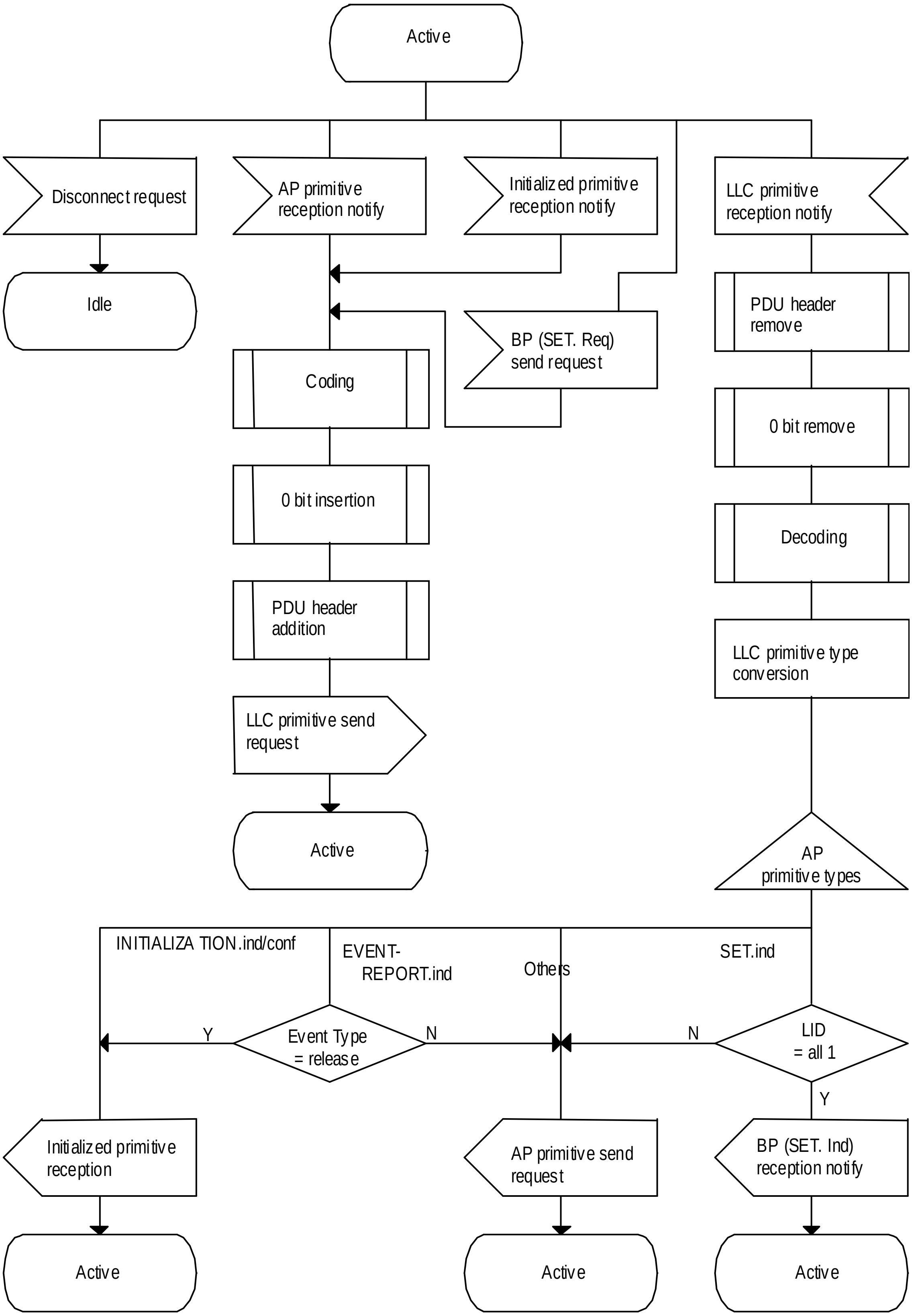


Attached Fig. G-10 SDL Diagram of the layer 7

2.3 Transfer Control (T-KE)



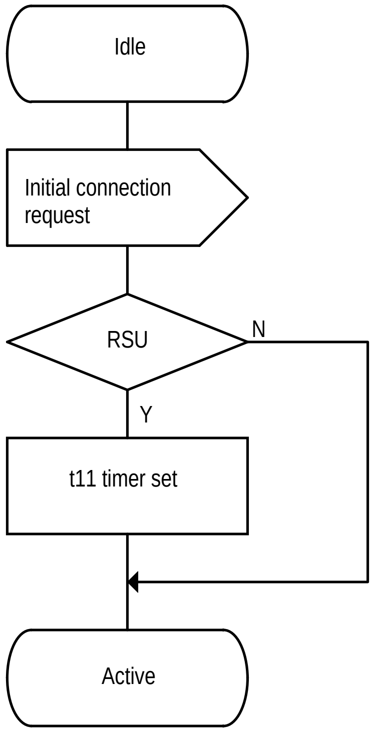
Attached Fig. G-11 SDL Diagram of the layer 7



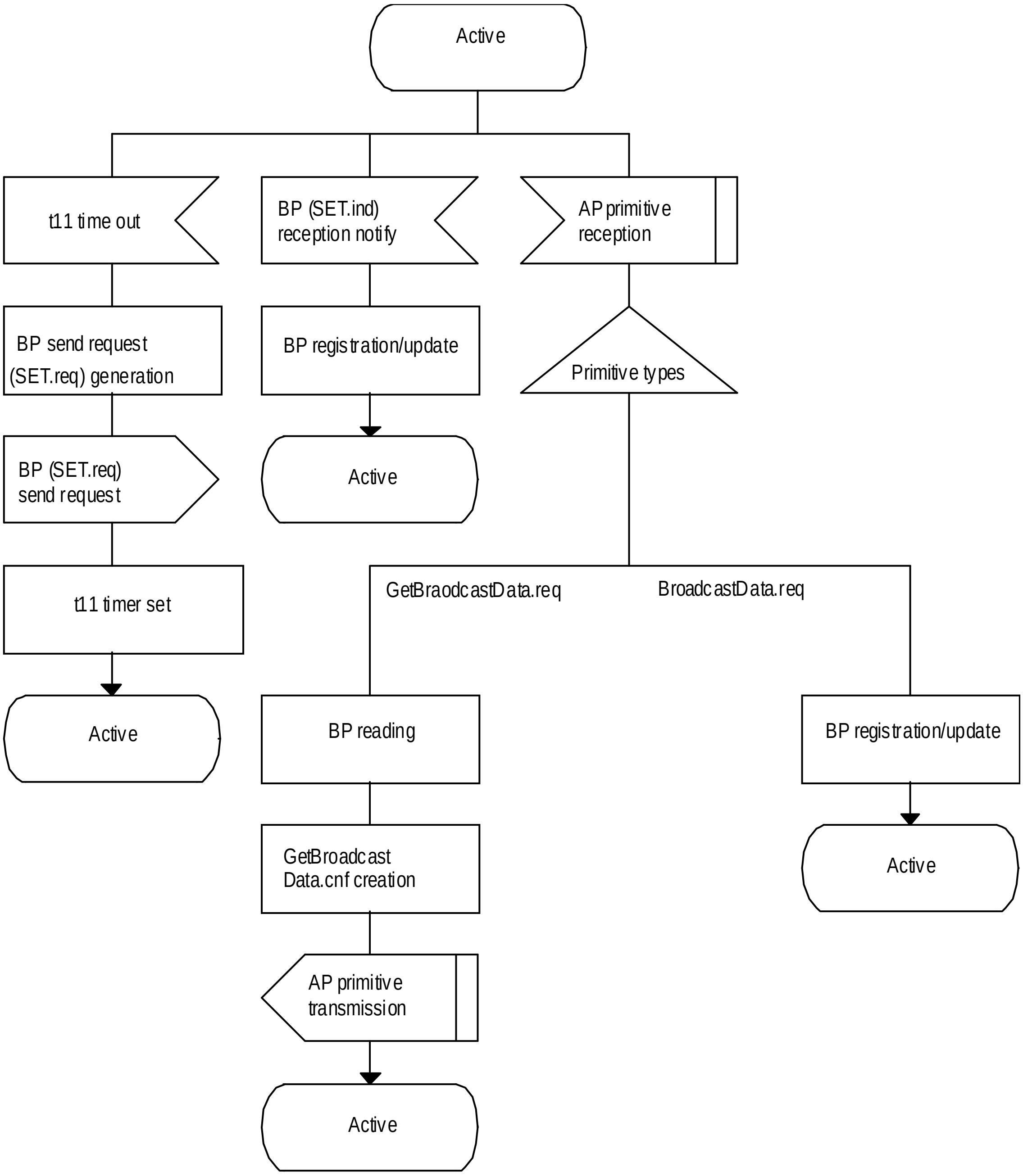
Attached Fig. G-12 SDL Diagram of the layer 7

3. Broadcast Communication Control Machine (B-KE)

3.1 Broadcast Communication Control



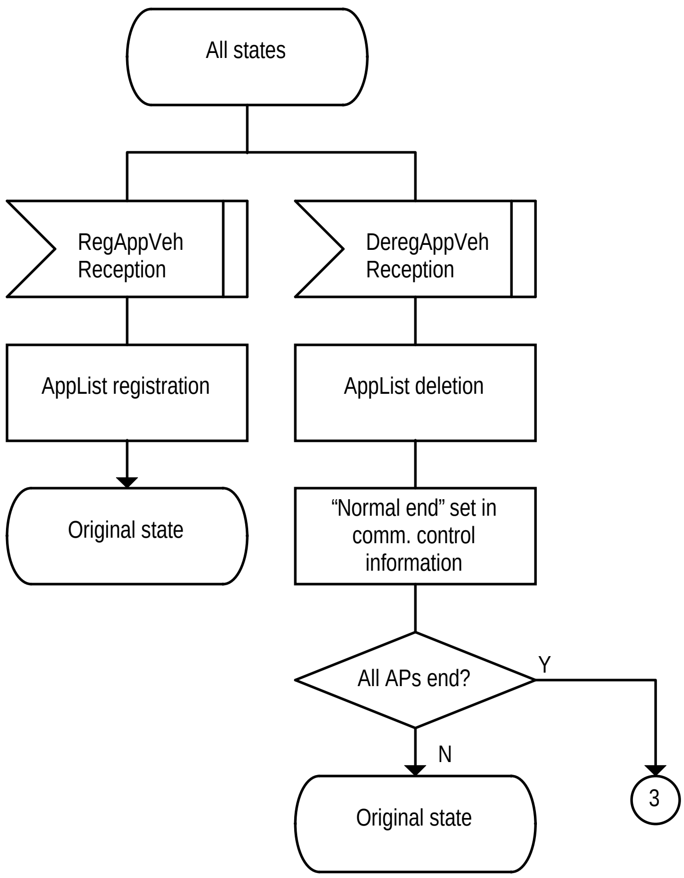
Attached Fig. G-13 SDL Diagram of the layer 7



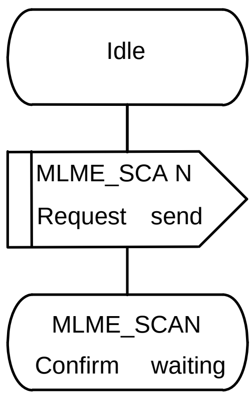
Attached Fig. G-14 SDL Diagram of the layer 7

4. Initial Connection Machine (1-KE)

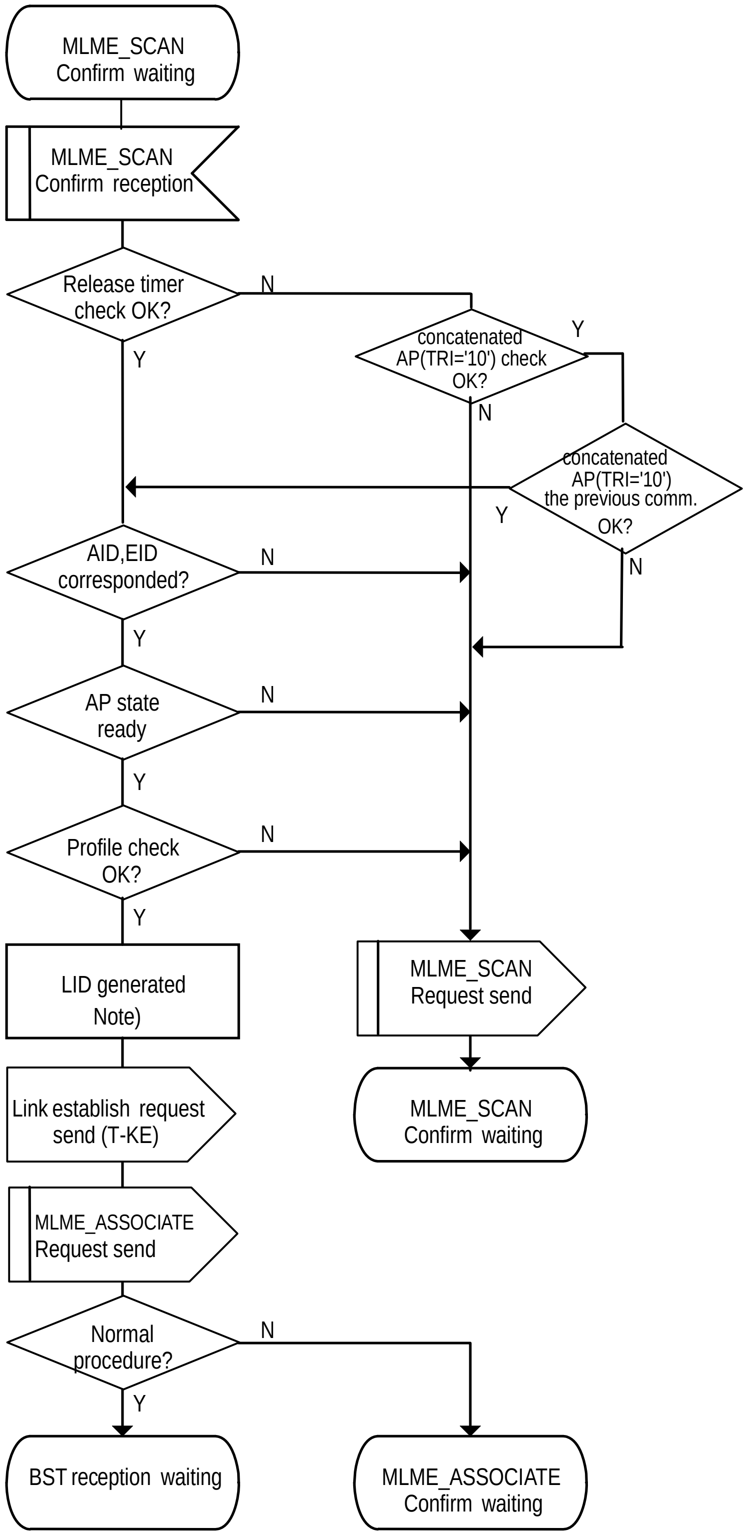
4.1 Initial Connection (Association) Control at Mobile Stations



Attached Fig. G-15 SDL Diagram of the layer 7

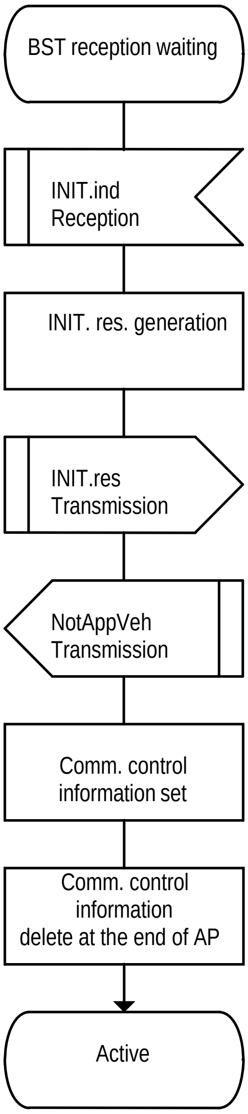


Attached Fig. G-16 SDL Diagram of the layer 7

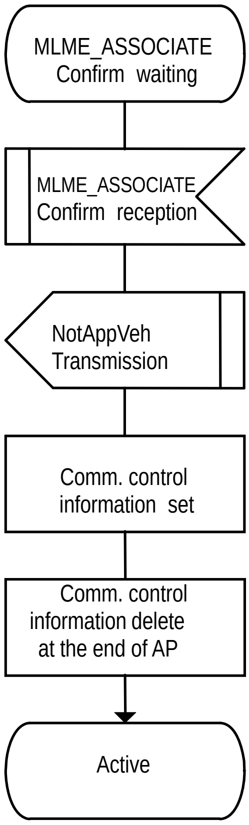


Note)　At a concatnated communication zoon, LID by the second base station must be the same as that by the first one.

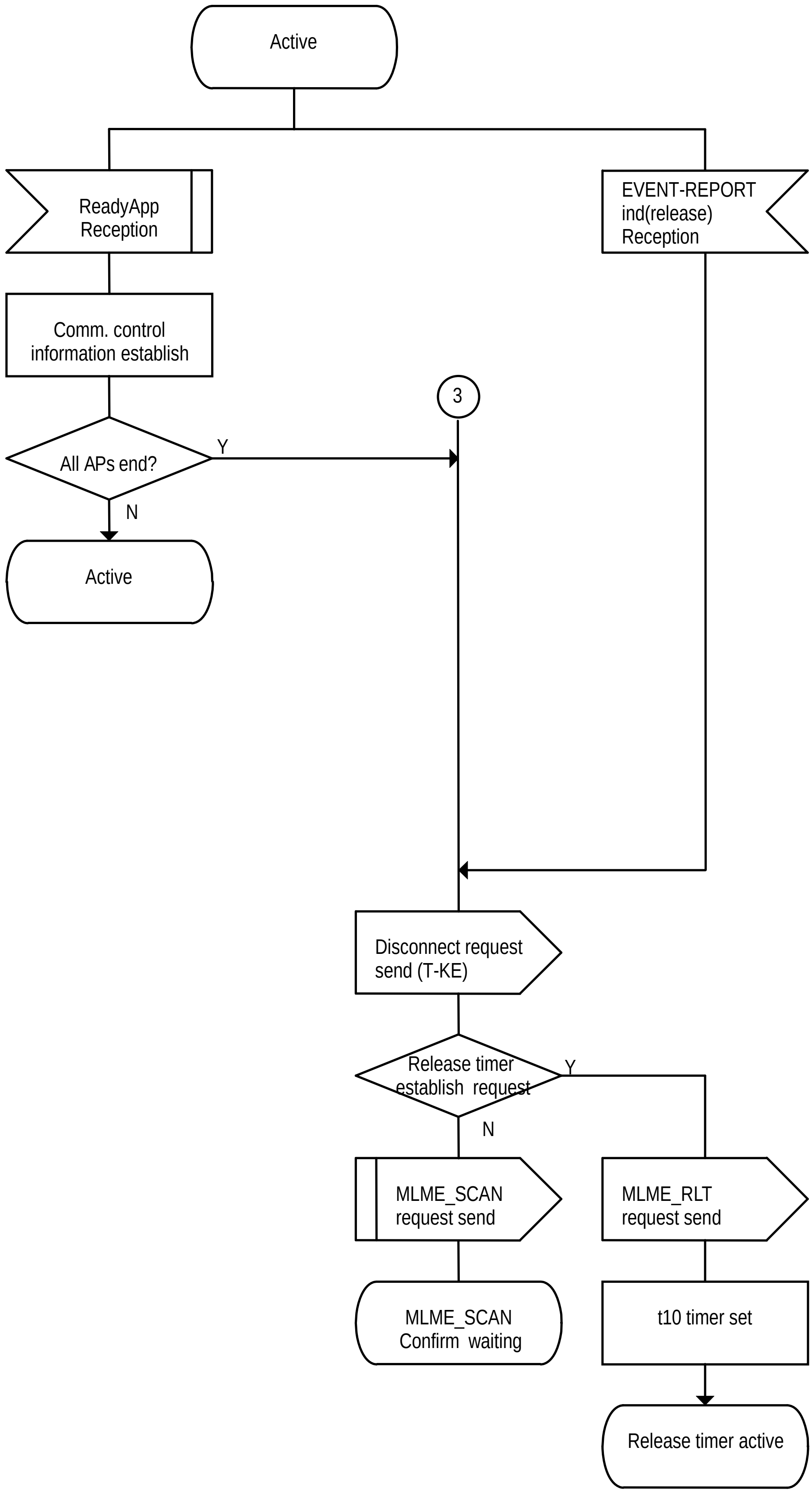
Attached Fig. G-17　SDL Diagram of the layer 7



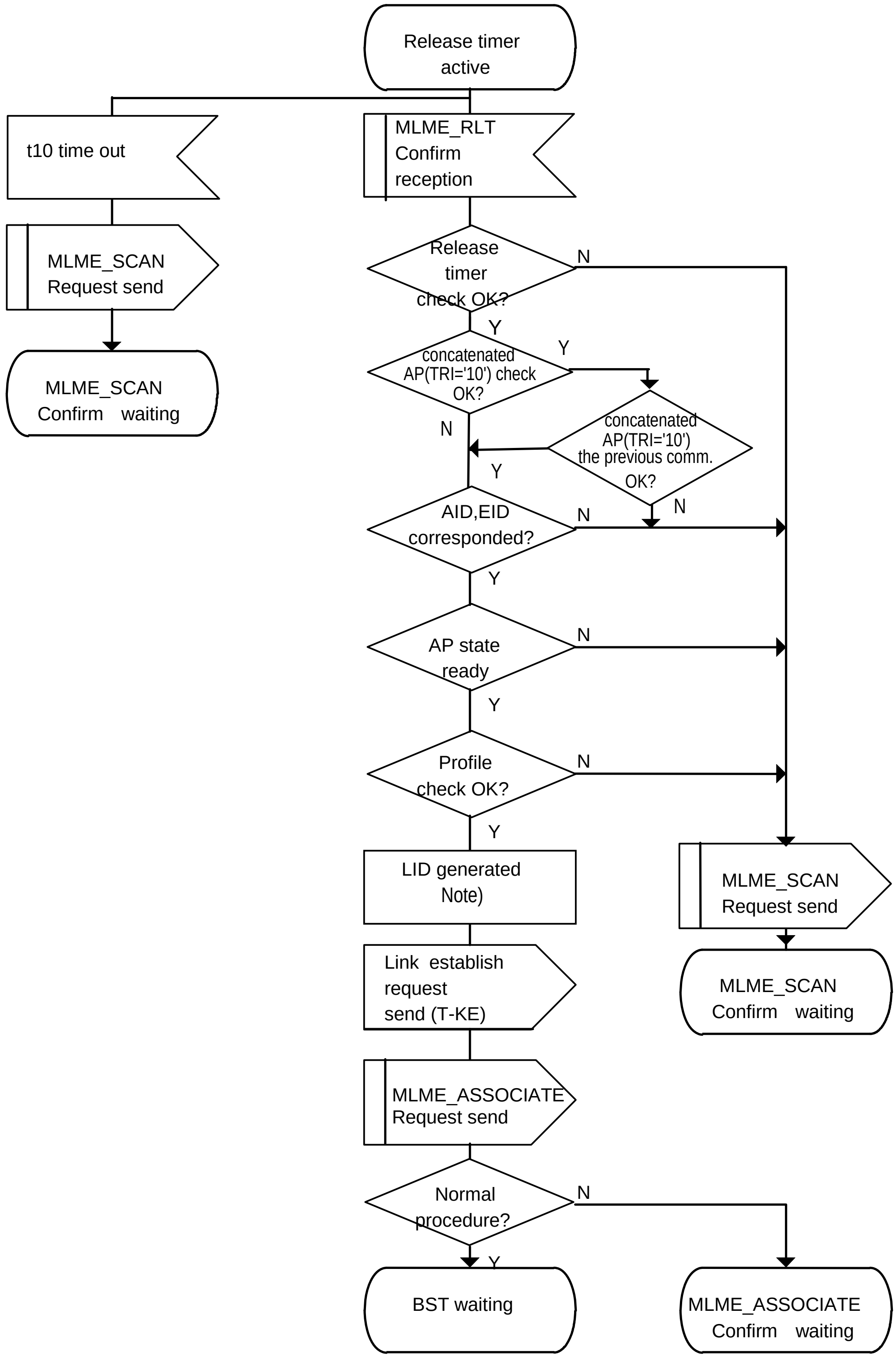
Attached Fig. G-18 SDL Diagram of the layer 7



Attached Fig. G-19　SDL Diagram of the layer 7



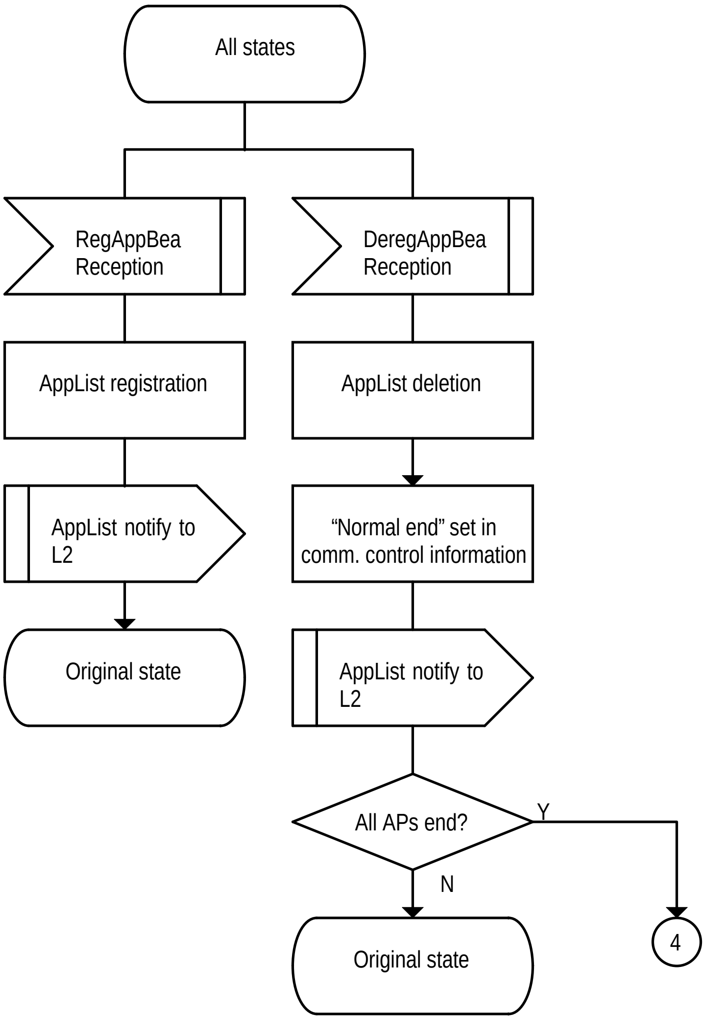
Attached Fig. G-20 SDL Diagram of the layer 7



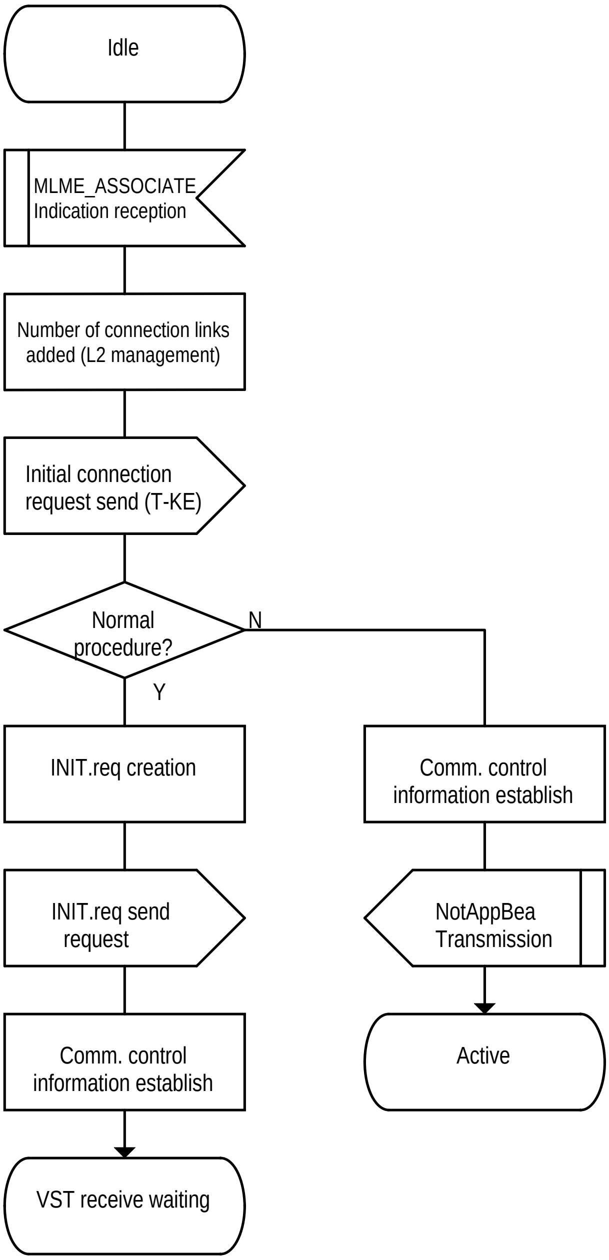
Note) At a concatnated communication zoon, LID by the second base station must be the same as that by the first one.

Attached Fig. G-21 SDL Diagram of the layer 7

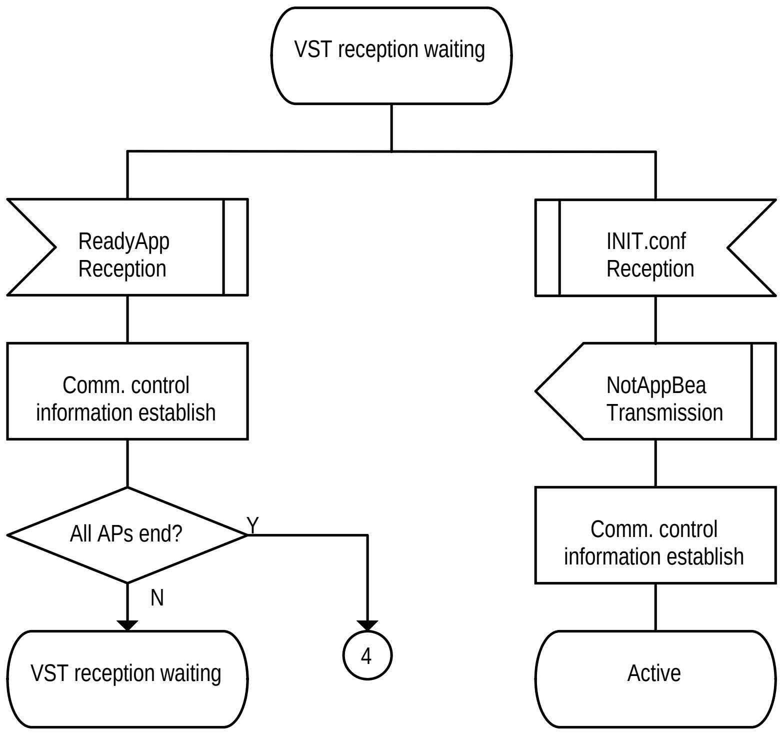
4.2 Initial Connection (Association) Control at RSU



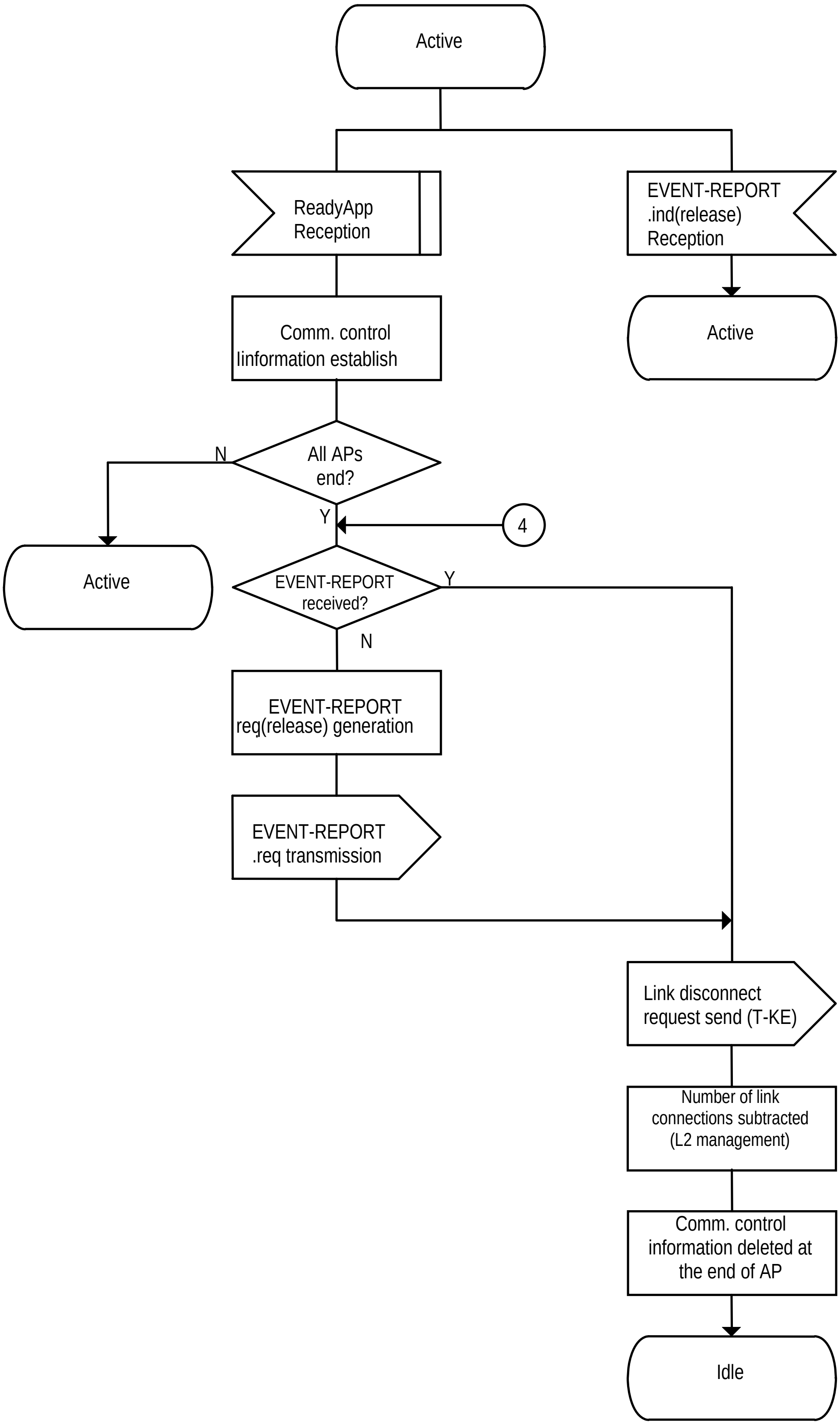
Attached Fig. G-22 SDL Diagram of the layer 7



Attached Fig. G-23　SDL Diagram of the layer 7



Attached Fig. G-24　SDL Diagram of the layer 7



Attached Fig. G-25 SDL Diagram of the layer 7

Annex H. Data Structures

This annex specifies the data structures in the Layer 7.

１． Use of modules

The T-KE shall use a DSRCData and a DSRCtransfer module.

Note １) IMPORT resp.EXPORT mechanism is standardized in[ISO 8824-1].

Note ２) Parameters (aid． etc.,) presented in the abstract structure of ASN.1 sentences will be bounded within regulated values or default one. Then, the transmission data length shall be 1Octet-length including of a extension bit, preamble bits and so on.

1.1 ASN.1 modules

```
DSRCData    DEFINITIONS::= BEGIN
        IMPORTS
        ContainerJ.y FROM ApplicationJ  --this line shall be given for each application
                                        -- which defines data of type container, J and y
                                        -- shall be replaced by an unambiguous suffix;
        RecordJ.y FROM ApplicationJ     -- this line shall be given for each application
                                        -- which defines data of type record, J and y
                                        -- shall be replaced by an unambiguous suffix;
        -- EXPORTS everything;
Action-Request::= SEQUENCE{
        mode                    BOOLEAN,
        eid                     Dsrc-EID,
        actionType              ActionType,
        accessCredentials       OCTET STRING (SIZE (0..127,…))        OPTIONAL,
        actionParameter         Container       OPTIONAL,
        iid                     Dsrc-EID        OPTIONAL
}
Action-Response::= SEQUENCE{
        fill                    BIT STRING (SIZE(1)),
        eid                     Dsrc-EID,
        iid                     Dsrc-EID        OPTIONAL,
        responseParameter       Container       OPTIONAL,
        ret                     ReturnStatus    OPTIONAL
}
ActionType ::= INTEGER(0..127,..)
ApplicationContextMark ::= Container            -- OCTET STRING (SIZE(0..127,...))
```

```
ApplicationList::=SEQUENCE (0..127,...) OF
          SEQUENCE {
                    aid             DSRCApplicationEntityID,
                    eid             Dsrc-EID                 OPTIONAL,
                    parameter       ApplicationContextMark   OPTIONAL
}
AttributeIdList::=SEQUENCE (0.. 127,...) OF INTEGER(0..127,...)
AttributeList::=SEQUENCE   (0..127,...) OF Attributes
Attributes::=SEQUENCE {
          attributeId       INTEGER (0..127,...),
          attributeValue    Container
}
BeaconID::=SEQUENCE{
          manufacturerid    INTEGER(0.. 65535),
          individualid      INTEGER(0..2^27-1)
}                           -- for registration of manufacturerid see   www.nni.nl/cen278
BroadcastPool::=SEQUENCE{
          directoryvalue    Directory,
          content   SEQUENCE (0..127,...) OF File
}
BST::=SEQUENCE{
          rSU                       BeaconID,
          time                      Time,
          profile                   Profile,
          mandApplications          ApplicationList,
          nonmandApplications       ApplicationList   OPTIONAL,
          profileList               SEQUENCE (0..127,...) OF Profile
}
Container::=CHOICE{
          integer                   [0]     INTEGER,
          bitstring                 [1]     BIT STRING,
          octetstring               [2]     OCTET STRING,
          universalString           [3]     UniversalString,
          beaconId                  [4]     BeaconID,
          t-apdu                    [5]     T-APDUs,
          dsrcApplicationEntityId   [6]     DSRCApplicationEntityID,
          dsrc-Ase-Id               [7]     Dsrc-EID,
          attrIdList                [8]     AttributeIdList,
          attrList                  [9]     AttributeList,
          broadcastPool             [10]    BroadcastPool,
```

```
        directory               [11]    Directory,
        file                    [12]    File,
        fileType                [13]    FileType,
        record                  [14]    Record,
        time                    [15]    Time,
        vector                  [16]    SEQUENCE (0..255) OF INTEGER(0..127,...),
        dummy                   [17..96] Reserved    For    iso-tc204-dsrc-appliction
Application,
        private                 [97..127]       Private,
        …
        , contI.x [i]       ContainerI.x    -- this line shall be given for each imported
                                            -- ContainerI.x, where I.x is replaced by the
                                related
                                            -- suffix and i is the registered tag starting with 0
                                            -- Gaps shall be filled with   contI.x [i]
                                            -- BIT STRING;
}
Directory::= SEQUENCE (0..127,...) OF FileName
Dsrc-EID::=INTEGER(0..127, ...)
DSRCApplicationEntityID::=INTEGER {
        system                                          (0),
        reserved-for-iso-tc204-dsrc-application         (1..12),
        private                                         (13),
        multi-purpose-payment                           (14),
        dsrc-resource-manager                           (15),
        reserved-for-iso-tc204-dsrc-application         (16),
        cruise-assist-highway-system                    (17),
        multi-purpose-information-system                (18),
        reserved-for-iso-tc204-dsrc-appliction          (19..28),
        private                                         (29..30),
        reserved-for-iso-tc204-dsrc-appliction          (31)
} (0..31, ...)
Event-Report-Request::= SEQUENCE{
        mode                    BOOLEAN,
        eid                     Dsrc-EID,
        eventType               EventType
        accessCredentials       OCTET STRING (SIZE(0..127,...))         OPTIONAL,
        eventParameter          Container       OPTIONAL,
        iid                     Dsrc-EID        OPTIONAL
}
```

```
Event-Report-Response::= SEQUENCE{
        fill            BIT STRING (SIZE(2)),
        eid             Dsrc-EID,
        iid             Dsrc-EID        OPTIONAL,
        ret             ReturnStatus    OPTIONAL
}
EventType::=INTEGER{
        release   (0)
} (0..127, ...)
File::=SEQUENCE(0..127,...) OF Record
FileName::=SEQUENCE{
        aseID           Dsrc-EID,
        fileID          INTEGER(0..127,...)
}
Get-Request::=SEQUENCE{
        fill                    BIT STRING (SIZE(1)),
        eid                     Dsrc-EID,
        accessCredentials       OCTET STRING (SIZE(0..127,...)) OPTIONAL,
        iid                     Dsrc-EID        OPTIONAL,
        attrIdList              AttributeIdList OPTIONAL
}
Get-Response::=SEQUENCE{
        fill                    BIT STRING (SIZE(1)),
        eid                     Dsrc-EID,
        iid                     Dsrc-EID        OPTIONAL,
        attributelist           AttributeList   OPTIONAL,
        ret                     ReturnStatus    OPTIONAL
}
Initialisation-Request::=   BST
Initialisation-Response::= VST
NamedFile::=SEQUENCE{
        name                    FileName,
        file                    File
}
ObeConfiguration::=SEQUENCE{
        equipmentClass          INTEGER(0..32767),
        manufacturerID          INTEGER(0..65535),
        obeStatus               INTEGER(0..65535) OPTIONAL
}
Profile::= INTEGER{
```

```
        reservedForISO/CENUse  (0..8),
        profile9                      (9),
        profile10                     (10),
        profile11                     (11),
        profile12                     (12),
        reservedForISO/CENUse         (13..118),
        privateUse                    (119..127)
} (0..127, ...)
Record::=CHOICE{ ..,
        recJ.y    [j] RecordJ.y,   -- this line shall be given for each imported RecordJ.y,
                                   -- where J.y is replaced by the related suffix and j is
                                   -- the registered tag
}
ReturnStatus::=INTEGER {
        noError                       (0),
        accessDenied                  (1),
        argumentError                 (2),
        complexityLimitation          (3),
        processingFailure             (4),
        processing                    (5),
        chainingError                 (6),
        reservedForFutureCENUse       (7..99),
        privateUse                    (100..127)
}(0..127,...)
Set-Request::=SEQUENCE{
        fill                  BIT STRING (SIZE(1)),
        mode                  BOOLEAN,
        eid                   Dsrc-EID,
        accessCredentials     OCTET STRING (SIZE(0..127,...))   OPTIONAL,
        attrList              AttributeList,
        iid                   Dsrc-EID          OPTIONAL
}
Set-Response::=SEQUENCE{
        fill    BIT STRING (SIZE(2)),
        eid             Dsrc-EID,
        iid     Dsrc-EID        OPTIONAL,
        ret     ReturnStatus    OPTIONAL
}
Time::=INTEGER(0..2^32-1)
        -- "UNIX time": number of seconds since 1st January 1970, 00:00 (UTC)
```

```
T-APDUs::= CHOICE{
        action.request              [0]     Action-Request,
        action.response             [1]     Action-Response,
        event-report.request        [2]     Event-Report-Request,
        event-report.response       [3]     Event-Report-Response,
        set.request                 [4]     Set-Request,
        set.response                [5]     Set-Response,
        get.request                 [6]     Get-Request,
        get.response                [7]     Get-Response,
        initialisation.request      [8]     Initialisation-Request,
        initialisation.response     [9]     Initialisation-Response
}
VST::=SEQUENCE{
        fill                        BIT STRING (SIZE(4)),
        profile                     Profile,
        applications                ApplicationList,
        obeConfiguration            ObeConfiguration
}
END

DSRCtransferData    DEFINITIONS::= BEGIN
        IMPORTS         T-APDUs         FROM   DSRCData
        -- EXPORTS everything;
        Message::=      T-APDUs         -- Message is transferred over the DSRC link;
END
```

Annex I. DSRC Application Entity ID

1 AID

AID defined in the layer 2 and DSRC Application Layer is used as DSRCApplication identifier. In this standard DSRCApplication identifier shall be set to 0, 14, 17 or 18. AID of 0, 1, 14, 15, 17, 18, 29 and 30 are already defined and the other AIDs are reserved as shown in Table 1.

Table 1 Classifications of AID (DSRCApplication Entity ID)

AID	Application	Note
0	System	
1	Application compliant with ISO Technical Report 14906	
2~13	Reserved for ISO-DSRC Application	
14	Multi-purpose Fee Collection System	Application compliant with this standard
15	DSRC Resource Manager	North America
16	Reserved for ISO-DSRC Application	
17	Cruise-Assist System	Application compliant with this standard
18	Multi purpose Information System	Application compliant with this standard
19~28	Reserved for ISO-DSRC Application	
29, 30	DSRC Test System Application	
31	Reserved for ISO-DSRC Application	

Note) It depends on a system operator which of classification the application belongs to and the definition of the classification is outside of the scope of this standard.

1.1 Classification of AID [Informative]

The example of the classification of AID defined by this standard is as follows.

AID=0 : system(Testing etc)

AID=14 : Applications that perform fee collection services mainly. Applied for Electric Toll Collection systems of toll ways.

AID=17 : Applications that mainly service the cruise-assist information on the road and need the real time processing.

AID=18 : Applications that is carried out mainly the information services and secondary fee collection services. Applied for the application except Electric Toll Collection systems (ETC) of toll ways and the cruise-assist information systems.

2 EID

2.1 Definition of EID

Although EID is an identifier to identify the elements that compose the application, EID is defined as relative address. Consequently, EID shall be used with the information of the element definition (ContextMark) which identifies the element. The application shall identify the elements of the other station by means of ContextMark and accesses to the element using the corresponding EID.

The contents of an EID with ContextMark shall be exchanged between a base station and a mobile station by means of the association procedures.

ContextMark shall be stored in parameters of RegisterApplicationRSU(Beacon)-service of the base station and parameter of RegisterApplicationOBU(Vehicle)-service of the mobile station.

The details of contents, size and so on for ContextMark are outside of the scope of this standard.

2.2 EID Establishment

(1) The number of EID shall be set not to be overlapped within each station. The EID of 0 is reserved for ETC application (AID=14) and the EID of 1 is reserved for the emergency call application. EID of 2 is reserved for broadcast application(AID=17) of cruise-assist information systems and EID of 3 is reserved for broadcast application(AID=18) of multi purpose information systems.

(2) If the application has plural elements (i.e. plural EID respond to an AID), ContextMark shall be given to each EID.

(3) If the application consists of a single element (i.e. an EID respond to an AID) and the information of the element is known, ContextMark can be omitted.

(4) If the application of a base station consists of a single element, EID can be omitted.

(5) Even if the application of a mobile station consists of a single element, EID can not be omitted.

(Note1) IID shall be used in the case of a base station consists of a element. The example of it is shown in 4.4.3.5(3).

(Note2) EID of 127 shall b used for testing of the group broadcasting.

2.3 Examples of EIDs use [Informative]

Examples of EIDs use are shown as follows.

(1) Association procedures and data exchange procedures

Examples of EIDs use are shown in Fig. 2.3-1, Fig 2.3-2, and Fig 2.3-3.

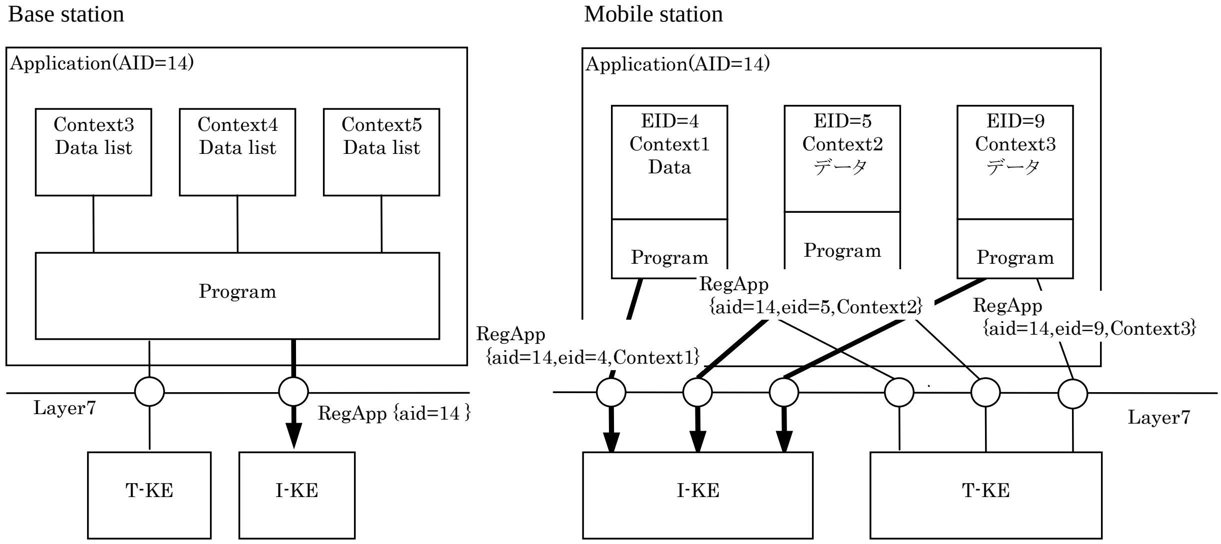


Fig 2.3-1 Example of RegisterApplication-service

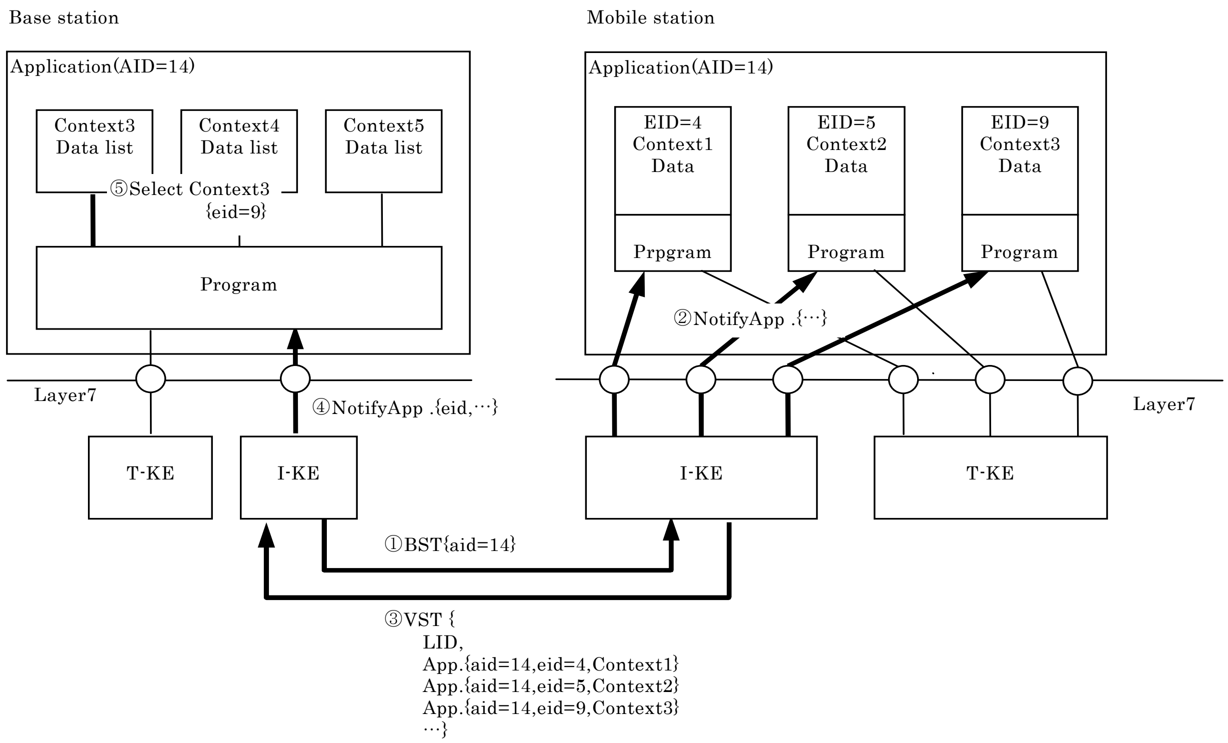


Fig 2.3-2 Example of Association procedures (Exchange of BST, VST)

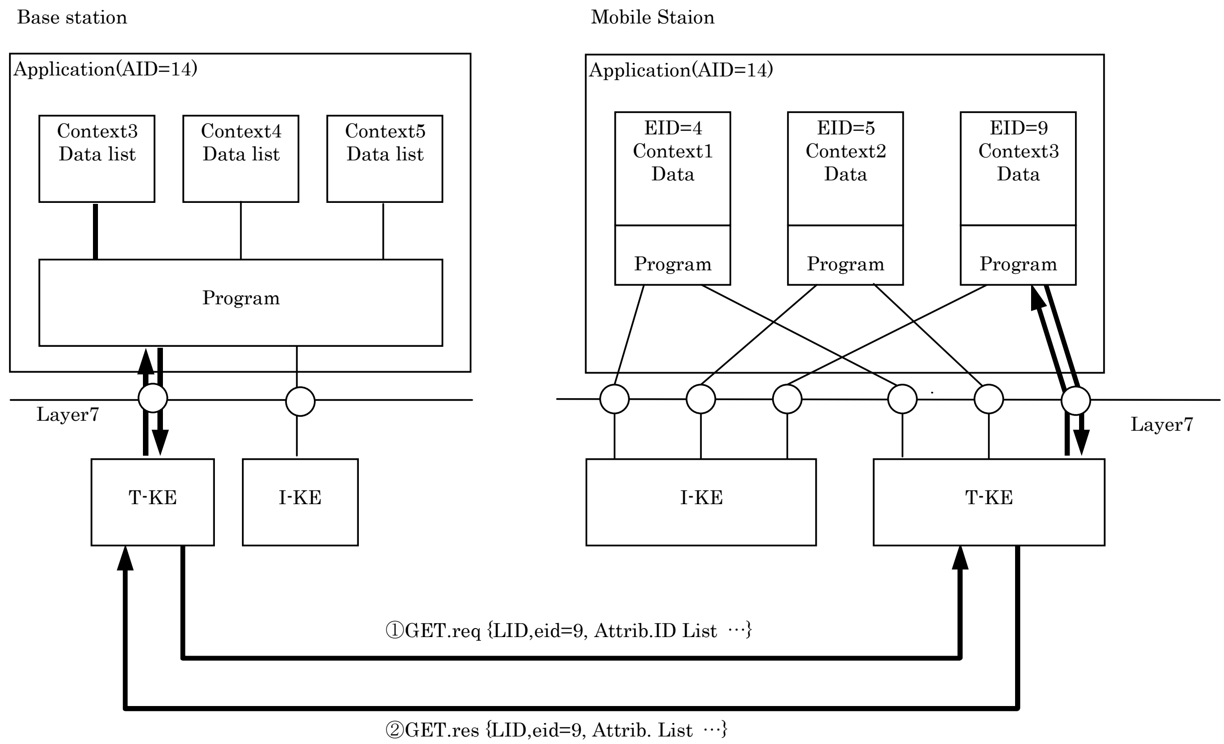


Fig 2.3-3 Example of Data Exchange procedures

(2) Reference of identifier in data exchange procedures

Examples of data exchange using EID (AID) are shown in Fig. 2.3-4 and Fig. 2.3-5.

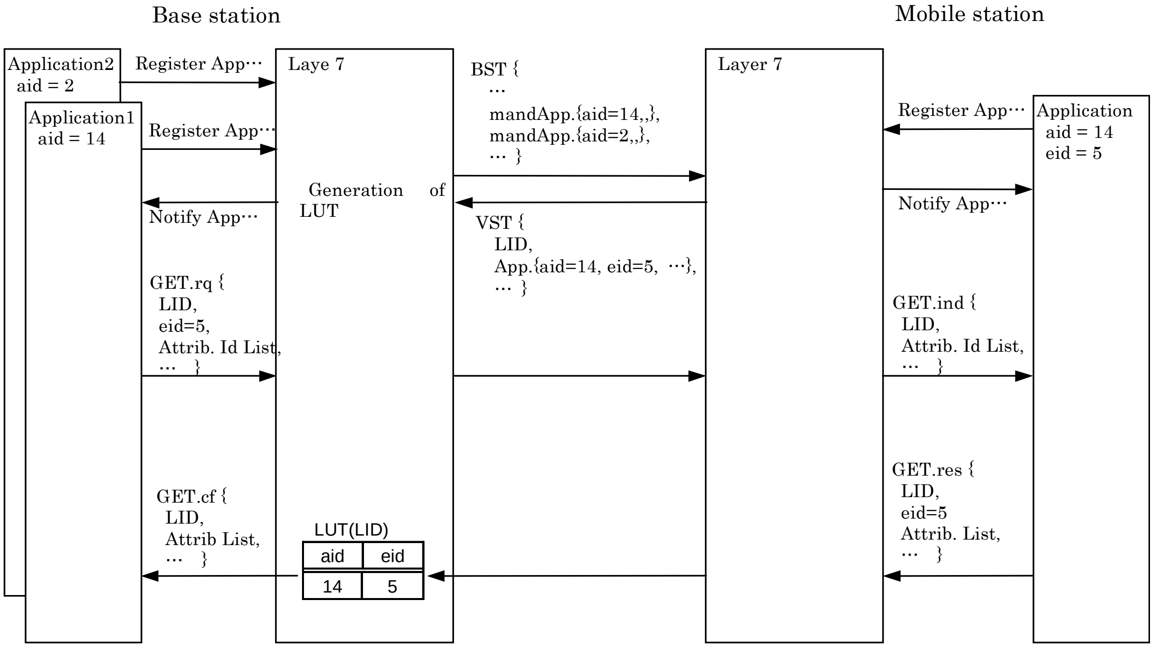


Fig 2.3-4 Example of Single EID

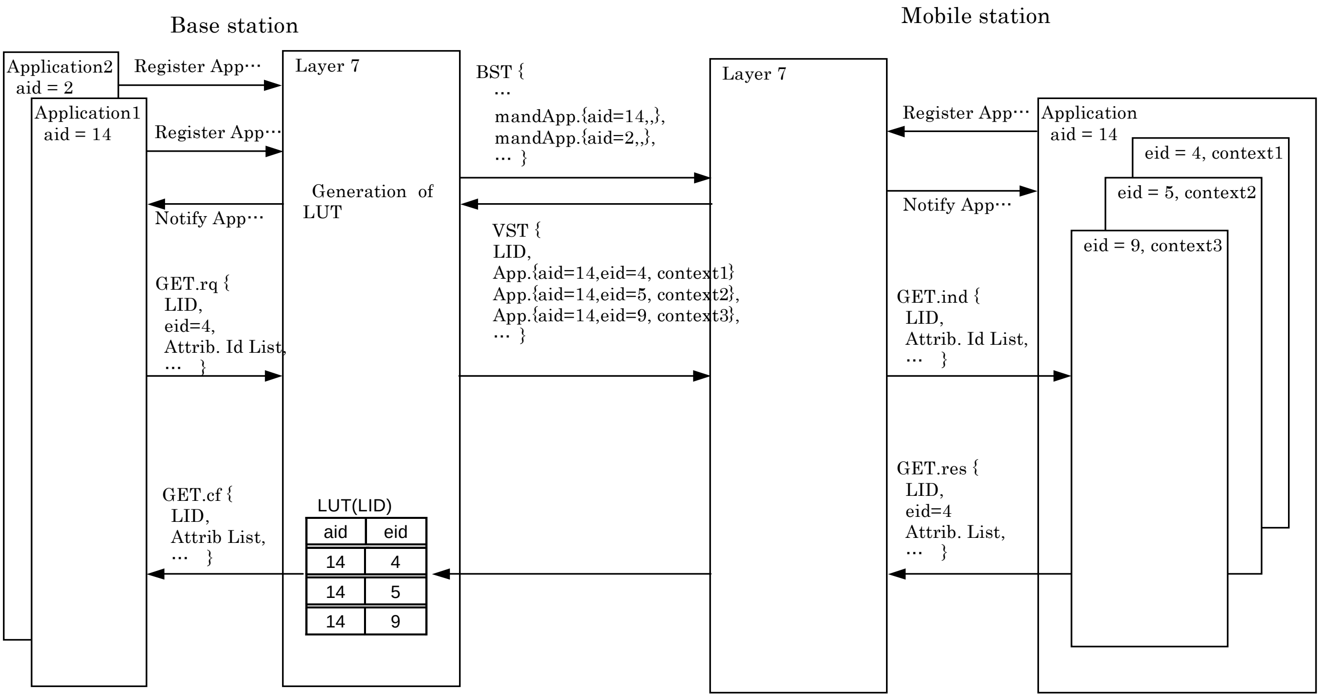


Fig 2.3-5 Example of Plural EID

Annex J. Protocol Version Identifier [Informative]

1. Summary

A Protocol Version Identifier (PVI) shall be used to select the communication protocol applied for Layer 2 from association procedure of Layer 7 to termination of transaction. This selection of protocol shall be done by PVI that is exchanged in the association procedure of Layer 2 and the communication shall be done by selecting the newest version protocol among some versions of protocol which is available on Base station and Mobile stations. The setting the PVI of Base station shall be done by the condition that not only the newest version but the old version protocol are supported on Base station and Mobile station. Therefore, the newest version protocol among the implemented protocols shall be set up on Base station.

The bigger number of PVI shall be recognized as the newest version. The details of each version is shown by Annex P.

In the case of revision of protocol version, the following conditions should be considered.

(1) The BS and MS have benefit of the improvement of communication facilities by adopting the newest version of protocol.

(2) The BS or MS is able to communicate using the previous version of protocol.

(3) The distinction of protocol version between the BS and the MS is made in the association procedures (link entry procedures) prior to the communication.

2. Procedures in Mobile Station

Basic underlying assumption of the association procedure using the PVI code is as follows:

The followings shall be referred as the pertinent details.

4.2.4.2.1.3 Transmission Channel Control Field (SIG) (1) Protocol Version Identifier (PVI)
4.2.4.2.3.1 Activation Channel (ACTC)
4.2.4.2.3.1.5 Link Request Information field (LRI)

(1) An MS interprets the PVI code within FCMC from BS.

(2) In the case where the PVI code of FCMC is the same PVI code in the MS, the MS transmits an ACTC, which set the same code to FCMC's code in a PVI response field and starts the association procedure.

(3) If the all PVI codes in the MS are older than the PVI code within FCMC, the MS transmits an ACTC in which a PVI response field sets the newest version code and then starts the association procedures.

(4) If the all PVI codes in the MS are newer than the PVI code within FCMC, the MS does not start the association procedures.

Annex K. Emergency reporting from the mobile station [Informative]

The request of the assignment with priority from an MS (Mobile Station) is assumed to apply to the emergency reporting that let a BS (Base Station) know an emergency at the MS.
The procedures of the emergency reporting are explained as follows. An example of a connection sequence is shown in Fig. 1.

(1) Procedures in MS

(a) In the case where the emergency reporting is needed (this judgment is outside of the scope of this standard), an MS shall notify the I-KE of the layer 7 by means of RegisterApplicationOBU(Vehicle).

(b) The I-KE shall interpret AID as the emergency reporting and shall indicate the association request of the assignment with priority (the assign demand bit of LRI is "1") to the layer 2 by way of the layer management.

(c) At the same time the I-KE shall notify the emergency reporting application to NotifyApplicationVehicle () and shall start the emergency reporting application.

(d) The emergency reporting application shall transmit the data of EID=1 immediately after starting.

(e) The transmitted data shall be held until the uplink slot is assigned in the layer 2 by way of the T-KE.

(f) When the uplink slot assignment is detected, the layer 2 shall transmit the data to be held and shall do the emergency reporting.

(2) Procedures in BS

(a) When the layer 2 accepts the association request of the assignment with priority (the assign demand bit of LRI is "1"), Data Link Layer shall assign an uplink slot with priority and shall notify the I-KE of the layer 7 by way of the layer management.

(b) The I-KE shall interpret the assign demand bit of LRI and shall start the emergency reporting application by means of NotifyApplicationRSU(Beacon). EID shall generate the value arranged beforehand (EID=1) at the I-KE of the layer 7.

(c) The emergency reporting application shall be kept waiting for a reception of the datum after starting.

(3) Attention

Even in the case where the association has been already completed and another application is under communication, the data of the emergency reporting must be transferred with priority. The layer 7 transmits the data based on the rank of the priority but there is a possibility of being late to transfer when there are the data that stagnate to be re-transmitted in the layer 2.

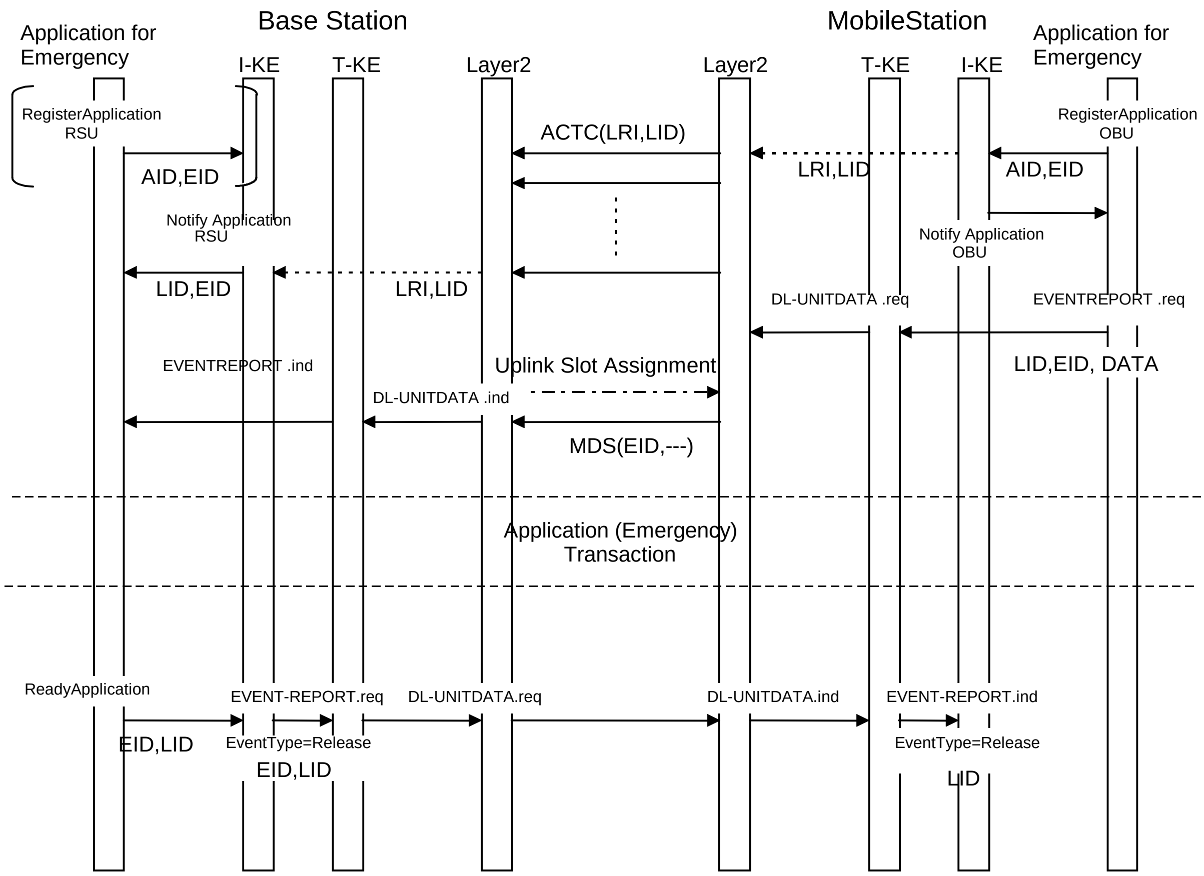


Fig. 1 Example of Connection Sequence of the Emergency Reporting

Annex L.   Unique Word

A unique word is used for TDMA frame synchronization. The unique words are defined in sub-clause 4.2.4 in this protocol version (Ver. 0;PVI=0). The definition is shown again in Table 1.

Even if a standard version changes, the length of field must be the same, but use of another types of unique words are not restricted.

Table 1 Unique Word defined by the protocol version 0

Applied method	Symbol	Usage	Bit assignment
ASK	UW1	FCMC	LSB MSB 0001 1011 1010 1000 0100 1011 0011 1110 32bits in length and shall be transmitted least significant bit (LSB) first in a bit string
	UW2	MDC,ACTC & ACKC	LSB MSB 0100 1011 0011 1110 16bits in length and shall be transmitted least significant bit (LSB) first in a bit string
π/4 shift QPSK	UW1	FCMC	LSB MSB 0110 1011 1000 1001 1001 1010 1111 0000 32bits in length and shall be transmitted least significant bit (LSB) first in a bit string
	UW2A	ACTC & ACKC	LSB MSB 1110 0001 0100 1001 16bits in length and shall be transmitted least significant bit (LSB) first in a bit string
	UW2B	MDC	LSB MSB 0011 1101 0100 1100 16bits in length and shall be transmitted least significant bit (LSB) first in a bit string

NOTE) The unique word of WCNC is shown in Annex C.

Annex M.   Fixed Equipment ID (FID)   [Informative]

The fixed equipment ID (FID) is an ID number of a base station used in association between a base station and a mobile station. This FID is not supposed to be given the same number in the next communication zone.

To number base stations is outside of the scope of this standard, but the numbering regulation is to be considered by the system operator.

The FID [11111111] shall not be permitted for the time being.

Annex N. Private Link Address

(1) When generated

In principle, a mobile station shall generate a new random number as a private link address when the operation starts and shall hold the value until the operation is finished.

Note 1) the start of an operation is defined as a time when the mobile station comes into operation by means of a user's turning on its power. Basically, the end of an operation is defined as a time when the mobile station stops by means of a user's turning off the power. As well, it is assumed that a link address is generated when the mobile station is turn on. But, it is permitted that a link address is generated when each communication is started under the guarantee of random link address. However, the same link address using for the first base station shall be used for the second base station in the continuous communication zone. And the previous link address shall be used when the second association procedure is carried out to the same base station after the termination of communication (independently of Good or No good).

It is not necessary that the private link address of a mobile station equal to the private link address using the previous base stations in the case that a mobile station is carried out the association procedure (link connection) with new base station except the tow base stations, which set up the continuous communication zone defined as DSRC protocol stuck. As well, after the complete link connection, the same private link address shall be used until the termination of communication with same base station (independently of Good or No good) if changing the frequency and transmission speed is occurred.

(2) Generation Algorithm

Link addresses are not supposed to be overlapped between mobile stations within the same communication zone at the same time. Therefore the generation algorithm which has the low probability of generating the duplicate link addresses between mobile stations shall be adopted in consideration of not only the randomness of a link address within a mobile station but also the randomness between mobile stations.

NOTE) The generation algorithm of link address is not defined especially. But the random characteristic of link address shall be fully considered.

(3) Handling procedure of Base Station with Duplicate LIDs

A base station shall consider the duplicate of LIDs in some probability. The examination of the duplication of LIDs and the procedure are defined as follows and are applied to layer 7.

(a) A base station shall examine the duplication of LIDs after receiving the association request from mobile stations.

(b) In the case where the duplicate LIDs are detected, a base station shall immediately transmit the release using the LID and shall release the connection with a mobile station that has the duplicate LID.

Annex O. Multicast Link Address [Informative]

A multicast link address that is a SAP of a link is defined and supposed to do a communication service to both this system operator and the specific user (a mobile station).

For the numbering of a multicast link address, the items of operation including the registration, administration and so on is outside of the scope of this standard and is defined separately.

For the numbering scheme, it is desirable to define plural number groups separately for system, private and application. The multicast link addresses of 120-126 are defined for testing of private use for a time. The other number is defined separately including the items of operation mentioned above.

NOTE) The link address of 120 shall be used for the transmission of Wireless Call Number Channel (WCNC) of test equipment.

Annex P. Communication Profiles

1. Communication Profile of this standard

A communication profile is the information to identify the communication facility of a base station and a mobile station. The definition of communication profile used for this standard is shown in Table 1.

2. Applied method of communication profile

2.1 compatibility relation between communication profiles

The communication profiles have relations of inclusion by addition and omission of function as shown in Fig.1. The communication profile A of Fig.1 is upwardly compatible with the communication profile B because the A includes all functions of B. Conversely, the included communication profile B is downwardly compatible with A. (A can operate as B without some function. But B can not operate as A.) Also, it is possible to define the communication profile of C in Fig.1 without the compatibility with A and B.

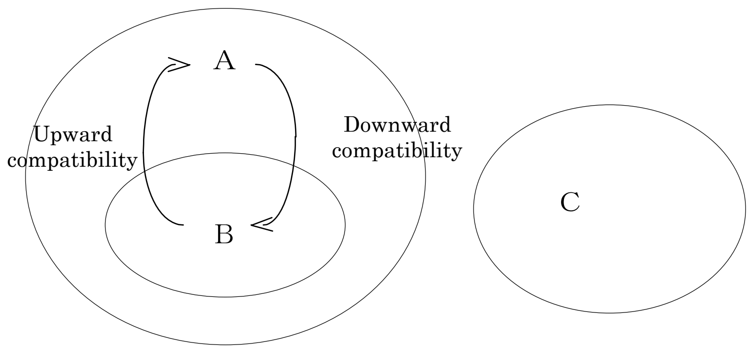


Fig.1 Compatibility of functions for communication profile

2.2 Exchange procedure of the number of communication profile

A communication profile is the information to identify the communication facility of a base station and a mobile station above mentioned. The exchange procedure of the number of communication profile is required in the association procedure between a base station and a mobile station.

Concretely, the procedure shall carry out that a mobile station selects and replies the available one among the number of communication profile that is transmitted from a base station. The following is the summary of the exchange procedure of communication profile by BST and VST.

The communication profile is used for the application registration by ResisterApplicationRSU(Beacon)/OBU(Vehicle) of Layer 7 and the association procedure. The treatment of communication profile is as follows for each case.

Table 1-a Number of communication profile and functions of each layer (Note1)

<table>
<tr><th colspan="4">Communication Profile</th><th>9 (Note2)</th><th>10</th><th>11</th><th>12</th></tr>
<tr><td rowspan="24">Layer7</td><td rowspan="13">T-KE</td><td colspan="2">ASN.1 Coding</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td colspan="2">ASN.1 Decoding</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td colspan="2">Octet allayment</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td colspan="2">Delete the insert bits</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td colspan="2">Concatenation/Chaining</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td colspan="2">Fragmentation</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td colspan="2">Multiplexing</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td>Fragmented header</td><td>Fixed one octet</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td rowspan="5">Primitive</td><td>GET</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td>SET</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td>ACTION</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td>EVENT-REPORT</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td>INITIALISATION</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td rowspan="9">I-KE</td><td colspan="2">Nominal Association procedure</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td colspan="2">Simple Association procedure</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td rowspan="7">Primitive</td><td>RegisterApplicationRSU(Beacon)</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td>RegisterApplicationOBU(Vehicle)</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td>DeregisterApplication</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td>NotifyApplicationRSU(Beacon)</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td>NotifyApplicationOBU(Vehicle)</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td>EndApplication
(ReadyApplication)</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td>BroadcastData</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td rowspan="2">B-KE</td><td rowspan="2">Primitive</td><td>GetBroadcastData</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td>Layer2</td><td colspan="2">Protocol Version Identifier Number
(refer to Table 1-c)</td><td></td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Layer1</td><td colspan="2">Physical Profile Identifier Number
(refer to Table 1-b)</td><td></td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
</table>

(NOTE1) Symbols in Table are follows.

M: Mandatory   --: Not implement function

(NOTE2) The communication profile number 9 is compatible with the communication profile number 9(Layer 7 profile 4) of "ELECTRONIC TOLL COLLECTION SYSTEM (ARIB STD-T55)". The same communication profile number is used commonly.

The communication profiles of 10,11,12 are defined in this standard.

Table 1-b Physical Profile Identifier (PPI)

Profile Number		0	1	2	3	4-7
Modulation	FCMC/ACTC	ASK	ASK	ASK	QPSK	Reserved
	MDC /ACKC	ASK	ASK	QPSK	QPSK	Reserved
Transmission speed	FCMC/ACTC	1024kbps	1024kbps	1024kbps	4096kbps	Reserved
	MDC /ACKC	1024kbps	1024kbps	4096kbps	4096kbps	Reserved
Occupied bandwidth		4.4MHz/10MHz	4.4MHz	4.4MHz	4.4MHz	Reserved
Channel allocation		2	7	7	7	Reserved

Table 1-c Protocol Version (NOTE3)

Protocol Version Identifier Number			0	1	2	3
LLC Sublayer	Type 1 Procedures	DL-UNITDATA.request without response request	M	M	Reserved	Reserved
		DL-UNITDATA.request with response request	M	M	Reserved	Reserved
		DL-UNITDATA.indication	M	M	Reserved	Reserved
		DL-UNITDATA.request wait response request	M	M	Reserved	Reserved
	Type 3 Procedures	DL-DATA-ACK.request	--	--	Reserved	Reserved
		DL-DATA-ACK.indication	--	--	Reserved	Reserved
		DL-REPLY.request	--	--	Reserved	Reserved
		DL-REPLY-STATUS.indication	--	--	Reserved	Reserved
		DL-REPLY-UPDATE.request	--	--	Reserved	Reserved
		DL-REPLY-UPDATES-STATUS.indication	--	--	Reserved	Reserved
MAC sublayer	Break of retransmission procedure by receiving the down link data (refer to 4.3.3.5.2.2.2.1 (4) retransimission)		M	--	Reserved	Reserved

(NOTE3) Symbols in Table are follows.
M: Applied --: Not Applied

(1) Registration of Application

(a) Application sets the available communication profile number to the parameter profile of RegisterApplicationRSU(Beacon)/OBU(vehicle) and sends to Layer 7.

(b) Layer 7 compares the parameter profile with own communication profile and registers the communication profile number to be able to use by itself to the profiles of application list in Layer 7.

(c) Layer 7 does not register the application without available communication profile to the application list.

(2) Association Procedure (Base station)

(a) BST has two parameters of profile and profilelist to register the profile. Layer 7 of a base station registers the following contents and sends to a mobile station.
profile : the typical communication profile to be used by itself
profilelist : the other alternative communication profiles
The alternative communication profile is compatible one.

(b) Layer 7 of a base station uses the profile received from VST for the communication profile to communicate at this moment. Layer 7 compares this communication profile with profiles of application list and does not send NotifyApplicationRSU(Beacon) to the application without same profile.

(3) Association Procedure (Mobile station)

(a) Layer 7 shall set the profile above the profilelist when the received BST is compared with the own communication profile.

(b) Layer 7 shall compare the list of communication profile to be able to use by itself with the profile and profilelist of BST and shall select the profile as follows.
☼ Compare the profile in sequence with the top compatible communication profile and elect the same communication profile.
☼ Compare the profilelist if there is no same profile and select the top compatible communication profile(the most function) among the same profiles.

(c) Compare the communication profile decided by (b) with the profilelist of application list and does not send the NotifyApplicationOBU(vehicle) to the application without the same profile. Also, Do not add its application to VST.

(d) Register the communication profile decided by (b) to profile of VST and send to a base station.

(e) IF there is no communication profile in the case of (b) or no application in the case of (c), do not send VST and terminate the communication.

2.3 Number of top communication profile

In the exchange procedure of communication profile mentioned above, the number of profile that is presented from a base station to a mobile station by BST includes the number of profile that can use typically by itself and has compatibility.

In the above mentioned, the top (the most function) number of profile presented from a base station to a mobile station is the top number of one to be able to use by itself. This does not mean that the top number of profile is same to the number of profile corresponding to the top function of a base station. As shown in 2.2 (1) Registration of Application, it is carried out the procedure that Layer 7 compares the parameter profile with own communication profile and registers the communication profile number to be able to use by itself to the profiles of application list in Layer 7 after Application sets the available communication profile number to the parameter profile of RegisterApplicationRSU(Beacon) and sends to Layer 7. That is to say, the top communication profile to be able to use by itself of a base station means as the top communication profile supported by a base station among the communication profile required by application. For example of Fig.1, the communication profile A is not included although a base station can support A in the case that communication profile B is included and A is not included.

It is same for a mobile station. It is impossible to select the available communication profile over the profiles registered from applications regardless of the function of a mobile station.

2.4 Compatibility of communication profile

The previous Fig.1 shows that the relation of inclusion between the function of a base station and mobile station corresponds to the communication profile. That is not described the compatibility of communication profile indicated the number of communication profile.

The same communication profile shall be used for communication between a base station and mobile station. For example of Fig.1, the communication profile A of a mobile station is required if the communication profile of a base station is A. In the same way, the communication profile B of a mobile station is required if the communication profile of a base station is B.   This is required to avoid the problem by discordance. Because there is a possibility that the function not implemented at one side is used at the another side if the communication profile of a base station is upward A and the one of a mobile station is downward B or the one of a base station is downward B and the one of a mobile station is upward A.   For the correct communication, the procedure that upward side narrows down the function and changes to the other communication profiles is considered regardless of the number of communication profile exchanged mutually between a base station and mobile station. But that procedure is not considered in this standard.

2.5 Registration of the communication profile by application

In case that one application registers the communication profile by RegistrationApplicationRSU(Beacon)/OBU(Vehicle) primitive, generally the registration of the same communication profile is expected at a base station and mobile station. But in case that the plural communication profiles are noticed from application, there is a possibility that the deferent one is registered according to the composition of a base station and mobile station. For example of Fig.1, it is considered that application has communication profile A and B in profile, while a base station can use the communication profile A, B and a mobile station can use only B.   In this case, it is possible that a mobile station can select B by to notice not only A but also B at a base station as shown in 2.2 Exchange procedure of the number of communication profile. Also, the reverse case is same. It is expected that the application can avoid the problem by the registration of plural profiles in consideration of the communication profile of a base station and mobile station. However, in this case, it is necessary to consider the possibility of mismatch as the case of following multi application by changing the version of application, a base station and a mobile station.

The selection of communication profile by application is outside of scope in this standard. It is considered that the suitable registration of communication profile is done by application in a base station and a mobile station.

2.6 Protocol on multi-application

It is considered that the plural application (or the same application with deferent version) is registered and the deferent communication profile is required for each application. Such example is shown in Fig.2. In the Fig.2, a base station is implemented two applications (or same application with deferent version). The Application 1 supports the communication profile A and the application 2 supports A and B. Also, the mobile station 1 is the same configuration as the base station and the mobile station 2 is implemented only application 1. In case that the base station in Fig.2 can not service simultaneously two communication profile A and B for the mobile station 1 and 2, it is suitable that the communication profile A is used commonly without the use of B of application 2. That is to say, it is necessary that application 2, which is considered to get the same service of application 1, have suitable conformance previously at the registration of communication profile.

It is considered that there is no problem as mismatch of communication profile according to the deferent version of application or plural applications implemented or configuration of station. The problem like this mismatch is out side of scope of this standard.

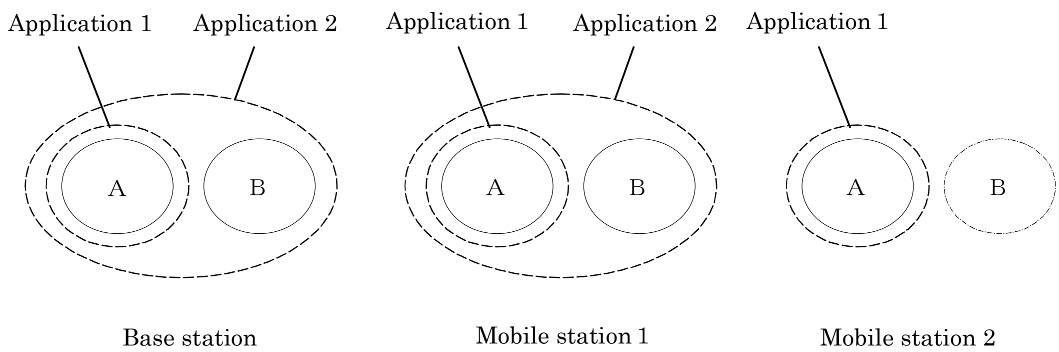


Fig.2 Example of plural communication profile

3. Supplementary explanation about communication profile in this standard

3.1 Supplementary explanation of communication profile

The contents of Table 1 that shows the correspondence between the number of communication profile and the function of each layer is explained as follows with a focus on the relation to Clause 2. As well, the relation of compatibility of each profile is shown in Fig.3.

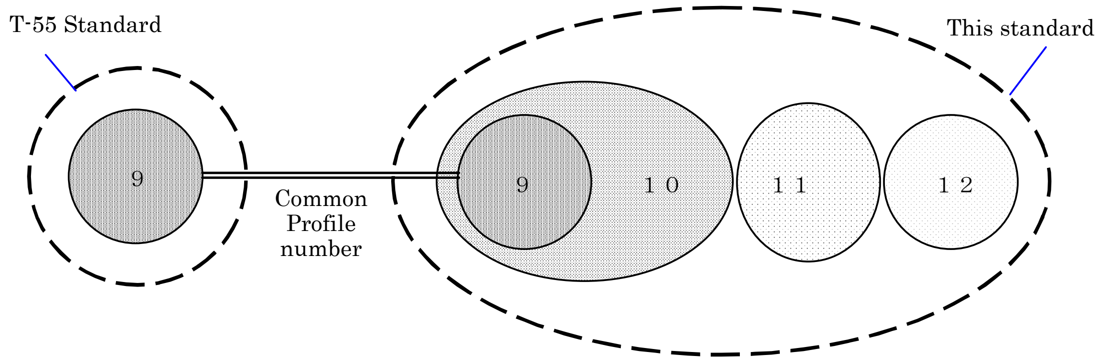


Fig.3 Relation of compatibility of the function of communication profile

(1) In the Table 1, the communication profile 9 is equal to the communication profile 9(Layer 7 profile 4) of "ELECTRONIC TOLL COLLECTION SYSTEM (ARIB STD-T55)".
That is to say, STD-T75 and STD-T55 is commonly referred to communication profile 9 n the case of definition as communication profile 9. STD-T75 and STD-T55 have some deference. But the communication profile 9 is defined as the compatible one with T55 on the basis of connectivity. This profile number is used commonly in this standard.

(2) The communication profile 10 is for 1024kbps(ASK modulation). This is considered tentatively for the future revision in ARIB STD-T55 and is revised in this standard. Accordingly, it is enough that the communication profile 10 is referred to only this standard STD-T75. The mixed implementation of the communication profile 10 of STD-T55 and T75 is not considered. As well, the communication profile 10 is upward compatible with communication profile 9 in the function and is not guaranteed the compatibility.

(3) The existing base station, mobile station and its application are used the communication profile 9. So, there is the possibility that the existing station can not recognized as the compatible communication profile. And the action of its case is not guaranteed. The base station and mobile station shall use the communication profile 9 although they support the function as the communication profile 10 in this standard on condition that the base and mobile stations using the communication profile 9 are mixed. (refer to Clause 2 about the registration of application and so on) In this case, the base station according to this standard shall notice the communication profile 9 to mobile stations like the base station

according to T55. The mobile station according to this standard and T55 shall reply the communication profile 9 in the same way. By this, it is possible that the plural mobile station are communicated by common and already known communication profile.

(4) The communication profiles 11-12 are defined by this standard. The communication profile 12 is for the FCMC and MDC of 4096kbps (π/4 shift QPSK modulation). And 11 is for the FCMC of 1024kbps(ASK modulation) and the MDC of 4096kbps(π/4 shift QPSK modulation).

The communication profile 9-11 have the FCMC frame including FCMC of 1024kbps(ASK modulation). The mobile station according to this standard can recognize the communication profile of a base station. But the mobile station with the communication profile of 11 can not communicate to the base station with the communication profile 9 and 10.

(NOTE) The relation of inclusion in function can be shown in Fig.3.

3.2 Example of how to use communication profile

The example of how to the use communication profile is shown in Table 2. It is necessary to consider the conformance of functions between a base station and plural mobile station in the communication zone when communication profile is used. Table 2 is shown for reference example to indicate the availability of narrowing down the communication profile in consideration of the above mentioned. So, Table 2 does not restrict the other combinations with the responsibility of a performer.

Table 2 Combination of communication profiles

Combination No.	Base station				Mobile station	
	Association Procedure			Profile to be proposed	Profile which can recognize	Profile which can reply
	FCMC/ ACTC	MDC	Profile			
1	ASK (T55 compatible)	ASK (T55 compatible)	9	9	9、10、11	9
2	ASK	ASK	10	10、9	(9)、10、11 (Note5)	10、9
3	ASK	QPSK	11	11	(9)、10、11 (Note5)	11
4	QPSK	QPSK	12	12	12	12

(Note5) The communication profile 9 is compatible with ARIB STD-T55. So, there is the case that the mobile station with the communication profile 9 does not recognize the base station in the association procedure with the communication profile 10. Accordingly, the number of

communication profile must be the combination No.1 of 9 in case that a base station must communicate to the mobile station with ARIB STD-T55 (ELECTRONIC TOLL COLLECTION SYSTEM).

(1) Combination 1

In this case, the number of communication profile that a base station can propose is only 9 in the communication zone of the base station with communication profile of 9. And a mobile station replies the same communication profile of 9. This gives the communication compatible to T55. It is possible that also the mobile station with communication profile of 10 can recognize the one of the base station by the association procedure to it.

(2) Combination 2

In this case, the number of communication profile that a base station can propose is 10 and 9 in the communication zone of the base station with communication profile of 10. And the mobile station that can reply is the one with communication profile of 10 and 9(reply 10) and with only 9(reply 9).

(3) Combination 3

In this case, the number of communication profile that a base station can propose is only 11 in the communication zone of the base station with communication profile of 11. And the mobile station replies the same communication profile of 11. This gives the communication of QPSK by this standard. *(NOTE6)*

(NOTE6) It is considered at "ANNEX.R Change of transmission speed" that the upward compatible communication profile is added to the one of 9,10 and 11.

The number of communication profile that a base station can propose is this upward compatible one in addition to 10, 9 and 11 under the consideration to the upward compatibility of ANNEX. R. And the reply of a mobile station is described in it.

In case that a base station always gives the communication zone with the upward compatible profile and a mobile station replies that one, a base station shall give the communication that is able to change the transmission speed. Also, a base station shall give the communication by ASK for the mobile station that reply the communication profile of 10.

But, it shall be the condition that a base station can service the plural communication profiles.

(4) Combination 4

In this case, the number of communication profile that a base station can propose is only 12 in the communication zone of the base station with communication profile of 12. And the mobile station replies the same communication profile of 12. This gives the communication of QPSK by this standard. The mobile station that can recognize this communication profile of 12 is only the one with profile of 12. The use of this communication profile is considered on condition that the interface of other DSRC systems or the mutual recognition is not needed in according to the configuration of application or implementation.

3.3 Summary of communication procedure by communication profile, PVI and PPI

The definitions related to profiles are as follows. And the phase and procedure are shown in Fig.4.

(1) Physical profile---------This indicates the parameters for the radio communication method (frequency, modulation, and data transmission speed) to the end of communication transaction including the association procedure. And this is registered the field of SIG in FCMC.

(2) Protocol version-------This indicates the protocol of Layer 2 to the end of communication transaction including the association procedure. And this is registered the field of SIG in FCMC.

(3) Communication profile---This is used to the end of communication transaction after the association procedure. This distinguishes the implemented function of Layer 7 and indicates the parameters of radio communication and the implemented contents of L1 and L2.

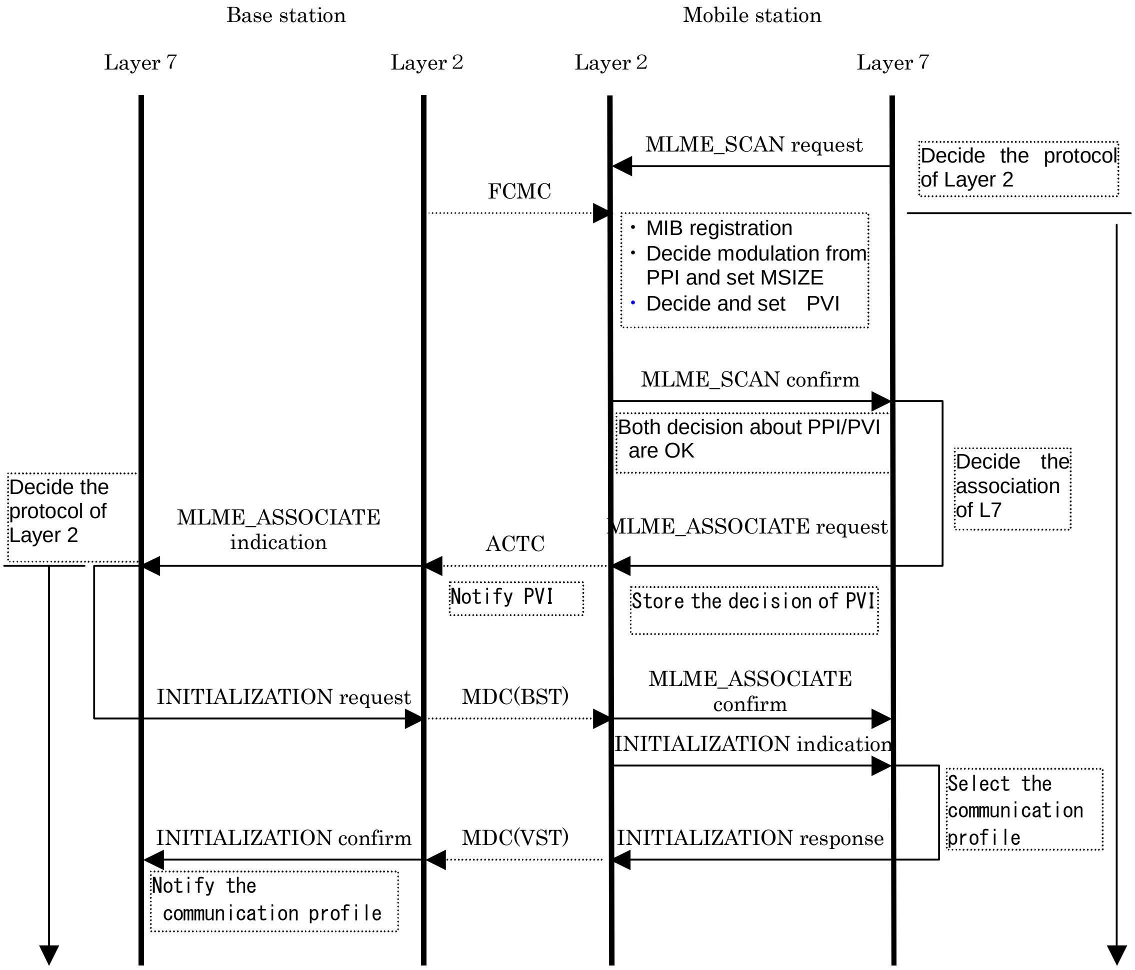


Fig.4 Summary of communication procedure

ANNEX Q. Installation and operation standard for Radio station that communicates with the RF equipment of mobile station for the test

The radio station that communicates with the RF equipment of mobile station for the test (hereafter "test equipment") is defined the standard because it gives interference or disturbance to other communications by installation or operation of it.

a. Strongly inhibit the test equipment from being used for the purpose except the test of mobile station

b. Do not use the test equipment on the condition of turning the boresight direction (direction of radiation) of antenna, which is described on the test equipment, to the direction of mobile station under not testing

c. Do not use the test equipment on the condition of turning the boresight direction (direction of radiation) of antenna, which is described on the test equipment, to the direction of base station

d. Do not use the test equipment on the condition of turning the boresight direction (direction of radiation) of antenna, which is described on the test equipment, to the direction of human, animals and other electrical equipments.

e. Use the test equipment at the position that is over 6meters distance from a road in optical length. If the attenuation equivalent to this distance is given, it is permitted to use one within 6meteres. Or, it is not applied in case that there are no vehicles or mobile stations on a road obviously

f. If there are some mobile stations to be not tested around there, disconnect power from such mobile stations as much as possible

ANNEX R. Change the data transmission speed [Informative]

Two data transmission speeds are defined in this standard. It is possible that a mobile station can change (NOTE1) the data transmission speed by the request of application. The communication profiles considered this are defined in annex P. It is possible to use this function on condition that the compatibility is maintained in the particular group of base station and mobile stations although the detail is not defined.

The following is the informative considerations for the change of data transmission speed in this standard.

(NOTE1) The mobile station shall have both the data transmission functions (1Mbps(ASK) and 4Mbps(QPSK)) and select the data transmission speed for MDC, ACKC and WCNC according to the communication profile informed from a base station.

1. Communication considered

(1) The following four communication frame formats are defined with the relation of communication profile.

(a) The data transmission speed including FCMC and MDC is 1Mbps(ASK). (communication profile of 9 and 10)

(b) The data transmission speed of FCMC is 1Mbps(ASK) and the one of MDC is 4Mbps(QPSK). (communication profile of 11)

(c) The data transmission speed of FCMC and MDC is 4Mbps(QPSK). (communication profile of 12)

(d) The data transmission speed of FCMC is 1Mbps(ASK) and the one of MDC is selectable(1Mbps(ASK) and 4Mbps(QPSK)) . This is upward compatible with the communication profile defined by (a) and (b).

(2) The mutual confirmation is done in association procedure in case that the both data transmission function (1Mbps(ASK) and 4Mbps(QPSK)) is given in a base and mobile stations and the selecting the data transmission speed between a base and mobile station.

(3) Whether a base station allows plural mobile stations with different data transmission speed in the same communication zone or not is depend on the capacity (configuration) of a base station.

2. Basic principle that has to be considered in the change of data transmission speed

(1) Do not allow the change of data transmission speed after the end of association between a base and mobile station. (restrict to the point-to-point communication and not applied to the multicast (all and group) communication.

(2) The data transmission speed of association (FCMC and ACTC) and communication management (FCMC) shall be 1Mbps(ASK). (initial set up)

(3) All such MDCs shall be applied the same data transmission speed in case that plural MDCs assignment are occurred for the same mobile station (same LID) in the same frame.

3. Association procedure

Recommended Practice 1:

The confirmation is carried out by informing the applied communication profile to Profile and profilelist of BST of base station and the possible (requiring) one to profile of VST of mobile station.

It is considered that the selection of such data transmission speed is done at the registration of communication profile in Layer 7 on mobile station. (It is considered that a mobile station has more than one communication profile.)

For applying this recommended practice 1, it is necessary that the following functions are implemented on condition that the compatibility between a base station and a mobile station is secured

(1) The function for the confirmation for the reply from a mobile station which is indicated that the selecting is done or not in association procedure.

This means the method of confirmation by a base station to the requirement of data transmission speed selecting from a mobile station and the default procedure.

For example, this means the rule whether a base station confirms by setting the modulation information to DRI of FCMC or not and whether ASK is selected or not when no response and so on.

(2) The function for deciding the modulation of MDC by managing each LID on a base station

On the protocol stuck of DSRC, there is not the function for management of LID in Layer1 and Layer 2. So, the interface rules to be used the data transmission speed changing function at sending procedure by applications (the procedure to indicate the data transmission speed when PDUs are transferred between Layer 7 and Layer 2) are required.

Also, at receiving procedure, the procedure to notify previously the data transmission speed to Layer 2 and Layer 7 by communication profile is required.

Further, the communication profile is registered in the communication management list on a base station and mobile station. So, it is required that not only the rules for interface primitive between Layer 7 and Layer Management Entity but also the parameters for MIB of Layer 2 and Layer 7 like communication profile and so on are added.

Recommended Practice 2:

The confirmation is carried out by setting and informing the data transmission identifier defined by communication profile to SC field of FCMC on base station and selecting and informing the identifier to ACTC on mobile station.

For applying this recommended practice 1, it is necessary that the following functions are implemented on condition that the compatibility between a base station and a mobile station is secured.

(1) The function for the confirmation for the reply from a mobile station which is indicated that the selecting is done or not in association procedure.

The review of ACTC field definition is required because ACTC is used for the confirmation by a base station to the reply of selecting data transmission speed from a mobile station. For example, the changing the meaning of application identifier in LRI field of ACTC (i.e. if there is the same AID between a base station and a mobile station, the parameters of communication are decided by BST/VST and ACTC to be sent from a mobile station is considered the reply of data transmission speed selecting) is required. This discrimination of protocol is required to be distinguished by Protocol Version Identifier and so on.

(2) Algorithm for selecting the data transmission speed on Layer 1

The algorithm for selecting the data transmission speed is required to a mobile station. Such methods are considered as the decision refer to the received radio level or selecting the higher data transmission speed that a base station proposes and a mobile station can use.

On the protocol stuck of DSRC, there is not the function for management of LID in Layer1 and Layer 2. So, the interface rules to be used the data transmission speed changing function at sending procedure by applications (the procedure to indicate the data transmission speed when PDUs are transferred between Layer 7 and Layer 2) are required.

Further, it is required that not only the rules for interface primitive between Layer 7 and Layer Management Entity but also the parameters for MIB of Layer 2 and Layer 7 like communication profile and so on are added.

DEDICATED SHORT-RANGE
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