CMUX Implementation – LE910Cx, ME910, ME310 series

User Guide

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1 Applicability Table

Table 1: Applicability Table

Products	Platform Version ID	Technology
LE910Cx SERIES	25	4G
ME910C1 SERIES	30	
ML865C1 SERIES		
ME310G1 SERIES	37	
ME910G1 SERIES		
ML865G1 SERIES		

Note: Platform Version ID is a reference used in the document. It identifies the different SW versions, that is 25 for SW version 25.xx.xxx, 30 for SW version 30.xx.xxx, etc...

2 Introduction

2.1 Scope

This document covers the technical characteristics of the CMUX Standard Protocol and the setting up and use of the Telit Serial Port MUX tool running on DTE.

All the features and solutions described in this document are applicable to all variants listed in the applicability table.

2.2 Audience

This document is intended for Telit customers, especially system integrators, interested to develop an application that uses CMUX Standard Protocol.

2.3 Contact Information, Support

For technical support and general questions, e-mail:

- TS-EMEA@telit.com
- TS-AMERICAS@telit.com
- TS-APAC@telit.com
- TS-SRD@telit.com
- TS-ONEEDGE@telit.com

Alternatively, use: https://www.telit.com/contact-us/

Product information and technical documents are accessible 24/7 on our website:
https://www.telit.com

2.4 Conventions

Note: Provide advice and suggestions that may be useful when integrating the module.

Danger: This information MUST be followed, or catastrophic equipment failure or personal injury may occur.

ESD Risk: Notifies the user to take proper grounding precautions before handling the product.

Warning: Alerts the user on important steps about the module integration.

All dates are in ISO 8601 format, that is YYYY-MM-DD.

2.5 Terms and conditions

Refer to https://www.telit.com/hardware-terms-conditions/.

2.6 Disclaimer

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3 Overview

Before dealing with the technical characteristics of the CMUX Standard Protocol [1] provided by the Telit Modules and the setting up and use of the Telit Serial Port MUX tool running on DTE (PC-Windows), it is useful to show how the two software components can be used together and which advantages they give. The Figure 1 shows four virtual connections (VDLCI1, VDLCI2, VDLCI3 and VDLCI4) which are running on a unique physical serial line (COM1/UART1); the Module has entered the Multiplexed Mode. The four different Applications running on DTE are tied, via the virtual connections, to four Access Points to communicate with four different Services provided by the Telit Module.

Follow the example below to enter the Virtual Service Device Configuration (Multiplexed Mode) showed on Figure 1:

- Telit Module and DTE are physical connected via UART1/COM1 serial ports, and both are powered ON;
- Run the Telit Serial Port MUX tool on DTE, refer to chapter 7;
- On DTE start, for example, three Hyper Terminals connected to three virtual ports provided by the Telit tool, e.g. COM3, COM4, COM5;
- Now the Hyper Terminals can send and receive data from the Module on three independent Virtual Channels by means of the Multiplexer Protocol implemented by the Telit Tool.

Note: VSD is a function that manages the logical connections between the physical serial ports and the Access Points. To have more information concerning the several VSD configurations see [2].

Table below summarizes the VSD Configuration of Figure 1.

Table 2: CMUX vs. Access Points

VSD Access Points			
vDLCI1	vDLCI2	vDLCI3	vDLCI4
UART1/VDLCI1	UART1/VDLCI2	UART1/VDLCI3	UART1/VDLCI4

Key:

"UART1/VDLCIx": Virtual Connection (channels) that must be used to reach the Access Point indicated on the top of the column. The user can use one or more Access Points.

TELIT LE910Cx modules provide one AT Commands Parser.

In general, the Access Point is the connection between the communication path and the Service offered by the module.

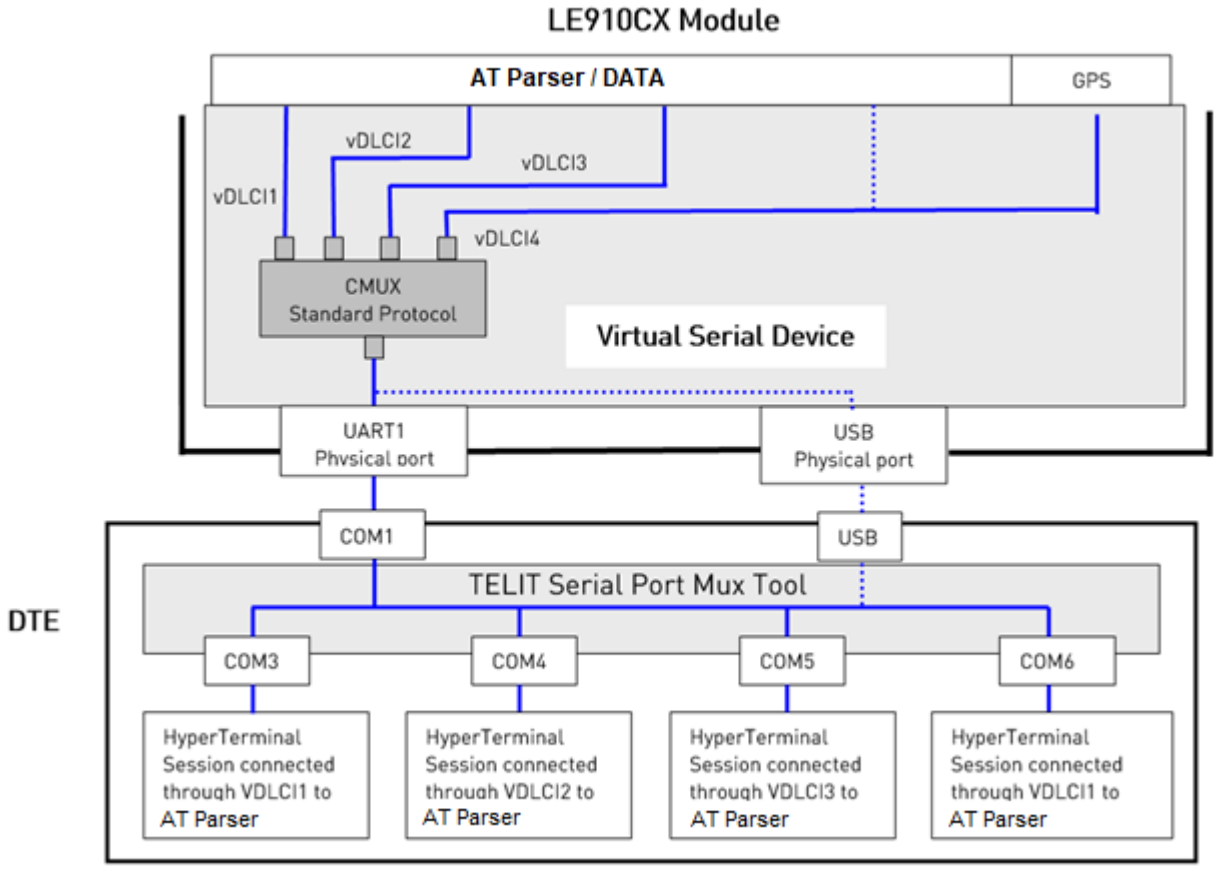


Figure 1: LE910Cx Module family

Same considerations are valid for modules belonging to the ME910 and ME310 Families, of course with the required adjustment, see Figure below.

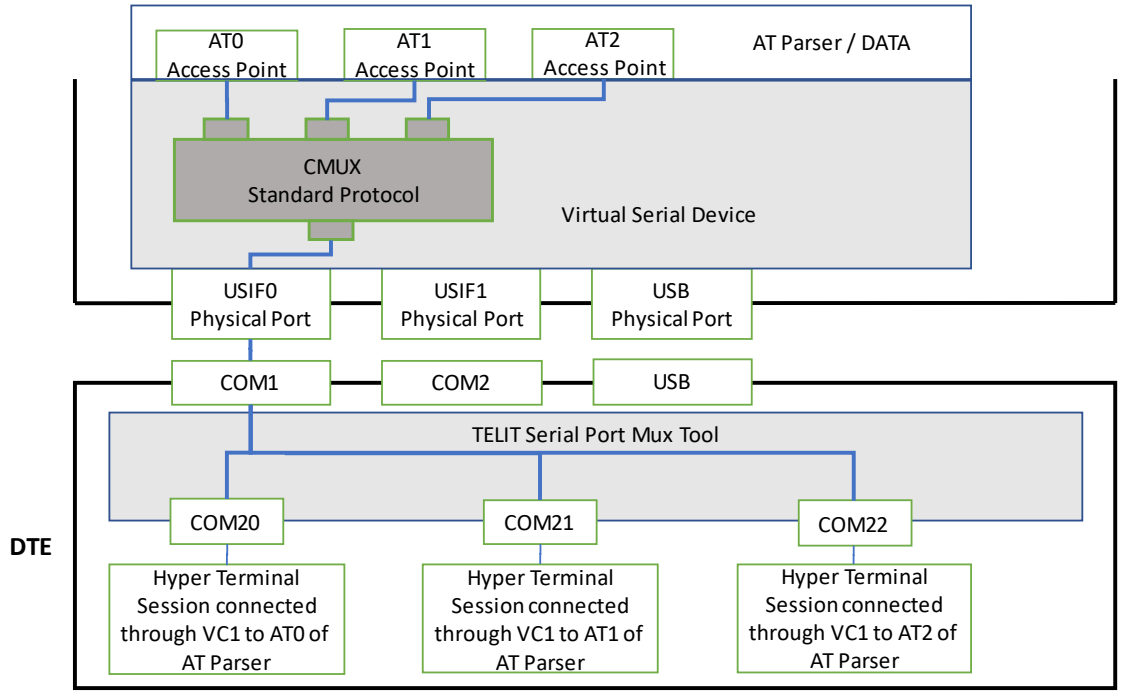


Figure 2: ME910 and ME310 Module families

Thanks to the multiplexing feature, operations such as controlling the module or using the SMS service can be performed via vacant virtual channels without disturbing the existing data flow and no access to a second Serial Port is needed.

> **Note:** The use of the multiplexing feature is strictly connected with the configuration of the VSD; it is suggested to see the several different configurations provided by Telit Modules, refer to [2].

Telit CMUX implementation supports the following features:

- Operating Option: Basic, refer to [1]
- Only UIH frames are supported, refer to [1]
- Four full DLCI (four Virtual Ports)
- Every CMUX Virtual Channel connected to an AT Instance has its own user profile storage in NVM
- Independent setting of Unsolicited Message
- Every CMUX Virtual Channel has its own independent flow control.

4 Serial Multiplexer Protocol

The next chapter introduces the CMUX Protocol and its Frames Structures with an attention to the Telit CMUX implementation. Refer to [1] to have the complete description.

4.1 CMUX Frame Structure

All information transmitted between the module and the application is based on frames that have the following structure, for Maximum Frame Structure Length see chapter 8.1

Flag	Address	Control	Length Indicator	Information Field	FCS	Flag
1 octet	1 octet	1 octet	1 or 2 octets	Unspecified length but integral number of octets	1 octet	1 octet

Figure 3: CMUX Frame Structure

Flag Octet

Each frame begins and ends with a flag octet defined as 11111001 in Binary format (0xF9 in Hexadecimal format).

Address Octet

The form of address octet is the following:

0	1	2	3	4	5	6	7
EA	C/R	DLCI					

EA: Extension Bit

It is set to 1.

C/R: Command/Response

The Initiator is the entity that sends the first SABM command using DLCI 0. In the Telit CMUX implementation, the Initiator is always the Application, consequently it sends a command to the Module with C/R = 1; when the Module (Responder) answers C/R is still 1. If on the same Data Link session, the Module sends a command towards the Application C/R is 0; when the Application answers C/R is still 0. The table below summarizes the concept.

Session Initiator	Direction	Responder	C/R Value	Command/Response
Application	→	Module	1	Command
Application	←	Module	1	Response
Application	←	Module	0	Command
Application	→	Module	0	Response

DLCI: Data Link Connection Identifier

DLCI value identifies the Virtual Port inside the Module with the following assignment:

DLCI	Virtual Port type
0	Reserved to Control Channel
1	Virtual Port #1
2	Virtual Port #2
3	Virtual Port #3
4	Virtual Port #4. Its use depends on the used module, refer to [2]

Note: The Services connected to Virtual Port #4 depend on the used Telit Module and the VSD configuration. To have detailed information refer to [2].

Control Octet

The content of the control octet defines the type of frame as in the following table:

Frame Type	Control Octet							
	0	1	2	3	4	5	6	7
SABM (Set Asynchronous Balanced Mode)	1	1	1	1	P/F	1	0	0
UA (Unnumbered Acknowledgement)	1	1	0	0	P/F	1	1	0
DM (Disconnected Mode)	1	1	1	1	P/F	0	0	0
DISC (Disconnect)	1	1	0	0	P/F	0	1	0
UIH (Unnumbered Information with Header check)	1	1	1	1	P/F	1	1	1

P/F stands for Poll/Final bit:

Refer to [1] to have a detailed description.

SABM (Set Asynchronous Balanced Mode)

The SABM command is used by the application to start the HDLC Connection and module will answer to this command with an UA Frame.

UA (Unnumbered Acknowledgement)

The UA response is sent by the module as an acknowledgement that a SABM or DISC command was accepted.

DM (Disconnected Mode)

In case module rejects SABM or DISC command it will send DM response, this happens if for example a SABM is sent for a DLCI not supported. Or if a DISC is sent to a DLCI Address already closed.

DISC (Disconnect)

The DISC is used to close a previously established connection. If the application sends a disc for the DLCI 0 (the control channel), all the established channels will be closed. The module will answer to this command with an UA Frame.

UIH (Unnumbered Information)

Please refer to the following chapters for the detailed information about UIH

Length Indicator

This Octet specifies the length of the Information Field

0	1	2	3	4	5	6	7
E/A	L1	L2	L3	L4	L5	L6	L7

E/A Bit should be 1 in case 7 bits are enough for the length (length <= 127) otherwise length should be coded with two octets as described below:

Octet 1:

0	1	2	3	4	5	6	7
0	L1	L2	L3	L4	L5	L6	L7

Octet 2:

0	1	2	3	4	5	6	7
L8	L9	L10	L11	L12	L13	L14	L15

To select the right length of the Information Field in accordance with the used Telit Module see chapter 8.1

Information Field

The information field is the payload of the frame and carries the user data. The field exists only for frame type that contains UIH Control Field. The P/F bit should be set to value 0 when this field is sent.

FCS (Frame Checking Sequence)

Refer to [1] to have a detailed description.

UIH Control Channel Frame Coding

Refer to chapter 4.1 and figure below. The Information field can carry UIH Commands or User Data. The Information field exists only for UIH frame type. The P/F bit should be set to value 0 when this field is sent. This chapter focuses on the UIH Commands; in this case DLCI shall always have the value 0. It means that the UIH Command is transferred on the logical Control Channel

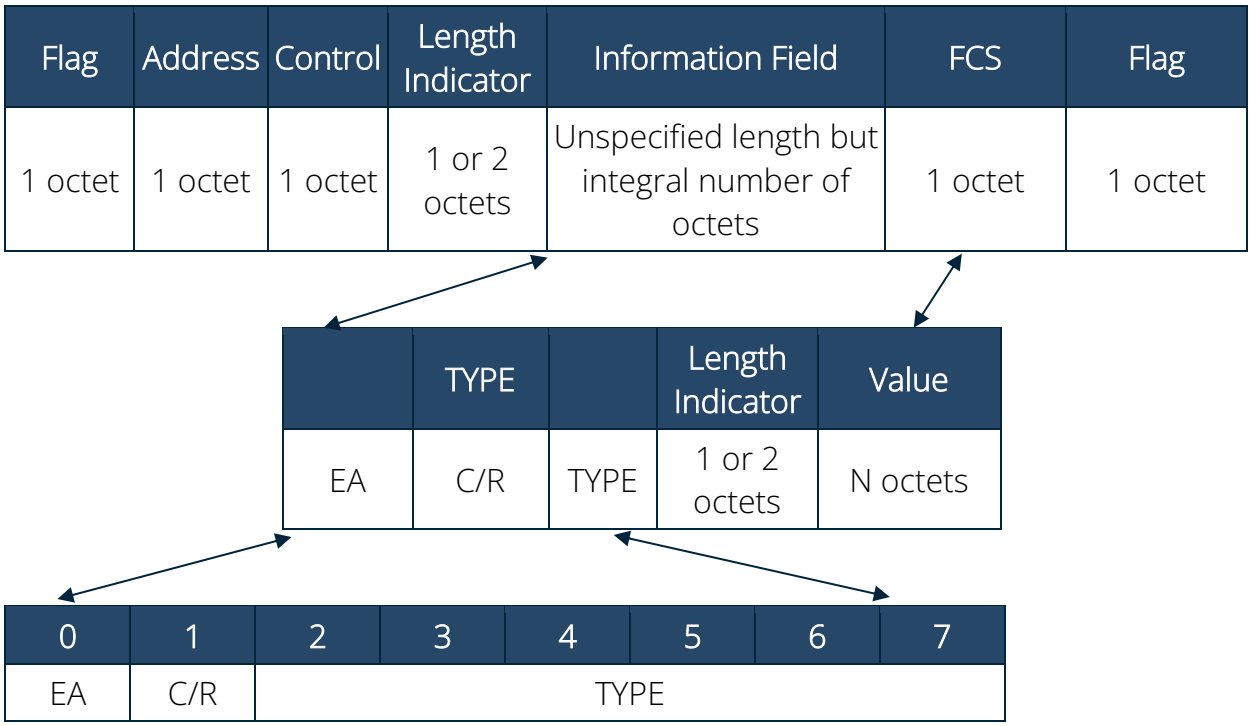


Figure 4: UIH Control Channel Frame

Type Octet:

EA: Extension Bit

It is always set to 1.

C/R: Identifies if it is a Command or Response

TYPE: Hereafter are listed the UIH Command TYPES followed by their Length Indicators (for its coding see chapter 4.1). If Length Indicators is not zero, it is followed the Values octets.

Multiplexer close down (CLD)

The CLD command is used to reset the link, exit Multiplexed Mode and enter AT Command Mode.

LSb							MSb	LSb							MSb
Type								Length Indicator							
E/A	C/R	0	0	0	0	1	1	E/A	0	0	0	0	0	0	0

Test Command (Test)

Test command is used to test the connection between module and the user application. The Length Indicator describes the number of values bytes, which are used as a verification pattern. The opposite entity shall respond with the same value bytes. Least Significant bit is on left side of the octet:

LSb							MSb					
Type								Length Indicator	Value 1	Value 2	Value ..	Value length
E/A	C/R	0	0	0	1	0	0	E/A	length	AnyChar	AnyChar	AnyChar	AnyChar

Modem Status Command (MSC)

MSC command is used to send Virtual V.24 Signals status. Each Virtual Connection has its own independent Virtual V.24 Signals status.

The two entities exchange MSC with the following format:

> **Note:** CMUXMODE not applicable for Platform Version ID 30 and 37 and for Platform Version ID 25 when M2M AT Parser enabled (AT#M2MATP=1).

When an entity sends its Virtual V.24 Signals status, the other one acknowledges the received message using the same message with C/R bit negated (octet Type of the Information Field). There are two scenarios depend on who sends first the message:

DTE (Application) communicates its Virtual V.24 Signals status:

DLCI=0, MSC (command from DTE with its V.24 Signals) DLCI=1

DCE (Telit Module) acknowledges:

DLCI=0, MSC (response from DCE with DTE V.24 Signals) DLCI=1

DCE (Telit Module) communicates its Virtual V.24 Signals status:

DLCI=0, MSC (command from DCE with its V.24 Signals) DLCI=1

DTE (Application) acknowledges:

DLCI=0, MSC (response from DTE with DCE V.24 Signals) DLCI=1

Format without Break Indication:

LSb							MSb												
Type								Length Indicator								DLCI			V.24 Octet	
E/A	C/R	0	0	0	1	1	1	E/A	0	1	0	0	0	0	0	E/A	1	DLCI	E/A	Lines Status

Format with Break Indication:

LSb							MSb													
Type								Length Indicator								DLCI			V.24 Octet		Break octet
E/A	C/R	0	0	0	1	1	1	E/A	0	1	0	0	0	0	0	E/A	1	DLCI	E/A	Lines Status	Break Status

V.24 Octet from Module to Application (see chapter 8.2)

0	1	2	3	4	5	6	7
0	FC	DSR	CTS	0	0	RING	DC

Figure 5: V.24 Octet DCE → DTE

V.24 Octet from Application to Module (see chapter 8.2)

0	1	2	3	4	5	6	7
1	FC	DTR	RTS	0	0	0	0

Figure 6: V.24 Octet DTE → DCE

FC: bit set to 1 when module or application is not able to accept any frames.

CTS: bit set to 1 when module is able to receive data (ref. cmd &K,\Q and related)

RTS: bit set to 1 when application can receive data. (ref. cmd &K,\Q and related)

DSR: bit set to 1 when module is ready to communicate (ref. cmd &S, and related)

DTR: bit set to 1 when application is ready to receive data. (ref. cmd &D, and related)

RING: bit set to 1 when module receive an incoming call (ref. cmd \R, and related)

DCD: bit set to 1 when module has an active data connection. (ref. cmd &C, and related)

> **Note:** When a new instance is established, the default settings are FC = 1, RTS = 0, DTR = 0. This means that the module will not be able to send the data to application until user changes the default setting to FC = 0, RTS = 1, DTR = 1. The application will send an MSC command to change this value before starting to send data.

Break Octet valid in #CMUXMODE 0 and 4

0	1	2	3	4	5	6	7
1	0	0	0	0	0	0	0

This octet will be sent each time a Break Signal is simulated.

Break Octet valid in #CMUXMODE 1, 5 and in all modules that do not provide #CMUXMODE command.

0	1	2	3	4	5	6	7
1	0/1	0	0	0	0	0	0

bit1 = 0 → no Break

bit1 = 1 → Break is required

Not Supported Command Response (NSC)

This response is sent in case a command type is not supported by the receiving entity.

LSb							MSb										
Type								Length Indicator								Command type		
E/A	C/R	0	0	1	0	0	0	E/A	1	0	0	0	0	0	0	E/A	C/R	Command type

Power Saving Control (PSC)

Standard PSC command is used to cause the Telit Module to enter the Power Saving Mode when it is in Multiplexed Mode. It simulates the AT+CFUN=0 command.

LSb							MSb								
Type								Length Indicator							
E/A	C/R	0	0	0	0	1	0	E/A	0	0	0	0	0	0	0

Telit PSC command has one more octet containing the Power Saving Mode, see Table below.

LSb							MSb								
Type								Length Indicator							PSM
E/A	C/R	0	0	0	0	1	0	E/A	1	0	0	0	0	0	0	mode

The table below shows which CFUN modes can be simulated using standard (Std) and Telit PSC to cause the Telit Module to enter the Power Saving Mode in accordance with the used Module Family

AT+CFUN mode	Std PSC	Telit PSC
0	not supported	mode = 0
1	not supported	mode = 1
2	not supported	not supported
4	not supported	not supported
5	not supported	mode = 5
7	not supported	not supported
9	not supported	not supported

Note: AT+CFUN command cannot be used in Multiplexed Mode.

Note: To get more information concerning Power Saving Mode refer to [6].

Note: In absence of communication between the Telit Module and the User Application it is suggested to send a periodic Test Command to the Telit Module to verify the CMUX protocol operating state.

Note: Here is the Telit PSC command and the related response.

F9 03 EF 07 43 03 05 11 F9 PSC CMD: CFUN=5

F9 01 EF 07 41 03 01 70 F9 PSC RSP: ACK=01

Note: After sending PSC frame AT+CFUN? reply with according so after the above:

TX > F9 07 EF 13 41 54 2B 43 46 55 4E 3F 0D C8 F9

// AT+CFUN? on VC1

RX < F9 05 EF 37 41 54 2B 43 46 55 4E 3F 0D 0D 0A 2B 43 46 55 4E 3A 20 35 0D 0A 0D 0A 4F 4B 0D 0A 96 F9

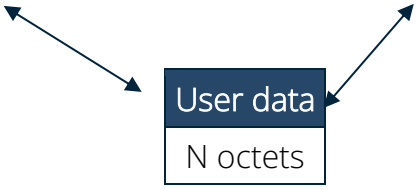
// Reply with AT+CFUN? (echo) + +CFUN: 5

UIH Data Channel Frame Coding

Refer to chapter 4.1 and figure below.

The Information field is the payload of the frame and carries the user data. The Information field exists only for UIH frame type. The P/F bit should be set to value 0 when this field is sent.

Flag	Address	Control	Length Indicator	Information Field	FCS	Flag
1 octet	1 octet	1 octet	1 or 2 octets	Unspecified length but integral number of octets	1 octet	1 octet



Length indicator

It specifies the length of the Information field. See its coding in chapter 4.14.1

User Data

User payload, the number of octets is defined by the Length Indicator

5 How to develop a MUX User Application

Scope of this chapter is to provide the reader with the guidelines to develop a User Application able to cause the connected module enters Multiplexed Mode and support the Multiplexing Protocol without the assistance of the Telit Serial Port MUX tool.

For VSD Configuration at Module Power ON for LE910Cx, ME910 and ME310 Families see figure below.

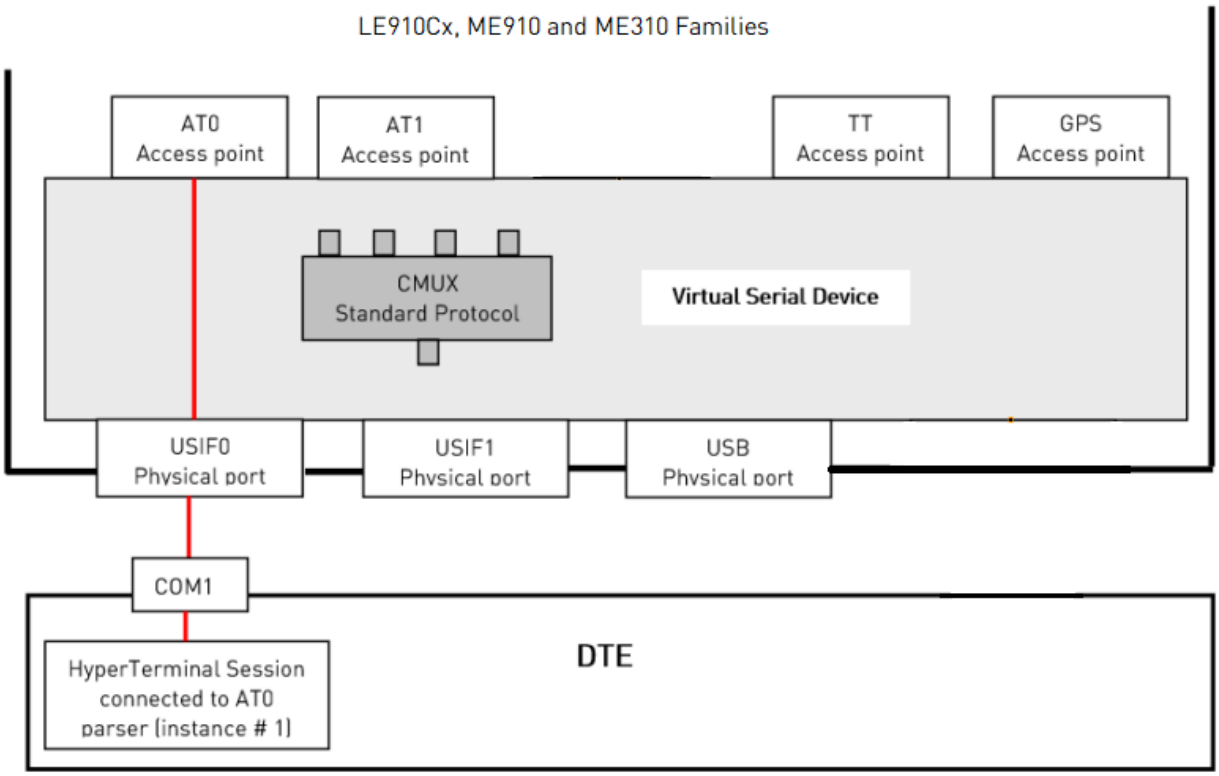


Figure 7: VSD Configuration

First, the User Application must force the connected module in Multiplexed Mode. To do that, it sends the AT commands listed below, see [3], [4], and [5] to get more information concerning the AT commands in accordance with the used module.

> **Note:** The commands are sent by means of a regular serial line protocol, no Multiplexing Protocol is still activated during this phase.

Disable Echo, Activate verbose format, Activate Hardware Flow Control, Program the DTR to close the current connection on its high to low transition

ATE0V1&K3&D2

OK

The following entered AT commands are not echoed; only OK is answered by the module.

Select the Serial Port Speed.

AT+IPR=115200

OK

Store the setting on profile 0 and at power on use profile 0

AT&W0&P0

OK

Note: CMUXMODE not applicable for Platform Version ID 30 and 37.

Note: CMUXMODE not applicable for Platform Version ID 25 when M2M AT Parser enabled (AT#M2MATP=1).

Start MUX protocol (Module enters Multiplexed Mode):

For Telit Modules provided with no configurable CMUX	For Telit Modules supporting configurable CMUX
See chapter 8.1	See chapter 8.1
AT+CMUX=0 OK	AT+CMUX=0,0,,122 OK

When the User Application receives the OK response of the +CMUX command, the module enters the Multiplexed Mode and the regular serial line protocol is no longer available. The User Application can continue to be connected to the module only via the Multiplexing Protocol, see Figure below and the example of CMUX messages sequence in hexadecimal format listed on the next page.

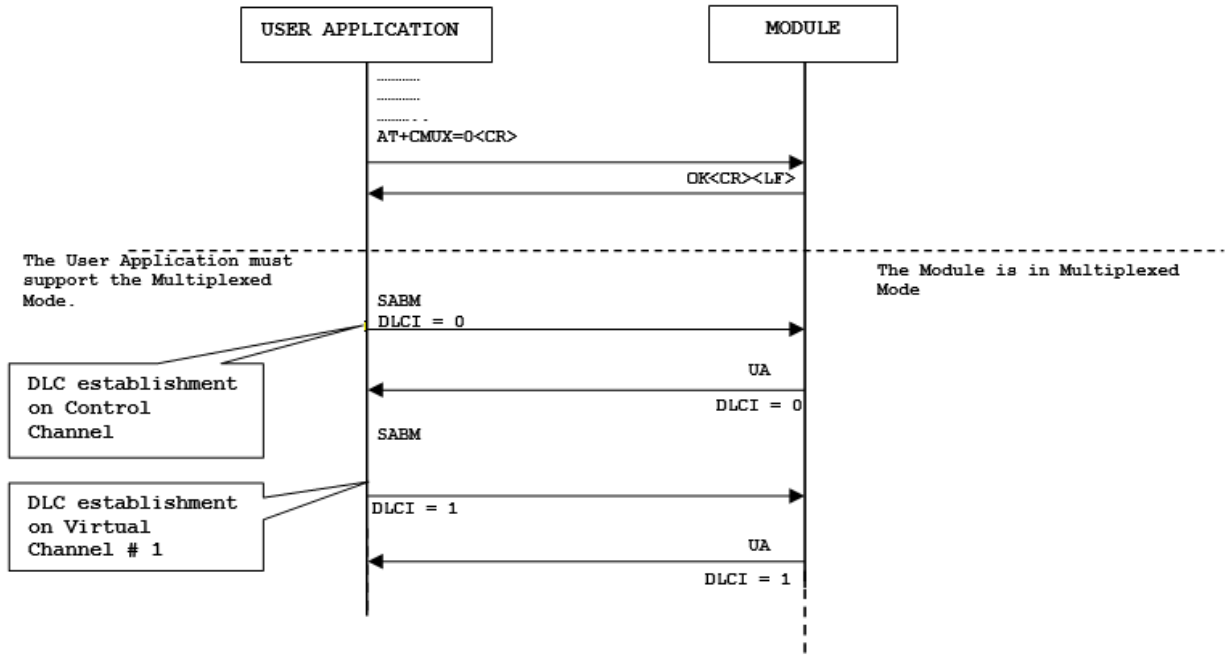


Figure 8: CMUX Protocol

After entering +CMUX AT Command, the CMUX protocol substitutes the regular serial line protocol. Hereafter is listed an example of CMUX protocol. The messages are in hexadecimal format.

Legend:

Red - messages sent from User Application (DTE) to Module (DCE)

Green - messages sent from Module to User Application

Black - comments

DLC establishment on Control Channel:

F9 03 3F 01 1C F -DLCI = 0, SABM CMD, POLL BIT=1

F9 03 73 01 D7 F9 -DLCI = 0, UA RESPONSE, FINAL BIT=1

DLC establishment on Virtual Channel # 1 (Open Virtual Port #1):

F9 07 3F 01 DE F9 -DLCI = 1, SABM CMD, POLL BIT=1

F9 07 73 01 15 F9 -DLCI = 1, UA RESPONSE, FINAL BIT=1

F9 01 EF 09 E3 05 07 0D 9A F9 -DLCI = 1, MSC: module reports its own V.24 status

Here DLC is established on Virtual Channel # 1.

Application sends to the module the Virtual V.24 Signal status concerning its Logical Port (COMx) connected to Virtual Channel #1: FC=0, RTS=0, DTR=1

User Application sends to the module the Virtual V.24 Signal status concerning its Logical Port (COMx) connected to Virtual Channel #2: FC=0, RTS=0, DTR=1

F9 03 EF 09 E3 05 07 0D FB F9 -DLCI = 0; UIH Frame, MSC CMD for Virtual Channel (DLCI) =2

Module answers with the just received Virtual V.24 Signal status. C/R bit belonging to the TYPE octet is negated

F9 01 EF 09 E1 05 07 0D 9A F9 -DLCI = 0; UIH Frame, MSC CMD for Virtual Channel (DLCI) =2

User Application answers with the just received Virtual V.24 Signal status. C/R bit belonging to the TYPE octet is negated.

F9 03 EF 09 E1 05 0B 4D FB F9

User Application sends the AT Command: AT+CGMM

F9 07 EF 11 41 54 2B 43 47 4D 4D 0D 2B F9

Module answers the AT command result:

<CR><LF>LE910C1-EU<CR><LF><CR><LF><OK>

F9 05 EF 29 0D 0A 4C 45 39 31 30 43 31 2D 45 55 0D 0A 0D 0A 4F 4B 0D 0A 60 F9

6 Summary and Recommendations

The customer/integrator designing its own Multiplexer Protocol Application shall remember:

- Telit Module supports the CMUX Basic Option and UIH Frames according to [1];
- Serial Port must be so configured: 8 data bits, no parity, 1 stop bit;
- It is mandatory to use the Hardware Flow control on the physical serial line that will support the Multiplexer Protocol. It should be set before entering Multiplexer Mode using AT command AT&K3 (both RTS/CTS active);
- Only for Platform Version ID 25 when M2M AT Parser is disabled (AT#M2MATP=0), DTR Lines should be set correctly (pulled-up), since a transition of the DTR signal causes the exit from Multiplexer Mode, this is valid only for modules equipped with a not updated software version, see chapter 8.3.

If the Telit Module is operating in Multiplexer Mode, the following restrictions will be applied:

- Software Flow control XON/XOFF is not supported;
- Call control: a voice call can be initiated, answered and closed on any channel;
- Call control: Data or Fax call can be initiated and answered on any channel but closed only on the channel where the call was started/answered;
- Phonebook access: if you wish to write the same phonebook entry using two or more different Virtual Channels at the same time, please note that only the last entry will be stored;
- Only for Platform Version ID 25 when M2M AT Parser is disabled (AT#M2MATP=0), when in Multiplexed Mode, the escape sequence "+++", sent on one Virtual Channel, will not be recognized and executed by the involved AT instance. It is responsibility of the Application to use the Break Octet of the Modem Status Command (MSC). Break Octet simulates the escape sequence.
- The commands listed below are ignored in case of Multiplexer Mode. To be more precise it is possible to read/write values, but they will have no effect on the behavior of the module, refer to [3], [4] and [5].

  AT+IPR

  AT+IFC

  AT+ICF

  ATS2; ATS12;

  ATS25

  AT+CMUX

  AT#SELINT

AT&F, ATZ, AT#Z

- Due to some restriction in the GSM/GPRS standard or limitation of the software the AT commands, listed below, will not be executed in parallel by the module. If one of the following commands are requested to be executed on one AT Instance (see chapter 3) while one of this command is running on another AT Instance, the latest execution is suspended until the first request is completed.

  ATA <Until CONNECT is not displayed>

  ATD <Until CONNECT is not displayed>

  ATO

  ATH

  AT+CGATT <Set command>

  AT+CGACT

  AT+COPS <Set Command or Test Command>

  AT+CREG <Set Command>

  AT#SEMAIL <Blocked after Ctrl-z is sent>

  AT#EMAILD <Blocked after Ctrl-z is sent>

  AT#SKTOP <Until CONNECT is not displayed>

  AT#SKTD <Until CONNECT is not displayed>

  AT#QDNS

  AT+CAMM

  All FTP Command

  All CSURV Command

  All Supplementary Service Command

  All Phone Book related command

  Note: This appears only when two or more of the commands listed above are combined. E.g.: commands AT#MONI, +CGMR, AT+COPS? will always be executed without suspension since only one of the commands listed above is running.

  For further restriction on behavior of other commands please refer to the specific documentation: [3], [4], [5] and [6].

An AT command executed by the selected AT Instance usually modifies only the behavior of the used AT Instance. It has its own User Profile stored in NVM. Vice-versa, the AT commands listed below modify the behavior of the whole set of AT Instances, regardless the used AT Instance and its connected Virtual Circuit.

AT#HFMICG

AT#HSMICG

AT+CMUT

AT#STM

AT#SHFEC

AT#CAP

AT+CLVL

AT#SRS

AT+CRSL

AT#SRP

AT#NITZ

AT+CALM

AT#SHFSD

AT#DAC

AT+COPS

AT#CODEC

AT#DVI

AT#E2SMSRI

AT#E2SLRI

AT+CSCB

At Module power on, the physical port ASC0 is connected to the AT0 Instance as showed in chapter 5, in accordance with that, ASCO uses the profile of AT0 Instance. When the Module is in Multiplexer Mode, the Virtual Channel 1 is connected to AT0 Instance (see chapter 3) and consequently uses the AT0 Instance profile.

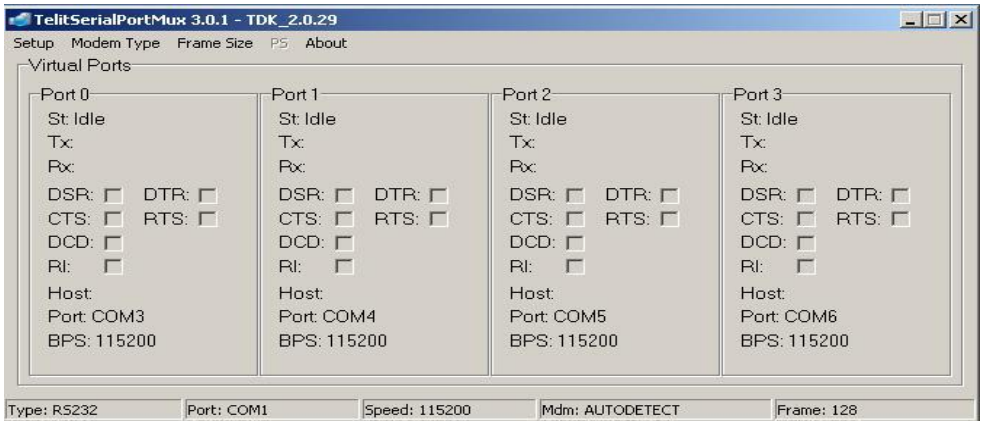
When Telit Module is in Multiplexed Mode please do not use AT+CFUN command, use the Power Saving Command (PSC), see chapter 4.1. For example, do not use AT+CFUN=5 with Module equipped with a not updated software version because the transition High/Low of the DTR signal causes the disconnection of the CMUX protocol, see chapter 8.3.

7 Telit Serial Port MUX tool

Telit has developed a tool called Telit Serial Port MUX showed in schematic manner on figures in chapter 3; the tool is running on a PC-Windows. From the figures it is possible infer that four Virtual Channels can exist at the same time on one physical line (COM1). Four logical COMx, provided by the Windows OS, can be used by four different PC-Applications to gain one of the four Virtual Channels.

7.1 Graphical Interface

After installing Telit Serial Port Mux tool on PC-Windows, it looks as in the following figure:



8 Appendix

8.1 How to select the Information Field length

To know if your actual used Telit Module supports a configurable CMUX protocol or if its configuration is fixed, use the following procedure. Assume a DTE is connected to your module and manually enter the listed below +CMUX commands.

Enter the command to see if the CMUX is configurable:

AT+CMUX=?

+CMUX: (0),(0),(6),(1-1500),(1-255),(0-100),(2-255),(1-255),(1-7)

OK

The AT command response indicates that the CMUX can be configurable, several parameters can be changed.

Note: Platform Version ID 25 modules answer only with the first four ranges.

Enter the command to get the actual values of the CMUX parameters:

AT+CMUX?

+CMUX: 0,0,5,128,10,3,30,0,0

OK

The fourth parameter is the Information Field Length: 128 octets (referring to the AT command above). In this case two octets are needed to constitute the Length Indicator, see chapter 4.1. The user can use the +CMUX command to change the CMUX configuration on the module, see [3], [4] and [5].

8.2 V.24 Link

For reader convenience hereafter is showed the V.24 link supported by the Telit Modules. The reader can compare the physical V.24 interface with the two V.24 octets provided by the CMUX protocol for each Virtual Channel:

- V24 Octet from DCE (Module) to DTE (Application), refer to chapter 4.1
- V24 Octet from DTE (Application) to DCE (Module), refer to chapter 4.1

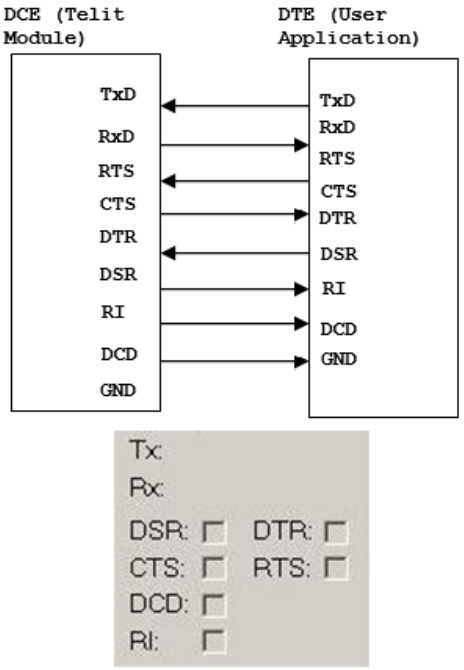


Figure 9: Complete V.24 Link versus Telit Serial Port MUX Panel

• DSR: Data Set Ready • CTS: Clear To Send • DCD: Data Carrier Detect • RI: Ring Indicator	• DTR: Data Terminal Ready • RTS: Request to send

8.3 DTR Signal vs. CMUX Protocol

Note: Applicable only to Platform Version ID 25 modules.

Only for Platform Version ID 25 when M2M AT Parser is disabled (AT#M2MATP=0), it is worth to remind that High → Low transition of the DTR signal causes the Module to exit the Multiplexed Mode. To avoid that and make available to the user the selection of one of the two CMUX implementations that can be provided by a Module, Telit has developed the following proprietary AT Command:

AT#CMUXMODE=<mode>

In accordance with the response of the AT#CMUXMODE=? Command, you can know the features supported by your Telit Module concerning the interaction between the CMUX protocol implementation and DTR transition:

AT#CMUXMODE=?

#CMUXMODE: (0,1,5)

OK

Parameter <mode> values:

0:	Ignore DTR feature is disabled, a transition of the physical DTR line instructs the DCE to disable the CMUX and switches to the normal command mode (Default value)
1:	Ignore DTR feature is disabled, a transition of the physical DTR line instructs the DCE to disable the CMUX and switches to the normal command mode
5:	Ignore DTR feature is enabled, the DCE does not care the physical DTR line transitions

Note: AT#CMUXMODE command has effect only on Platform Version ID 25 when M2M AT Parser is disabled (AT#M2MATP=0). For Platform Version ID 30 and 37 and for Platform Version ID 25 when M2M AT Parser enabled (AT#M2MATP=1), the behavior is the same of <mode>=5 (ignore DTR feature is enabled, the DCE does not care the physical DTR line transitions).

9 Acronyms and Abbreviations

Table 3: Acronyms and Abbreviations

Acronym	Definition
ARFCN	Absolute Radio Frequency Channel Number
AT	Attention command
BA	BCCH Allocation
BCCH	Broadcast Control Channel
CA	Cell Allocation
CBM	Cell Broadcast Message
CBS	Cell Broadcast Service
CCM	Current Call Meter
CLIR	Calling Line Identification Restriction
CTS	Clear To Send
CUG	Closed User Group
DCD	Data Carrier Detect
DCE	Data Communication Equipment
DCS	Digital Cellular System
DGPS	Differential GPS, the use of GPS measurements, which are differentially corrected
DNS	Domain Name System
DSR	Data Set Ready
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi Frequency
DTR	Data Terminal Ready
GGA	GPS Fix data
GLL	Geographic Position – Latitude/Longitude
GLONASS	Global positioning system maintained by the Russian Space Forces
GMT	Greenwich Mean Time
GNSS	Any single or combined satellite navigation system (GPS, GLONASS and combined GPS/GLONASS)
GPRS	Global Packet Radio Service
GPS	Global Positioning System
GSA	GPS DOP and Active satellites
GSM	Global System Mobile
GSV	GPS satellites in view
HDLC	High Level Data Link Control
HDOP	Horizontal Dilution of Precision
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity
IP	Internet Protocol
IRA	International Reference Alphabet
IWF	Interworking Function
ME	Mobile Equipment
MO	Mobile Originated
MT	either Mobile Terminated or Mobile Terminal
NMEA	National Marine Electronics Association
NVM	Non-Volatile Memory
PCS	Personal Communication Service
PDP	Packet Data Protocol
PDU	Packet Data Unit
PIN	Personal Identification Number
PPP	Point to Point Protocol

Acronym	Definition
PUK	Pin Unblocking Code
RLP	Radio Link Protocol
RMC	Recommended minimum Specific data
RTS	Request To Send
SAP	SIM Access Profile
SCA	Service Center Address
SMS	Short Message Service
SMSC	Short Message Service Center
SMTP	Simple Mail Transport Protocol
TA	Terminal Adapter
TCP	Transmission Control Protocol
TE	Terminal Equipment
UDP	User Datagram Protocol
USSD	Unstructured Supplementary Service Data
UTC	Coordinated Universal Time
VDOP	Vertical dilution of precision
VTG	Course over ground and ground speed
WAAS	Wide Area Augmentation System

10 Related Documents

Refer to https://dz.telit.com/ for current documentation and downloads.

Table 4: Related Documents

Ref.	Book Code	Document Title
[1]	-	3GPP TS 07.10 Version 7.2.0
[2]	80000NT10045A	Virtual Service Device, Application Note
[3]	80502ST10950A	LE910Cx AT Commands Reference Guide
[4]	80529ST10815A	ME910C1/ML865C1 AT Commands Reference Guide
[5]	80617ST10991A	ME310G1/ME910G1/ML865G1 AT Commands Ref. Guide
[6]	1VV0300784	Telit Modules Software User Guide

11 Document History

Table 5: Document History

Revision	Date	Changes
1	2023-11-07	New document template Changed example and added Note in clause UIH Control Channel Frame Coding Minor corrections in clause 8.3 DTR Signal vs. CMUX Protocol
0	2023-04-18	First issue

From Mod.0818 Rev.11

Technical Documentation