

LM Technologies Ltd.

AT Command Manual

Applicable for Firmware version 4.5X, 4.6X, 6.5X, 6.1X

Revision	Date	Name	Description
v1.0	21-07-2009	Kanwal	Initial Draft version
v1.1	24-09-2009	Kanwal	New AT command added
v1.2	15-06-2010	Kanwal	Applicable to firmware v4.53, v4.61
v1.3	22-03-2011	Sumeet	Updates for firmware v6.51

This device complies with the following radio frequency and safety standards.

Important to OEM Manufacturer:

This following FCC Warning must be included in the HOST User Manual.

FCC Warning

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE 1: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- -Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- -Consult the dealer or an experienced radio/TV technician for help.

NOTE 2: Any changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance.

Note 1: This module certified that complies with RF exposure requirment under portable or mobile or fixed condition, this module is to be installed only in portable or mobile or fixed applications.

A portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user

A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal computer, are considered to be mobile devices if they meet the 20 centimeter separation requirement.

A fixed device is defined as a device is physically secured at one location and is not able to be easily moved to another location.

Note 2: Any modifications made to the module will void the Grant of Certification, this module is limited to OEM installation only and must not be sold to end-users, end-user has no manual instructions to remove or install the device, only software or operating procedure shall be placed in the end-user operating manual of final products.

Note 3: The device must not transmit simultaneously with any other antenna or transmitter.

Note 4: To ensure compliance with all non-transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational. For example, if a host was previously authorized as an unintentional radiator under the Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that the after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements. Since this may depend on the details of how the module is integrated with the host, LM Technologies Ltd shall provide guidance to the host manufacturer for compliance with the Part 15B requirements.

Note 5: FCC ID label on the final system must be labeled with "Contains FCC ID: VVXLM78X" or "Contains transmitter module FCC ID: VVXLM78X".

The transmitter module must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the host product. LM Technologies Ltd is responsible for the compliance of the module in all final hosts.

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2.9

1 Introduction

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

- 1) LM048 adapter
- 2) LM058 adapter
- 3) LM048 SPA adapter
- 4) LM400 module
- 5) LM780 module
- 6) LM071 module
- 7) LM072 module
- 8) LM048v2 adapter
- 9) LM058v2 adapter

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></cr>	Carriage Return	0x0D
<lf></lf>	Line Feed	0x0A
<cr,lf></cr,lf>	Carriage return and line feed	0x0D, 0x0A
XXXXXXXXXXX	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 except "AT" test command. <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. e.g. STOP1 where STOP is the parameter related to serial port stop bits and 1 is the parameter value.

<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 "XXXXXXXXXXXXXX"<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 "XXXXXXXXXXXXXXX"<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

Cor	mmand Type	Parameter	Command
Device Information		Test	AT
		Firmware Version	AT+VER
		Settings	AT+ENQ
Reset		Restore Factory	AT+RESET
		Settings	
Serial Port		Baud Rate	AT+BAUD
		Stop Bits	AT+STOP
		Parity bits	AT+PAR
		Flow Control	AT+FLOW
l		Character Echo	AT+ECHO
		Command Response	AT+RESP
		Modem Signal	AT+MODEM
Bluetooth	Туре	Device Role	AT+ROLE
	Information	BD Address	AT+ADDR
		Inquire devices	AT+FIND
		RSSI	AT+RSSI
	Settings	Device Name	AT+NAME
		Security	AT+PIN
		Discoverability	AT+DCOV
	Connection	Connect inquired	AT+CONN
		device	
		Drop connection	AT+DROP
		Bonding	AT+BOND
		Auto Connect	AT+ACON
Misc		Escape Sequence	+++
		Escape Sequence	AT+ESC
		handling	
		Mode switch	AT+AUTO
		Remote Configuration	AT+RCFG
		Low power Mode	AT+SLEEP

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 AT+VER

Returns the device firmware version

2.8.2.1 Syntax

AT+VER<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: v4.50

2.8.3 AT+ENQ

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

AT+ENQ<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,If>ROLEM, MASTER ROLE <cr,If>". All other settings and other device information is listed in similar manner.

2.8.4 AT+RESET

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

AT+RESET<cr>

2.8.4.2 Response

<command_response>

2.8.5 AT+BAUD

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

2.8.5.1 AT+BAUDb<cr>

where b – varies from 10 to 20 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 AT+BAUD14<cr>

b	Baud rate (bps)
10	1200

11	2400
12	4800
13	9600
14	19200
15	38400
16	57600
17	115200
18	230400
19	460800
20	921600

2.8.5.1.1 Response

<command_response>

2.8.5.2 AT+BAUD?<cr>

2.8.5.2.1 Response

<cr,lf>BAUDb<command_response> if the command is successful. Here, b- current
baud rate setting. E.g on default setup, the response will be
<cr,lf>BAUD14<command_response>

2.8.6 AT+STOP

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

2.8.6.1 AT+STOPn<cr>

where n - can be 1 or 2 depending on no of stop bits used.

n Stop bits (no)	
1	1
2	2

2.8.6.2 Response

<command_response>

2.8.6.3 AT+STOP?<cr>

2.8.6.3.1 **Response**

<cr,lf>STOPn<command_response> if the command is successful. Here, n- no of stop bits. E.g on default setup, the response will be <cr,lf>STOP1<command_response>

2.8.7 AT+PAR

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

2.8.7.1 AT+PARn<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**

<command_response>

2.8.7.2 AT+PAR?<cr>

2.8.7.2.1 Response

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

2.8.8 AT+FLOW

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

2.8.8.1 AT+FLOWc<cr>

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

c Flow Control	
'+'	Enable
'_'	Disable

Note, this command will cause the device to reboot.

2.8.8.1.1 **Response**

<command response>

2.8.8.2 AT+FLOW?<cr>

2.8.8.2.1 **Response**

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

Note:

- 1. In LM048 SPA adapter with firmware series 4.6x, AT+FLOW refers to DTR/DSR flow control and no RTS/CTS handling is supported. For all other products, AT+FLOW refers to RTS/CTS flow control.
- 2. In LM048v2 and LM058v2 adapters running v6.5x firmware, this setting can be used in conjunction with AT+MODEM command to choose different configurations of RS232 lines. See Section 2.8.11

2.8.9 AT+ECHO

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 sending this command in query format.

2.8.9.1 AT+ECHOc<cr>

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

С	Echo back	
' +'	Enable	
' <u>-</u> '	Disable	

2.8.9.1.1 Response

<command_response>

2.8.9.2 AT+ECHO?<cr>

2.8.9.2.1 **Response**

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

2.8.10 AT+RESP

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 sending this command in query format.

2.8.10.1 AT+RESPc<cr>

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

С	Command Response	
'+'	Enable	
'_'	Disable	

2.8.10.1.1 Response

<command_response>

2.8.10.2 AT+RESP?<cr>

2.8.10.2.1 Response

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

2.8.11 AT+MODEM

This command is available only for v6.5x firmware. This is the default firmware in LM048v2 and LM058v2 adapters. This command is used in conjunction with AT+FLOW command to enable/disable various RS232/Modem Signals. The current setting can also be retrieved by sending this command in query format.

2.8.11.1 AT+MODEMc<cr>

Where parameter c is used to disable or configure Local Loopback or Remote Transfer settings on the adapter

(Modem Signals
'-'	Disable
'L'	Local Loopback
'R'	Remote Transfer

2.8.11.1.1 Response

<command_response>

The meaning of the modems signals is described in section 2.8.11.3

2.8.11.2 AT+MODEM?<cr>

2.8.11.2.1 Response

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

2.8.11.3 Modem Signal Meaning

The modem signal setting is used in conjunction with AT+FLOW Settings to enable/disable RS232 modem control signals as per the table below.

FLOW CONTROL (AT+FLOW)	MODEM SIGNAL (AT+MODEM)	RS232 SIGNALS	Description
FLOW-	MODEM-	Tx, Rx, GND	3 wire configuration
FLOW+	MODEM-	Tx, Rx, GND, RTS, CTS	RTS CTS signals are used for data flow control between host and adapter, and NOT transferred to remote side wirelessly.
FLOW-	MODEML	Tx, Rx, GND, RTS<->CTS, DTR<->DSR	RTS looped back to CTS, DTR looped back to DSR
FLOW+	MODEML	Tx, Rx, GND, RTS, CTS, DTR<->DSR	RTS CTS signals used for data flow control between host and adapter, and NOT transferred to remote side wirelessly. DTR looped back to DSR. This configuration is equivalent to LM048 adapter running v4.5x firmware
FLOW-	MODEMR	Tx, Rx, GND, RTS(R), CTS(R), DTR(R), DSR(R)	All 7 signals used. All RS232 control signals (DTR, DSR, RTS and CTS) transferred wirelessly to remote side.
FLOW+	MODEMR	Tx, Rx, GND, RTS, CTS, DTR(R), DSR(R)	All 7 lines used. Only DTR, DSR signals transferred wirelessly to remote side. If RTS, CTS signals are not used, then this configuration is equivalent to LM048 SPA Adapter running v4.6X firmware.

2.8.15 AT+RSSI

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

2.8.15.1 AT+RSSI<cr>

2.8.15.1.1 Response

<cr,lf><RSSI><command response>

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

2.8.16 AT+NAME

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 sending this command in query format.

2.8.16.1 AT+NAME=XXXX<cr>

Where the parameter "XXXX" is a character string with a maximal length of 16.

2.8.16.1.1 Response

<command_response>

2.8.16.2 AT+NAME?<cr>

2.8.16.2.1 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>

2.8.17 AT+PIN

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 sending this command in query format.

2.8.17.1 AT+PIN=XXXX<cr>

Where the parameter "XXXX" is a 4-8 digit string.

2.8.17.1.1 Response

<command_response>

2.8.17.2 AT+PIN-<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.

2.8.17.2.1 Response

<command_response>

2.8.17.3 AT+PIN?<cr>

2.8.17.3.1 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>

2.8.18 AT+DCOV

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

2.8.18.1 AT+DCOVc<cr>

Where parameter c is a character used to enable/disable the discoverability status.

С	Status	
'+'	Discoverable	
'_'	Non-discoverable	

Note, this command will cause the device to reboot.

2.8.18.1.1 Response

<command response>

2.8.18.2 AT+DCOV?<cr>

2.8.18.2.1 Response

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

2.8.19 AT+CONN

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

2.8.19.1 AT+CONN<cr>

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

2.8.19.1.1 Response

<command response><host event> where <host event> will be connection related event and depends on the connection attempt result.

2.8.19.2 AT+CONN= XXXXXXXXXXXXX<cr>

Connect the local bluetooth device to the bluetooth device address specified by XXXXXXXXXXXXX.

2.8.19.2.1 Response

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

2.8.19.3 AT+CONNn<cr>

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

2.8.19.3.1 Response

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

2.8.20 AT+DROP

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.

2.8.20.1 AT+DROP<cr>

Drop current connection when the device in online command mode.

2.8.20.1.1 Response

<command response><host event> where <host event> will be dis-connection event.

2.8.21 AT+BOND

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 sending this command in query format.

2.8.21.1 AT+BOND=XXXXXXXXXXXXXXCr>

2.8.21.1.1 Response

<command_response>

2.8.21.2 AT+BOND-<cr>

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

2.8.21.2.1 Response

<command response>

2.8.21.3 AT+BOND?<cr>

2.8.21.3.1 Response

<cr,If><XXXX-XX-XXXX><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, If>0000-00-0000<cr,lf><command response>

2.8.22 AT+ACON

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

2.8.22.1 AT+ACONc<cr>

Where parameter c is a character used to enable/disable the auto connection feature.

С	Connect Type	
' +'	Auto Connect	
'_'	Manual	

2.8.25 AT+RCFG

This command enables or disables configuration from the remote device by executing the remote access hand shaking protocol. Please ask for separate document for remote configuration details. The current setting can also be retrieved by sending this command in query format.

2.8.25.1 AT+RCFGc<cr>

Where parameter c is a character used to enable/disable the remote configuration.

С	Status
'+'	Enable
'_'	Disable

2.8.25.1.1 Response

<command_response>

2.8.25.2 AT+RCFG?<cr>

2.8.25.2.1 Response

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

2.8.26 AT+SLEEP

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.

2.8.26.1 AT+SLEEPc<cr>

Where parameter c is a character used to enable/disable the auto power saving feature.

С	Status	
'+'	Enable	
′_′	Disable	

2.8.26.1.1 Response

<command_response>

2.8.26.2 AT+SLEEP?<cr>

2.8.26.2.1 Response

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

2.9 Default Factory Settings

Parameter	Default Value	Default Value	Description
	(v4.xx firmware)	(v6.5x firmware)	
BAUD	14	14	19200 bps
STOP	1	1	1 stop bit
PAR	0	0	None
FLOW	+	-	+: Hardware,
			- : Disabled
ECHO	+	+	Enabled
RESP	+	+	Enabled
MODEM	Not supported	-	Disabled
ROLE	S	+	Slave device
NAME	Serial Adapter	SerialAdapterXX	Device name. XX is last 2
			digits of Bluetooth Address
PIN	1234	1234	Enabled
DCOV	+	+	Discoverable
BOND	0000-00-000000	0000-00-000000	No Bonding
ACON	+	+	Auto-Connect
ESC	+	+	Enabled
RCFG	+	+	Enabled
SLEEP	-	-	Disabled