LM Technologies Ltd.

AT Command Manual

Applicable for Firmware version RACv1.03, v4.22

Contents

1 Introduction

This document describes the configuration commands to control the operation of following LM Bluetooth devices:

1) LM048 adapter
2) LM058 adapter
3) LM400 module
4) LM780 module
5) LM071 module
6) LM072 module

2 AT command Set

2.1 History

The AT command set was developed by Hayes to control the operation of telephony modems. The command set has been extended to control bluetooth device primary operation such as inquiry, connection setup/ disconnection etc. Other AT commands are also available to control the serial port setup and other user friendly features.

The Bluetooth device powers up in unconnected state and can be configured using UART interface similar to telephony modems. The device will act as Bluetooth slave by default and can be inquired/connect from other Bluetooth master device in neighborhood. The AT commands can be used to change the default behavior and settings for the current as well as future power up cycles.

2.2 Terminology

Symbol	Description	ASCII value (Hex)
<cr>	Carriage Return	0x0D
<lf>	Line Feed	0x0A
<cr,lf>	Carriage return and line feed	0x0D, 0x0A
XXXXXXXXXXXX	12 hexadecimal BD address sequence	

2.3 Command format

All the AT commands except the "AT" test command use the below command structure:

<header><name>< parameters> <cr>

<header> - Each command will start with "AT" character sequence.
<name> - Command name as shown in below table listing all the available commands.

<parameters> - The parameters are required for most of the commands. The parameter may be character, integer and character sequence (BD address, Pin code, Name etc) depending on the command operation.

<cr> - This character terminates the command packet and signals the device to proceed with command execution.

2.4 Command Response

The AT commands will have the response in the below format:

<parameter,value><command_response>

<parameter,value> - This sequence will be part of response to the commands sent in query format.
<command_response> - The command response can be any one of following types:

 ➢ <cr,lf>OK<cr,lf> - If the command has been sent to Bluetooth device in correct format and is applicable in current device operating mode.
 ➢ <cr,lf>ERROR<cr,lf> - If the command has been sent in wrong format/command is invalid/ command is not applicable in current device operating mode.
 ➢ <cr,lf> - If the command response has been disabled.

2.5 Host Events

Host device connected to Bluetooth device will receive an event sequence on occurrence of Bluetooth related events.

Different <host_event> are:

 ➢ <cr,lf>CONNECT "XXXXXXXXXXXX"<cr,lf> - The event sequence will be received on a successful connection attempt either by local device or from a remote bluetooth device.
 ➢ <cr,lf>CONNECT Attempt Fail<cr,lf> - When the attempted connection attempt from the local Bluetooth device fails for some reason. The reason for connection failure will not be listed.
 ➢ <cr,lf>DISCONNECT "XXXXXXXXXXXX"<cr,lf> - On the disconnection of the current active connection, the sequence will be received.
 ➢ <cr,lf>Inquiry Cancelled<cr,lf> - When the inquiry operation from the local Bluetooth device is pre terminated using the AT command, the event will be sent to host device.

2.6 Operation Mode:

The device will always be in one of the below operating modes:

Online Data Mode	Data transfer mode when device is in connected state.
Command Mode	Accepts AT command for device configuration.
Online Command Mode	Accepts almost all AT commands for device configuration in connected state.

2.7 Command Types

These commands are case-insensitive.

Command Type		Parameter	Command
Device Information		Test	AT
		Firmware Version	ATI0
		Settings	ATI1
Reset		Restore Factory Settings	ATZ0
Serial Port		Baud Rate	ATL
		Stop Bits	ATK
		Parity bits	ATM
		Flow Control	ATC
		Character Echo	ATE
		Command Response	ATQ
Bluetooth	Type	Device Role	ATR
	Information	BD Address	ATB
		Inquire devices	ATF
		RSSI	ATI2
	Settings	Device Name	ATN
		Security	ATP
		Discoverability	ATH
	Connection	Connect inquired device	ATA
		Drop connection	ATH
		Bonding	ATD
		Auto Connect	ATO
Misc		Escape Sequence	+++
		Escape Sequence handling	ATX
		Mode switch	ATO
		Low power Mode	ATS

2.8 Command Description

2.8.1 AT

This command allows the connected host device to check the availability of the Bluetooth device. The connected host device must have same serial port settings as configured for the Bluetooth device.

2.8.1.1 Syntax
AT<cr>

2.8.1.2 Response
<command_response>

2.8.2 ATI0
Returns the device firmware version

2.8.2.1 Syntax
ATI0<cr>

2.8.2.2 Response
<cr,lf>FW VERSION: vX.YZ<command_response>

Where X: Major release of device firmware

YZ: Minor release/updates of device firmware

e.g. FW VERSION: v4.22, RACv1.03

2.8.3 ATI1
List all the device information and all the settings along with their brief description. The settings include serial port, Bluetooth related and other misc settings.

2.8.3.1 Syntax
ATI1<cr>

2.8.3.2 Response
<command_response>

<cr,lf><Parameter Setting, Brief Description><cr,lf> for each parameter.

e.g. device role setting will be listed as "<cr,lf>ATR=1, SLAVE ROLE <cr,lf>". All other settings and other device information is listed in similar manner.

2.8.4 ATZ0
This command is used to restore the default factory settings and perform device reboot. The default factory settings are listed in table [reference]

2.8.4.1 Syntax
ATZ0<cr>

2.8.4.2 Response
<command_response>

2.8.5 ATL
The command allows setting the baud rate for the serial UART port. The current baud rate setting can also be retrieved by using the sending this command in query format.

2.8.5.1 ATLb<cr>
where b – varies from 10 to 19 for different baud rates. The baud rate varies from 1200bps to 921 Kbps. e.g. To set 19200 as UART baud rate, the command is ATL2<cr>

b	Baud rate (bps)
*	1200
#	2400
0	4800
1	9600

2	19200
3	38400
4	57600
5	115200
6	230400

2.8.5.1.1 Response
<command_response>

2.8.5.2 ATL?<cr>

2.8.5.2.1 Response
<cr,lf>b<command_response> if the command is successful. Here, b- current baud rate setting. E.g on default setup, the response will be <cr,lf>2<command_response>

2.8.6 ATK
The command is used to specify one or two stop bits for serial port communication. The current setting can also be retrieved by using the sending this command in query format.

2.8.6.1 ATKn<cr>
where n – can be 0 or 1 depending on no of stop bits used.

n	Stop bits (no)
0	1
1	2

2.8.6.2 Response
<command_response>

2.8.6.3 ATK?<cr>

2.8.6.3.1 Response
<cr,lf>n<command_response> if the command is successful. Here, n- no of stop bits. E.g on default setup, the response will be <cr,lf>0<command_response>

2.8.7 ATM
The command is used to specify the parity type of serial port. The current setting can also be retrieved by using the sending this command in query format.

2.8.7.1 ATMn<cr>
where n – varies from 0 to 2 depending on the type of parity used.

N	Parity Type
0	None
1	Odd
2	Even

2.8.7.1.1 Response

2.8.7.2 ATM?<cr>

2.8.7.2.1 Response

<cr,lf>n<command_response> if the command is successful. Here, n- parity type. E.g on default setup, the response will be <cr,lf>0<command_response>

2.8.8 ATC

The command is used to enable/disable the RTS/CTS flow control for the serial port. The current setting can also be retrieved by using the sending this command in query format.

2.8.8.1 ATCc<cr>

Where parameter c is a character used to enable/disable the flow control.

c	Flow Control
1	Enable
0	Disable

Note, this command will cause the device to reboot.

2.8.8.1.1 Response

<command_response>

2.8.8.2 ATC?<cr>

2.8.8.2.1 Response

<cr,lf>c<command_response> if the command is successful. Here, c- current flow control setting. E.g on default setup, the response will be
<cr,lf>1<command_response>

2.8.9 ATE

The command is used to enable/disable the echo back of command characters from the Bluetooth device. The current setting can also be retrieved by using the sending this command in query format.

2.8.9.1 ATEc<cr>

Where parameter c is a character used to enable/disable the echo back feature.

c	Echo back
1	Enable
0	Disable

2.8.9.1.1 Response

<command_response>

2.8.9.2 ATE?<cr>

2.8.9.2.1 Response

<cr,lf>c<command_response> if the command is successful. Here, c- current echo back setting. E.g on default setup, the response will be
<cr,lf>1<command_response>

2.8.10 ATQ

The command is used to enable/disable the command response from the Bluetooth device. Different types of command response may be received by Host device and are listed in Command Response . The current setting can also be retrieved by using the sending this command in query format.

2.8.10.1 ATQc<cr>

Where parameter c is a character used to enable/disable the command response.

c	Command Response
0	Enable
1	Disable

2.8.10.1.1 Response

<command_response>

2.8.10.2 ATQ?<cr>

2.8.10.2.1 Response

<cr,lf>c<command_response> if the command is successful. Here, c- current command response setting. E.g on default setup, the response will be
<cr,lf>0<command_response>

2.8.11 ATR

The command is used to set the local device as Bluetooth Master/Slave. The current setting can also be retrieved by using the sending this command in query format.

2.8.11.1 ATRc<cr>

Where parameter c is a character used to configure the local device type.

c	Device Type
0	Master
1	Slave

Note, this command will cause the device to reboot.

2.8.11.1.1 Response

<command_response>

2.8.11.2 ATR?<cr>

2.8.11.2.1 Response

<cr,lf>c< command_response> if the command is successful. Here, c- current device type setting. E.g on default setup, the response will be
<cr,lf>1<command_response>

2.8.12 ATB

This command is used to display the Bluetooth address of the local device.

2.8.12.1 ATB?<cr>

2.8.12.1.1 Response

<cr,lf><XXXX-XX-XXXXXX>< command_response> if the command is successful. Here, XXXX-XX-XXXXXX is the Bluetooth address of local device.

2.8.13 ATF

This command is used to search for any Bluetooth device in the neighborhood within one minute. If any device is found, its name and address will be listed. Maximum limit of devices searched is 8. The search ends with a message "Inquiry ends. xx device(s) found." This command is available only when the adaptor is in the manual master role.

2.8.13.1 ATF?<cr>

2.8.13.1.1 Response
<command_response><cr,lf>Inquiry Results:<cr,lf>

<Sr No><DeviceName><XXXX-XX-XXXXXX><cr,lf> for every device found. Here, XXXX-XX-XXXXXX is the Bluetooth address of local device. e.g. "1 Serial Adapter 001E-3A-2CDAB7"

Sending AT command will cancel the ongoing search operation. If the search is finished (1 minute timeout / max devices found), then the command will return error.

2.8.13.1.2 Response
<cr,lf> Inquiry cancelled<command_response>

2.8.14 ATI2

Inquire RSSI value for current bluetooth connection. This command is available in online command mode when the device is in connected state.

2.8.14.1 ATI2<cr>

2.8.14.1.1 Response
<cr,lf><RSSI><command_response>

<RSSI> - can be STRONG/AVERAGE/WEAK depending on the received radio signal strength.

2.8.15 ATN

This command is used to specify a name for the adaptor. You can specify a friendly name using 0 to 9, A to Z, a to z, space and –, which are all valid characters. Note that "first space or -, last space or – isn't permitted". The default name is "Serial Adapter". The current device name can be retrieved by using the sending this command in query format.

2.8.15.1 ATN=XXXX<cr>
Where the parameter "XXXX" is a character string with a maximal length of 16.

2.8.15.1.1 Response

2.8.15.2 ATN?<cr>

2.8.15.2.1 Response
<cr,lf><NAME><command_response> if the command is successful. Here, <NAME> is the device name . E.g on default setup, the response will be <cr,lf>Serial Adapter<command_response>

2.8.16 ATP
This command is used to specify a PIN code for a secured bluetooth connection. The default PIN is "1234". Paired Bluetooth devices should have a same PIN code. The current pin code setting can be retrieved by using the sending this command in query format.

2.8.16.1 ATP=XXXX<cr>
Where the parameter "XXXX" is a 4-8 digit string.

2.8.16.1.1 Response
<command_response>

2.8.16.2 ATP0<cr>
This command will cancel the pin code security for Bluetooth connections. The remote Bluetooth device must also cancel pin code security in order to connect successfully with local Bluetooth device. Some devices e.g. Mobile phone do not allow connection without pin code security so disabling pin code security will prohibit successful connection with these devices.

2.8.16.2.1 Response
<command_response>

2.8.16.3 ATP?<cr>

2.8.16.3.1 Response
<cr,lf><PIN><command_response> if the command is successful. Here, <PIN> is the pin code in use . E.g on default setup, the response will be <cr,lf>1234<command_response> .Incase, the pin code security is disabled the response will be <cr,lf>NULL<command_response>

2.8.17 ATH0/1
It is used to specify whether the adaptor can be discovered or connected by remote devices. The current setting can also be retrieved by using the sending this command in query format.

2.8.17.1 ATHc<cr>
Where parameter c is a character used to enable/disable the discoverability status.

c	Status
1	Discoverable
0	Non-discoverable

Note, this command will cause the device to reboot.

2.8.17.1.1 Response

2.8.17.2 ATH?<cr>

2.8.17.2.1 Response

<cr,lf>c<command_response> if the command is successful. Here, c- current discoverability status setting. E.g on default setup, the response will be <cr,lf>1<command_response>

2.8.18 ATA

This command is used to establish a connection. It is available only when the local Bluetooth device is in the manual master role.

2.8.18.1 ATA<cr>

Connect the local bluetooth device to specified bonded bluetooth device. It is available only when "ATD=xxxxxxxxxxxx" is executed..

2.8.18.1.1 Response

<command_response><host_event> where <host_event> will be connection related event and depends on the connection attempt result.

2.8.18.2 ATAn<cr>

Where parameter n is list index of the remote device found through ATF? command.
n- varies from 1 to 8.

2.8.18.2.1 Response

<command_response><host_event> where <host_event> will be connection related event depending on the connection attempt result.

2.8.19 ATH

This command is used to drop connection from master or slave device. It is only allowed in online command mode when the device is in connected state.

2.8.19.1 ATH<cr>

Drop current connection when the device in online command mode.

2.8.19.1.1 Response

<command_response><host_event> where <host_event> will be dis-connection event.

2.8.20 ATD

For security purpose, this command is used to specify a unique remote Bluetooth device to be connected. In the master role, the local device pairs and connects with the designated remote slave address. In the slave mode, this command is a filter condition to accept the connection request from the master device. The current bonded device address can be retrieved by using the sending this command in query format.

2.8.20.1 ATD=XXXXXXXXXXXX<cr>

2.8.20.1.1 Response

<command_response>

2.8.20.2 ATD0<cr>

Restore the status in which the local Bluetooth device can connect with any remote device. There is no device bonded with local device.

2.8.20.2.1 Response
<command_response>

2.8.20.3 ATD?<cr>

2.8.20.3.1 Response
<cr,lf><XXXX-XX-XXXXXX><command_response> if the command is successful. Here, XXXX-XX-XXXX is the Bluetooth address of bonded device. . E.g on default setup, there will be no bonded device, hence the response will be <cr,lf>0000-00-000000<cr,lf><command_response>

2.8.21 ATO0/1
This command is used to enable/disable auto-connection feature in the master role. The current setting can also be retrieved by using the sending this command in query format.

2.8.21.1 ATOc<cr>
Where parameter c is a character used to enable/disable the auto connection feature.

c	Connect Type
0	Auto Connect
1	Manual

Note, this command will cause the device to reboot. In Manual connect type, the local device (if master type) will need to use ATF? command to find Bluetooth devices in neighborhood and then use ATAn to connect to specific device.

2.8.21.1.1 Response
<command_response>

2.8.21.2 ATO?<cr>

2.8.21.2.1 Response
<cr,lf>c<command_response> if the command is successful. Here, c- current connect type setting. E.g on default setup, the response will be
<cr,lf>0<command_response>

2.8.22 ATX
This command Disable/Enable the handling of escape sequence "+++". Note: The escape sequence must be sent with guard time of 1000 msec. The current setting can also be retrieved by using the sending this command in query format.

2.8.22.1 ATXc<cr>
Where parameter c is a character used to enable/disable the escape sequence handling.

C	Status
1	Enable
0	Disable

Note: When the device is in data mode (connected state), it can be forced into online Command mode during active connection to the remote device. The "+++" escape sequence must be sent with guard time of 1000msec. The next AT command must be sent after

waiting for the response "<cr,lf>OK<cr,lf>" to indicate switching from online data mode to online command mode.

2.8.22.1.1 Response
<command_response>

2.8.22.2 ATX?<cr>

2.8.22.2.1 Response
<cr,lf>c<command_response> if the command is successful. Here, c- current status.
E.g on default setup, the response will be <cr,lf>0<command_response>

2.8.23 ATO
The command directs the device to switch from online command mode to online data mode. This command is only allowed in connected state.

2.8.23.1 ATO<cr>

2.8.23.1.1 Response
<cr,lf>OK<cr,lf>

2.8.24 ATS
This command is used to enable/disable auto-power saving feature of RS232 driver as well as low power modes of Bluetooth device. The current setting can also be retrieved by sending this command in query format.

2.8.24.1 ATSc<cr>
Where parameter c is a character used to enable/disable the auto power saving feature.

c	Status
1	Enable
0	Disable

2.8.24.1.1 Response
<command_response>

2.8.24.2 ATS?<cr>

2.8.24.2.1 Response
<cr,lf>c<command_response> if the command is successful. Here, c- current setting.
E.g on default setup, the response will be <cr,lf>1<command_response>

2.9 Default Factory Settings

Parameter	Default Value	Description
L	2	Baudrate = 19200 bps
K	0	Stop bit = 1
M	0	Parity = None
C	0	Flow Control = None
E	1	Echo = Enabled
Q	0	Response = Enabled
R	1	Role = Slave
N	Serial Adapter	Device name = Serial Adapter
P	1234	Pin code = Enabled
H	1	Discoverable = Enabled
D	0000-00-0000	Bonding = None
0	0	Auto-Connect = Enabled
X	1	Escape Sequence (+++) Handling = Enabled
S	1	Auto Power Saving = Enabled