6.8.5 "AT*SIWRWORESP"\r\n

i. Execution only command
ii. This command is used to send data to the BLE device with the properties "Si_Wrt" i.e. 0x40.
iii. The command format is "AT*WRCHARVAL=conn-ID, char-Handle, length, actual-bytes".
iv. e.g. "at*WRCHARVAL=1,0019,10,12345abcdef!()12" command is used to send data to 1st connected device, on characteristic 0019. No of bytes to write are 16 (0x10) and actual bytes are 12345abcdef!()12.
v. As shown in the example command, no of bytes to transmit is hex value.
vi. As shown in the example command, actual data bytes are not separated by comma. When the values 0x31 and 0x32 are sent i.e. ASCII 1 and 2 are sent, the data buffer is copied and sent to remote device transparently.
vii. Note : The actual data bytes to be sent should not have "\r\n" within the data itself, because it is the terminating string for AT command parser.
viii. For command "AT*WRWORESP=conn-ID, char-Handle, length, actual-bytes" adapter gives OK response if all the following conditions are true:

    a. connection ID is correct (if adapter is connected to 3 devices and CID mentions 4, then it is invalid)
    b. Characteristic handle has Wr_req properties
    c. Value of "length" field is less than 21 i.e. (0x15). This is limitation of BLE stack.
    d. Actual data bytes are same as value of "length" field.

ix. After the LM device responds to this command with OK, it then sends the data to remote BLE device.

6.8.6 NOTIF_IND notification Indication

ii. Indication given by LM device.
iii. When the LM device receives data from the remote BLE device, it notifies the user on UART.
iv. E.g. the command below shows some indication reports:

```
IND*:NOTIF_IND=1:0019 R_bytes:0014
dataFromBLEDev123456

IND*:NOTIF_IND=1:0019 R_bytes:0003
789

IND*:NOTIF_IND=1:0019 R_bytes:0014
abcdefghijklmnopqrst

IND*:NOTIF_IND=1:0019 R_bytes:0006
uvwxyz

IND*:NOTIF_IND=1:0019 R_bytes:0014
abcdefghijklmnopqrst

IND*:NOTIF_IND=1:0019 R_bytes:0006
uvwxyz
```

v. In the report "IND*:NOTIF_IND=1:0019 R_bytes:0014 dataFromBLEDev123456" the adapter shows CID as 1, Characteristic from which data is received is 0x0019, the actual received bytes are 0x0014, and then the actual bytes are reported without comma separation e.g. "dataFromBLEDev123456".
vi. The LM device can receive a maximum of 20 bytes i.e. 0x14 bytes in one notification packet.
vii. If the remote device sends more than 20 bytes in one packet, then the LM device shows two notification indication messages. E.g. if the remote device sends the string "dataFromBLEDev123456789", the adapter shows "dataFromBLEDev123456" first and then "789".

7. Firmware upgrade on LM devices

LM devices based on the CSRB5348 chipset offer two interfaces to perform a firmware upgrade. The user can send the new firmware image over the air i.e. over the SPP-Bluetooth connection. The SPP connection needs to be established with the remote device, then AT commands can put the LM device into the Firmware upgrade mode. The Remote SPP device then sends the new firmware image over the SPP connection.

In the UART interface method, the user can connect the LM device to a PC and open a COM port to communicate with the LM device. The user then needs to issue AT commands to put the LM device in the firmware upgrade mode and then the actual file can be sent over the UART interface.

The Upgrade interface is set to "OTA" by default on LM devices. Users can issue the AT command "AT*UPGRADEINT=OTA / AT*UPGRADEINT=UART" to change the upgrade interface or use the command "AT*UPGRADEINT=?" to query the current upgrade interface.

```
at*upgradeint=?at*upgradeint=?
OK
REP*:UPGRADEINT=UART
at*upgradeint=OTAat*upgradeint=OTA
OK
at*upgradeint=?at*upgradeint=?
OK
REP*:UPGRADEINT=OTA
at*upgradeint=UARTat*upgradeint=UART
OK
at*upgradeint=?at*upgradeint=?
OK
REP*:UPGRADEINT=UART
```

In this section, the term "new image" refers to the firmware image to which the LM device will be upgraded to.

The new image needs to fulfill the criteria below:

i. New Firmware image is provided as a "xxxxxxx.bin" file to user.
ii. User should have this image on PC/device used to connect to the LM device for the OTA/UART upgrade.
iii. LM device can only be upgraded with the image provided by LM Technologies.

7.1 Firmware upgrade over UART interface

When UPGARDEINT setting is set to UART, the firmware on LM device can be upgraded over the local UART interface i.e. the Rx line of LM devices can receive the new image.

The section below describes the steps for upgrading the firmware over the UART interface.

i. To initiate the firmware upgrade on the LM device, make sure that it is not connected to any other Bluetooth or BLE device.
ii. Also ensure that the UARTCONF setting is set to “UART” before starting the upgrade procedure. If UART configuration is set to Latency, the new firmware image will not be successfully downloaded and the LM device will not upgrade. In this case the LM device might not give any error response.
iii. The AT commands below show how to enter the Firmware upgrade mode for the UART upgrade interface.

```
at*upgradeint=?at*upgradeint=?
OK
REP*:UPGRADEINT=UART

AT*uartconf=?AT*uartconf=?
OK
REP*:UART_CONFIG=UART_THROUGHPUT

at*upgrade=LMUPDATEV_068LM_SPP+GAPCEN_0115at*upgrad
e=LMUPDATEV_068LM_SPP+GAPCEN_0115
OK
 Upgrade Interface is UART.
 Ready For OTA file receive...
```

iv. After the LM device outputs the string “Ready For OTA file receive…” the user can start sending the file over UART.
v. Once the LM device starts receiving the file, it keeps updating the status messages on the UART for the upgrade progress.
vi. After the new firmware image transfer is completed, the LM device will process it internally which can take around 20 seconds. During this time there should be no characters received by the LM device on Rx line, otherwise the received characters are considered as part of new image and upgrade procedure may fail.
vii. An example of a successful Firmware upgrade can be seen below. After the upgrade procedure, the LM device will reboot itself with the new image and show the power on messages and LED sequence.

```
at*upgradeint=?at*upgradeint=?
OK
REP*:UPGRADEINT=UART
AT*uartconf=?AT*uartconf=?
OK
REP*:UART_CONFIG=UART_THROUGHPUT
at*upgrade=LMUPDATEV_068LM_SPP+GAPCEN_0115at*upgrad
e=LMUPDATEV_068LM_SPP+GAPCEN_0115
OK
```

```
 Upgrade Interface is UART.
 Ready For OTA file receive...PTN2 Sign_OK
SinkClosed  V_Pass_2SPP+GapCentral_Message_Loop
```

7.2 Firmware upgrade over the Air

This procedure is also referred to as an OTA firmware upgrade, i.e. Over the Air Firmware Upgrade. This section describes the procedure to perform an over the air firmware upgrade.

Note: The LM device can only receive new images over the SPP profile. The adapter does not support other Bluetooth profiles to receive a new image.

7.2.1 Peer Bluetooth device requirements:

i. The peer Bluetooth device should support sending files over SPP profile (some mobile applications may not support this).
ii. LM technologies other SPP profile products e.g. LM048/LM058/LM072/LM961/LM074/LM068 can be used as a remote device to send the new image.
iii. Peer device should support pairing requirements.
iv. LM devices will only connect with Paired devices so it will only receive new images from paired devices.

7.2.2 Pairing and Authentication of Peer device:

i. LM device can pair with remote device with fixed PIN for BT2.0 device.
ii. LM device can pair with remote device with dynamic PIN and MITM protection enabled for BT2.1 and above devices.
iii. For detailed pairing procedure of LM devices with AT commands, refer to the section 8: “Simple Secure Pairing between LM device and remote device”

7.2.3 LM device requirements:

i. LM device can be SPP master (initiate connection with remote device) or SPP Slave (Accept connection request from remote device).

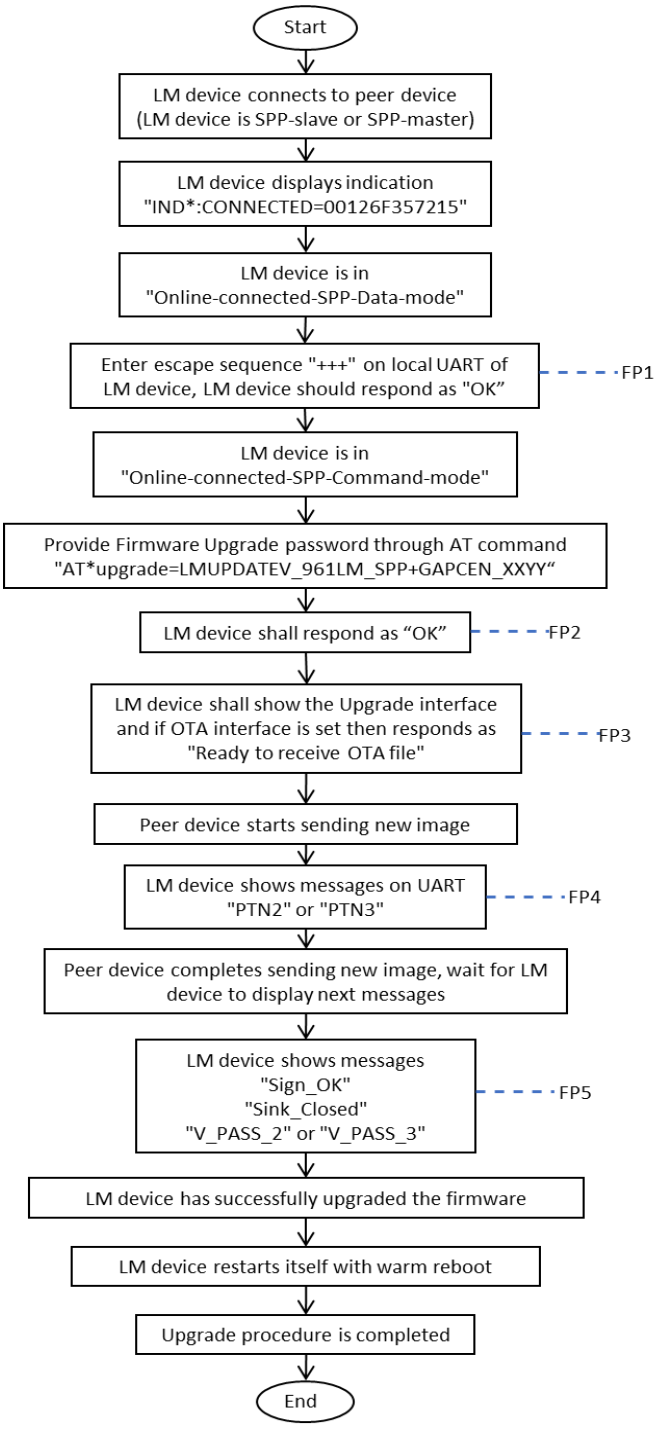
7.3 OTA Firmware upgrade procedure Flow chart

The flow chart below illustrates the firmware upgrade procedure, highlighting messages when the upgrade operation is successful.

The comments show the failure points as FP1 to FP5.
The cause of failure points and actions to overcome them are discussed in the subsequent section.

Note: During the upgrade procedure, after the LM device displays the message “Ready to receive OTA file”, if the user fails to send the image to the LM device, the LM device cannot terminate the OTA mode. The user must provide power-on/off cycle to come out of OTA upgrade mode.

Figure 1: Firmware Upgrade Flowchart



Note: The firmware upgrade password is dependent on the current firmware version.

7.4 Possible Failure points and corrective actions

The following section describes the possible failure points while performing an Over the Air firmware upgrade. It also covers possible reasons for error and what a user can do to correct it.

7.4.1 Failure point 1:

i. Once the LM device connects to the remote SPP device, it enters in Online-connected-data-mode.
ii. User need to enter the escape sequence to enter in the Online-connected-command-mode.
iii. After entering the escape sequence “+++”, the LM device should respond as OK.
iv. If LM device does not respond as “OK” (it will not reply as “ERR” as it is in Online-connected-data-mode), it is still in online-connected-data-mode.
v. LM device is ready to process firmware upgrade even if there are multiple attempts of failure to enter in Online-connected-command-mode.
vi. User cannot process further steps if LM device does not enter in online-connected-command-mode.

7.4.2 Failure point 2:

i. Once the LM device enters in the Online-connected-command-mode, the user should provide the firmware upgrade password through AT commands.

ii. If the user provides the correct firmware upgrade password, the LM device responds to the command as “OK” and displays the message “Ready to receive OTA file”
iii. The LM device replies as “ERR”
    a. If the user enters a wrong password for upgrade command, LM device responds as ERR.
    b. Firmware upgrade password is dependent on current firmware version of the LM device.
    c. E.g. if the current firmware version on the adapter is “SPPC_XXYY”, the firmware upgrade password will be “AT*upgrade=LMUPDATEV_abcLM_SPP+GAPCEN_XXYY”.
    d. In the “AT*upgrade” command the string after “=” is case sensitive and should be entered in all uppercase (for letters).
    e. The field abc refers to the actual LM device number i.e. 961/074/068 and XXYY refers to the major and minor firmware.
    f. If the LM device replies as “ERR”, the user should try entering the correct password and try to get the message “Ready For OTA file receive…”.
    g. The LM device can process successfully even though it already had more than one failure attempt while getting “Ready to receive OTA file” message.

7.4.3 Failure point 3:

i. Once the LM device enters in Online-connected-command-mode, the user should provide the firmware upgrade password through AT command.
ii. If the user provides the correct firmware upgrade password, the LM device responds to the command with “OK”.
iii. After displaying the OK response, the LM device displays the message “Ready For OTA file receive…” if it is in the state to receive the upgrade image.
iv. LM device replies as “State Err”
    a. If the firmware upgrade password is correct but LM device is not in the state (disconnected from the remote device) to perform the upgrade procedure, it will respond as “State err” to the “AT*upgrade” command.
    b. The LM device will display “State err” message if it is not connected to a remote device or it has lost the current connection.
    c. If LM device replies as “State err”, the user cannot proceed to the firmware upgrade procedure and should check for the SPP connection of LM device with peer device.
    d. In this case, the user shall start the upgrade procedure from the beginning.
    e. Refer to the image below:

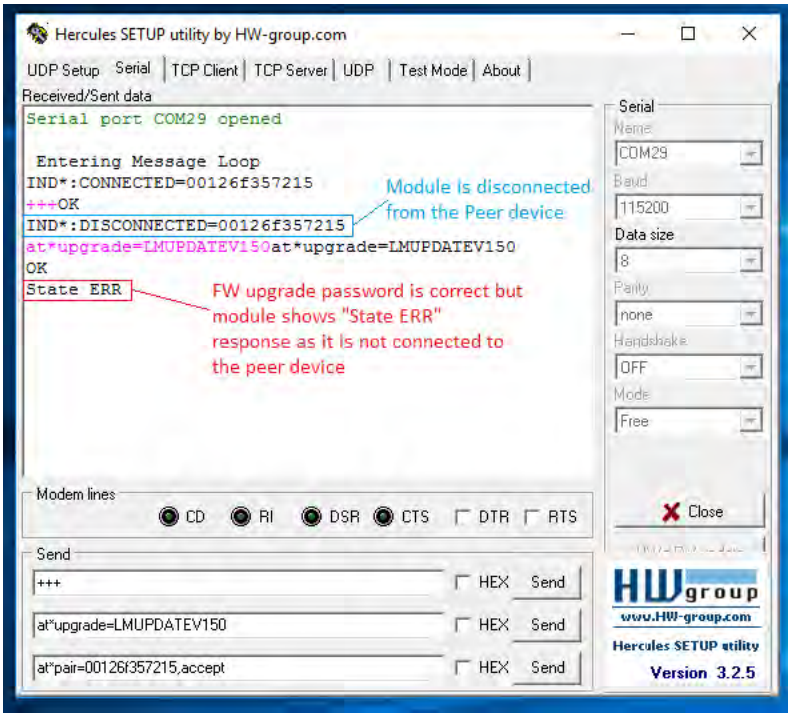


Figure 2: UART messages when the adapter is not connected to the peer device

7.4.4 Failure point 4:

i. After the LM device shows the message “Ready to receive OTA file”, it is ready to receive the upgrade image.
ii. After the peer device begins sending the file, the LM device opens internal memory partition (PTN2 or PTN3) to store this image.
iii. The message “PTN2”/”PTN3” indicates that the LM device is writing the file to partition2/partition3.
iv. This message should appear one or two seconds after the peer starts sending the new image file.
v. If the LM device does not show this message, but the peer device indicates that the file has been sent, an error has occurred.
vi. In this case the user should power the adapter on and off or reset the adapter with the “AT*reset=1” command and try the procedure from start again.
vii. Refer to the image below

Figure 3: UART messages when the adapter opens a partition to write a new image

7.4.5 Failure point 5:

i. The message “PTN2”/”PTN3” indicates that the LM device is writing a file to partition2/partition3, LM device is receiving the file and writing it to the partition.
ii. After the peer device shows that it has successfully sent the file, LM device will close the partition.
iii. After the partition is closed, the message “Sign_OK” displayed by LM device indicates that the LM device has received correct Signature from the new image.
iv. The message “Sink_Closed” indicates that the LM device has closed the partition.
v. After the partition is closed, the adapter takes 20-25 seconds to process the image and apply the checks. In this duration, there should be no data sent from the remote device over SPP or user should not sent any data on local UART of LM device.
vi. If the upgrade procedure is completed successfully then the LM device shows the message “V_PASS_2” / “V_PASS_3”.
vii. If adapter shows the “failed-CRC” message:
    a. If CRC of the received image is not matching to the CRC mentioned in the image, the adapter shows a “Failed-CRC” message.
    b. This may be because of disturbances/interferences in wireless transmission. In this case, user should power-on-off the LM device and repeat the procedure from beginning.
    c. Make sure that the UARTCONF setting on the LM device is set to “UART_THROUGHPUT”

```
AT*UARTCONF=?
OK
REP*:UART_CONFIG=UART_THROUGHPUT
```

    d. Make sure that the remote device which is sending the new image also has maximum UART throughput setting.
    e. Refer to the image below:

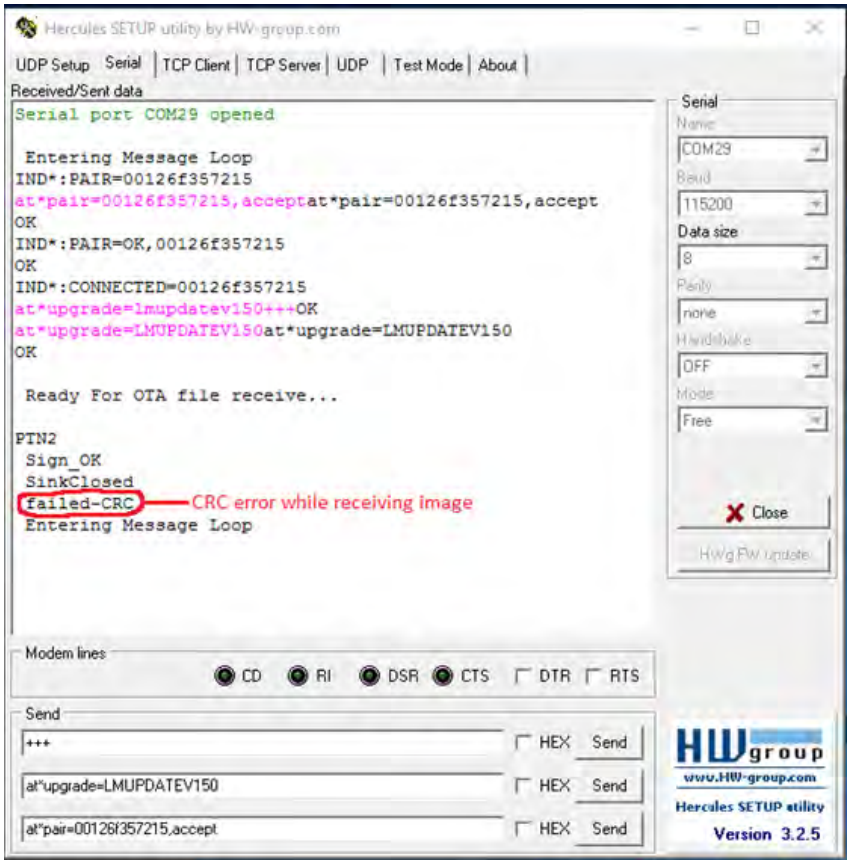


Figure 4: UART messages when the CRC of the received image does not match

viii. If the adapter shows “failed-Sign” message:
   a. If adapter shows the “failed-Sign” message, it indicates that the signature of adapter firmware is different than the signature of the new image.
   b. This indicates that the firmware upgrade procedure has been followed correctly but there is error in new image provided for the firmware upgrade.
   c. If the image is not suitable for performing a firmware upgrade the user should contact LM technologies.
   d. The adapter restarts itself with a warm reset and starts executing the existing image.
   e. Refer to the image below:

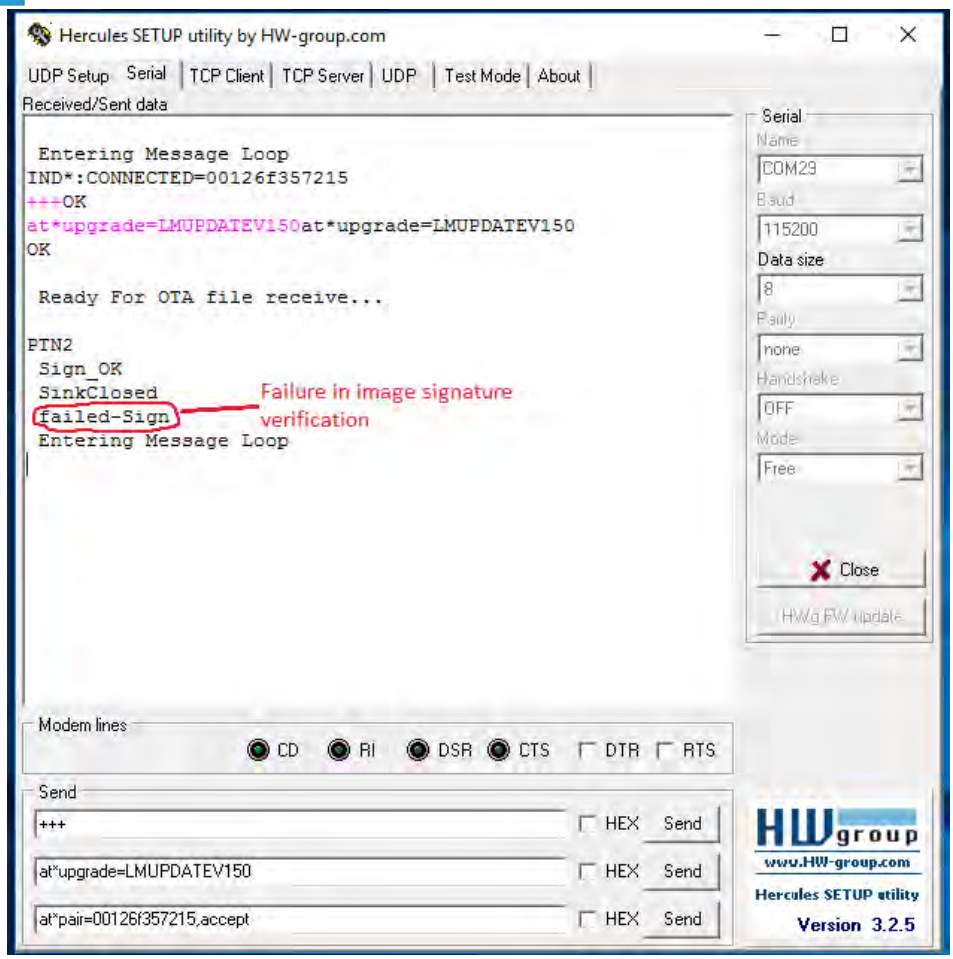


Figure 5: UART messages showing a failure in image verification

7.4.6 Successful firmware Upgrade:

i. The image below depicts the messages shown by the LM device during a successful firmware upgrade procedure.
ii. After showing message “V_Pass_2” or “V_Pass_3”, the LM device performs warm reset and starts executing the new image.
iii. In the image below, the message “Entering Message Loop” indicates that the device has performed warm reboot. The message “GATT Initialised” indicates that the new image has GATT/BLE functions enabled.

```
 NAME=LM961_2_Default
 PAIR=ON
 DCOV=ON
 BAUD=5
 STOP=0
 PARITY=0
 FLOW=OFF
 SPPRole=DUAL
 ACON=Off
 DPIN=Off
 PIN=1234
 VER=1.50
REP*:SETTINGS=END
at*addr=?at*addr=?
OK
REP*:ADDR=00025b00a5a5
IND*:PAIR=00126f357215
at*pair=00126f357215,acceptat*pair=
00126f357215,accept
OK
IND*:PAIR=OK,00126f357215
OK
IND*:CONNECTED=00126f357215
+++OK
at*upgrade=LMUPDATEV150at*upgrade=LMUPDATEV150
OK

 Ready for OTA file receive...

PIN2
 Sign_OK ---------- Signature of image is correct
 SinkClosed ---------- Sink Closed Successfully
  V_Pass_2 ---------- Image running from Partition 2
 Entering Message Loop ---- Device is running updated image
 GATT Initialised ---- Updated image has GATT enabled
```

Figure 6: UART messages showing successful firmware upgrade

8. Simple Secure Pairing between LM device and remote device

This section describes the messages from the LM device during the pairing procedure. It also covers the AT commands that a user will need to provide as per the settings of DPIN, MITM and IOTYPE.

The LM device uses BT2.1 security supporting the dynamic PIN or Passkey, but is also compatible with BT2.0 devices which shares fixed PIN during the pairing procedure.

8.1 Pairing of LM device (BT2.1) with BT2.0 devices

Here the BT2.0 device is treated as LM Technologies' LM048 device, with firmware version 6.57. When the LM068 has DPIN as DPIN=OFF, it is compatible with BT2.0 devices. When DPIN=OFF, the LM device does not care about MITM, IOTYPE settings.
When DPIN is OFF, LM device uses PIN during the pairing procedure with remote devices. Default PIN is 1234, users can change this to numeric only, Alpha only or alphanumeric.
As per Bluetooth standards, maximum of 16 characters are allowed in PIN setting.

8.1.1 LM device has setting DPIN=OFF

i. When the pairing procedure is started on the LM device, LM device accepts the pairing requests.
ii. If the remote device is BT2.0 device, it uses Fixed PIN.
iii. If the fixed PIN of LM device is same as the other device, then pairing is successful.
iv. After completing the pairing procedure, the LM device indicates the status of pairing to user e.g. "IND*:PAIR=OK,00126f357215" or "IND*:PAIR=FAIL,00126f357215" .
v. If the fixed PIN of LM device is not same as remote device's PIN, pairing fails.

8.2 Pairing of LM device (BT2.1) with BT2.1 devices

Here the BT2.0 device is treated as LM Technologies' LM048 adapter with firmware version 6.19. The passkey used during the pairing procedure is dependent on the IO-type setting on the LM device.

If IO-type is keyboard only, the LM device will expect the passkey from the user and use it internally for the pairing procedure.

When the IO-type is display only, the LM device will display the passkey and the user should use the same passkey on the remote device to complete the pairing procedure.

When IO-type is Display with yes/no confirmation, the LM device displays passkey and expects confirmation from the user whether the passkey for remote device is the same.

When the IO-type is NO-INOUT i.e. no input no output then it depends on the peer device whether the pairing will be successful or not. If the IO-type is No-input-no-output, MITM should be off otherwise the LM device will never be able to pair with a remote device.

If the LM device and remote device has IO-type as No-input-no-output and MITM as off, then devices may pair successfully by "just works" pairing type.

8.2.1 LM device has settings DPIN=on, MITM=on, IO-type=Keyboard-only

i. After the LM device indicates Pairing as "IND*:PAIR,00126f357215" and the user accepts the Pairing request with "AT*PAIR=00126f357215, accept", the LM device starts the pairing procedure.
ii. IO-type as Keyboard only indicates that user can provide Passkey for pairing using AT commands.
iii. The Bluetooth stack will use this passkey for completing the pairing procedure with the remote device.
iv. During the pairing procedure, the LM device displays the message "IND*:PASSK=?". This indicates that the LM device requires a Passkey from the user.
v. The user should respond to this with "at*passkey=1234". i.e. the passkey for the remote device is 1234. It can be any integer in range of 32bit value.
vi. After completing the pairing procedure, the LM device indicates the status of pairing to the user e.g. "IND*:PAIR=OK,00126f357215" or "IND*:PAIR=FAIL,00126f357215" .

8.2.2 LM device has settings DPIN=on, MITM=on, IO-type=display only

i. After the LM device starts the pairing procedure with a remote device and has IO-capability as Display only, the LM device shows the Passkey for the remote device as "IND*:PASSKEY=311303" here number 311303 is for reference only and should vary for every device.
ii. IO-type as Display only indicates that the Passkey generated by the Bluetooth stack for pairing is displayed by the LM device.
iii. The user should ensure that the other device uses the same passkey as provided by the LM device in above indication.
iv. If the remote device uses the same passkey, then the pairing procedure should be completed successfully.
v. After the pairing procedure is completed, the LM device indicates this as "IND*:PAIR=OK,00126f357215" . 00126f357215 is the reference BD address and LM068 will show the remote devices BD-Address.

8.2.3 LM device has settings DPIN=on, MITM=on, IO-type=Display Y/N

i. After the LM device starts the Pairing procedure with the remote device and has IO-capability as Display_YN i.e. Display passkey and Confirmation is required as Yes or No, LM device shows the Passkey for remote device and expects the confirmation from user as yes or No.
ii. The passkey is displayed by the LM device as "IND*:PASSKEY=756830".
iii. User shall make sure the pass key on the remote device is also same as that displayed by LM device and provide confirmation with the AT command as "at*passcfm=00126f357215,Yes" or "at*passcfm=00126f357215,No".

8.2.4 LM device has settings DPIN=on, MITM=on, IO-type=no-Input-no-output

i. Pairing with the remote device may or may not be successful and depends on MITM and IO-type settings of remote device.
ii. If the remote device also has the same settings, then pairing may be successful otherwise the pairing might fail.

8.2.5 LM device has settings DPIN=on, MITM=off, IO-type=no-Input-no-output

i. Pairing with the remote device might be successful if the remote device also has DPIN=on, MITM=off and IO-type as no one.
ii. If the remote device has MITM=on or IO type other than no input no output, the LM device cannot pair with that device.

9. LED Indication

9.1 Power on LED sequence

1. All LEDs blink fast during power on for 3 seconds. Note that all LEDs will blink approximately 6 to 7 times.
2. The LM device shows the power on LED sequence after AT*Reset=1 and AT*Reset=2 commands.

9.2 LED0

1. LED0 (RED LED on LM068) is constantly ON to indicate that the LM device is powered and is ready to process AT commands
2. If LED0 is not ON, the LM device may not be powered correctly or not initialised.
3. The state of LED0 is irrespective of Bluetooth connection or pairing state.

9.3 LED1

1. On LM devices, LED1 (Yellow LED on LM068) indicates the data transfer in the SPP connected state.
2. When the LM device is not connected to the remote SPP device, LED1 should be OFF.
3. When the LM device is connected to remote SPP device, LED1 is ON while the LM device is sending/receiving data to/from the remote device.
4. LED1 should be off when there is no active data transfer on the Bluetooth SPP connection.

9.4 LED2

9.4.1 SPP Connected state:

1. LED2 (Blue LED on LM068) will constantly stay ON when the module/LM device is connected to the remote device over a SPP connection.
2. LED2 will constantly stay ON when it is connected to a remote device while its role is slave or master.

9.4.2 Slave-mode:

1. When the module/LM device is in slave mode, LED2 will keep blinking fast until the module/LM device enters Connected state or Pairing mode.

9.4.3 Master-mode:

1. When the module/LM device is not connected to a remote device and is in master mode, LED2 will blink slowly until the module/LM device enters Pairing state or Connected state.

9.5 Pairing State

1. When the LM device is in pairing mode, LED-1 and LED2 will keep blinking fast until pairing is completed.

10.Appendix

10.1 Abbreviations

SSP	Simple Secure Pairing
BT	Bluetooth
BLE	Bluetooth low energy
BD-Address	Bluetooth address of device
BT2.0	Bluetooth 2.0 stack
BT2.1	Bluetooth 2.1 stack
MITM	Man In The Middle protection
IOTYPE	Input Output Type (IO capability of device)
DPIN	Dynamic PIN
PIN	Personal Identification Number
OTA Upgrade	Over The Air Upgrade

10.2 BLE Peripheral characteristics

Characteristic	Bit field for characteristic	Indication on LM068	Description
broadcast	0x01	“Bd”	Broadcasts of the Characteristic Value User cannot read or write on this characteristic
read	0x02	"Rd "	Reads of the Characteristic Value. User can read this characteristic with RDCHARVAL command
write_cmd	0x04	"Wr_cmd "	Writes of the Characteristic Value without response. User can write on this characteristic with AT*WRWORESP command
write	0x08	"Wr_req "	Writes of the Characteristic Value with response.

			User can write on this characteristic with AT*WRCHARVAL command
notify	0x10	"CCFG "	Client configuration flag for notification enable If user enables this flag, remote device shows notification
indicate	0x20	"Indi "	Indications of a Characteristic Value with acknowledgement. LM068 will show indication message if receives data form this characteristic
write_sig	0x40	"Wr_signed "	Signed writes to the Characteristic Value using Signed Write Command. User can write on this characteristic with AT*SIWRWORESP command

10.3 GATT UUID type

1. All UUID values are in Hex.
2. 16-bit Attribute UUID is represented as “1801”
3. 32-bit UUID is represented as “32005b32”
4. All UUIDs are Big Endian, i.e. for example 128-bit UUID 00112233-4455-6677-8899-aabbccddeeff
5. uuid[0] = 0x00112233, uuid[1] = 0x44556677, uuid[2] = 0x8899aabb, and uuid[3] = 0xccddeeff.
6. If the service-UUID is 128-bit, it is completely mentioned in the report of FindServ e.g. “00005500-d102-11e1-9b23-00025b00a5a5”
7. If the characteristic has 128-bit UUID then only first 32 bits are shown e.g.

8. “00005501” is shown whereas the actual 128-bit UUID is “00005501-D10211E1-9B230002-5B00a5a5” here the remaining bits are same as that of the 128-bit Service UUID shown above.

10.4 GATT_Status_code

The BLE stack outputs an error if the required operation fails. The table below lists the possible error codes with a description.

Sr No	Error code	Error description
1	0x0	gatt_status_success
2	0x1	gatt_status_invalid_handle
3	0x2	gatt_status_read_not_permitted
4	0x3	gatt_status_write_not_permitted
5	0x4	gatt_status_invalid_pdu
6	0x5	gatt_status_insufficient_authentication
7	0x6	gatt_status_request_not_supported
8	0x7	gatt_status_invalid_offset
9	0x8	gatt_status_insufficient_authorization
10	0x9	gatt_status_prepare_queue_full
11	0xa	gatt_status_attr_not_found
12	0xb	gatt_status_not_long
13	0xc	gatt_status_insufficient_encr_key_size
14	0xd	gatt_status_invalid_length
15	0xe	gatt_status_unlikely_error
16	0xf	gatt_status_insufficient_encryption
17	0x10	gatt_status_unsupported_group_type
18	0x11	gatt_status_insufficient_resources
19	0x12	gatt_status_application_error
20	0x13	gatt_status_initialising
21	0x14	gatt_status_failure
22	0x15	gatt_status_att_reg_failure
23	0x16	gatt_status_att_db_failure
24	0x17	gatt_status_max_connections
25	0x18	gatt_status_abnormal_disconnection
26	0x19	gatt_status_link_loss

Sr No	Error code	Error description
27	0x1a	gatt_status_mtu_already_exchanged
28	0x1b	gatt_status_value_mismatch
29	0x1c	gatt_status_rej_psm
30	0x1d	gatt_status_rej_security
31	0x1e	gatt_status_key_missing
32	0x1f	gatt_status_connection_timeout
33	0x20	gatt_status_retrying
34	0x21	gatt_status_peer_aborted
35	0x73	gatt_status_device_not_found
36	0x74	gatt_status_sign_failed
37	0x75	gatt_status_busy
38	0x76	gatt_status_timeout
39	0x77	gatt_status_invalid_mtu
40	0x78	gatt_status_invalid_uuid
41	0x79	gatt_status_success_more
42	0x7a	gatt_status_success_sent
43	0x7b	gatt_status_invalid_cid
44	0x7c	gatt_status_invalid_db
45	0x7d	gatt_status_db_full
46	0x7e	gatt_status_invalid_phandle
47	0x7f	gatt_status_invalid_permissions

10.5 BLE Service UUIDs

BLE Service UUIDs for reference only.

Sr No	Service	UUID
1	Generic Access	0x1800
2	Alert Notification Service	0x1811
3	Automation IO	0x1815
4	Battery Service	0x180F
5	Blood Pressure	0x1810
6	Body Composition	0x181B
7	Bond Management Service	0x181E
8	Continuous Glucose Monitoring	0x181F
9	Current Time Service	0x1805
10	Cycling Power	0x1818
11	Cycling Speed and Cadence	0x1816
12	Device Information	0x180A
13	Environmental Sensing	0x181A
14	Fitness Machine	0x1826
15	Generic Attribute	0x1801
16	Glucose	0x1808
17	Health Thermometer	0x1809
18	Heart Rate	0x180D
19	HTTP Proxy	0x1823
20	Human Interface Device	0x1812
21	Immediate Alert	0x1802
22	Indoor Positioning	0x1821
23	Internet Protocol Support Service	0x1820
24	Link Loss	0x1803
25	Location and Navigation	0x1819
26	Mesh Provisioning Service	0x1827
27	Mesh Proxy Service	0x1828
28	Next DST Change Service	0x1807
29	Object Transfer Service	0x1825
30	Phone Alert Status Service	0x180E
31	Pulse Oximeter Service	0x1822
32	Reference Time Update Service	0x1806
33	Running Speed and Cadence	0x1814
34	Scan Parameters	0x1813
35	Transport Discovery	0x1824
36	Tx Power	0x1804
37	User Data	0x181C
38	Weight Scale	0x181D

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.

PART 15 INFORMATION TO THE USER

NOTE: 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.

*RF warning for Mobile device:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

IC Warning:

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

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

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

(1) l'appareil nedoit pas produire de brouillage, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

la distance entre l'utilisateur et le dispositif ne doit pas être inférieure à 20 cm