

OPL1000

ULTRA-LOW POWER 2.4GHZ WI-FI + BLUETOOTH SMART SOC

AT Instruction Set and Examples



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1. INTRODUCTION

1.1. Scope of Document Application

This file is a consolidated description of functions of OPL1000 AT Command Set, and of Application Methods.

The Command set mainly comprises of Basic AT Commands, WIFI Function AT Commands, TCP/IP Function AT Commands, and BLE Function AT Commands, etc. OPL1000 AT Commands, by default, use serial-port UART1 for transmission, with baud rate of 115200bps, and format of "8N1".

1.2. Command Descriptions

AT Commands can be categorized into 4 types:

| Type | Command Format | Description |
|-------------------------|----------------|----------------------------------------------------------------------------------------------------|
| Test Command(s) | AT+ <x>=? | This command is used for inquiry of the parameters and value range of installation commands. |
| Inquiry Command(s) | AT+ <x>? | This command is used for restoring to the current value of parameters |
| Installation Command(s) | AT+ <x>=<...> | This command is used for install user-defined parameter values. |
| Execution Command(s) | AT+ <x> | This command is used for variable parameter functions controlled by internal procedure of modules. |

Note :

- Not every AT command contains instructions of all 4 types described above.
- The value contained inside [] is of default value, which can be left blank, or may not have displayed value.
- AT commands do not distinguish between upper and lower cases.
- AT commands end with "ENTER" \r\n. Please note to install serial-port tool as "New Line Mode".

2. BASIC AT COMMANDS

2.1. List of Basic AT Commands

| Command(s) | Description |
|----------------|---------------------------------------------------|
| AT | Test AT Module |
| AT+RST | Re-Activate Module |
| AT+GMR | Check Version Message |
| AT+GSLP | Enter Deep-Sleep Mode |
| ATE | Terminate Echo Function |
| AT+RESTORE | Restore to Factory Setting |
| AT+UART_CUR | Set up current UART Temporary Setting |
| AT+UART_DEF | Set up UART Setting, and Save to Flash |
| AT+SLEEP | Install Sleep Mode |
| AT+SYSRAM | Inquiry of Currently Remaining RAM Size |
| AT+MACADDRDEF | Install Device Origin Mac Address Stored to Flash |
| AT+RFHP | Install RF Power |
| AT+READFLASH | Read Flash |
| AT+WRITEFLASH | Write Flash |
| AT+ERASEFLASH | Erase Flash |
| AT+DHCPARPCCHK | Install DHCP ARP Check Procedure |
| AT+MACDATARATE | Install Wi-Fi Tx Data Rate |
| AT+WIFIMACCFG | Install Wi-Fi Related Parameters |

2.2. Description of Basic AT Commands

2.2.1. AT—Testing of AT Module

| | |
|--------------------------|----|
| Command Execution | AT |
| Feedback | OK |
| Parameter Description(s) | - |

2.2.2. AT+RST—Reset Module

| | |
|--------------------------|------------------------------------------------------------------------|
| Command Execution | AT+RST |
| Feedback | OK |
| Parameter Description(s) | - |
| Note | After having executed this command, the system will reboot, by default |

2.2.3. AT+GMR—Version Inquiry Message

| | |
|--------------------------|---------------------------------------------------------------------|
| Command Execution | AT+GMR |
| Feedback | <AT version info> <SDK version info> <compile time> OK |
| Parameter Description(s) | • <AT version info> • <SDK version info> • <compile time> |

2.2.4. AT+GSLP—Entry into Deep-Sleep Mode

| | |
|----------------|-----------------------------------------------------------------------------------------------------|
| Command | AT+GSLP= <Duration>, <I/O> |
| Execution | |
| Feedback | <Duration> OK |
| Parameter | <Duration> : Install OPL1000 sleep duration in unit of millisecond. |
| Description(s) | OPL1000 will be automatically woken after the sleep duration lapses. <I/O> GPIO number to Wakeup |

2.2.5. ATE—On-Off Echo Function

| | |
|----------------|--------------------------|
| Command | ATE |
| Execution | |
| Feedback | OK |
| Parameter | • ATE0 : Switch-off Echo |
| Description(s) | • ATE1 : Switch-on Echo |

2.2.6. AT+RESTORE—Restore to Factory Setting

| | |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command | AT+RESTORE |
| Execution | |
| Feedback | OK |
| Note | By restoring to factory setting, it will erase all parameters stored in Flash, as all parameters will be of default value. ° Restore factory setting will result in system reboot. |

2.2.7. AT+UART_CUR—Install UART Temporary Setting

| Command(s) | Inquiry of Command(s) : AT+UART_CUR? | Designate Command(s) : AT+UART_CUR= <baudrate>,<databits>,<stopbits>,<parity>,<flow control> |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| Feedback | <div>+UART_CUR:<baudrate>,<databits>,<stopbits>,<parity>,<flow control></div> <div>OK</div> <div>The inquiry returns UART actual parameter values, and due to clock division, it is normal to have some deviance in value between the actual and default parameter values of UART.</div> | |
| Parameter Description(s) | <div>• <baudrate> : UART baudrate</div> <div>• <databits></div> <div>▸ 5 : 5 bit databit</div> <div>▸ 6 : 6 bit databit</div> <div>▸ 7 : 7 bit databit</div> <div>▸ 8 : 8 bit databit</div> <div>• <stopbits> :</div> <div>▸ 1 : 1 bit stopbit</div> <div>▸ 2 : 1.5 bit stopbit</div> <div>▸ 3 : 2 bit stopbit</div> <div>• <parity> :</div> <div>▸ 0 : None</div> <div>▸ 1 : Odd</div> <div>▸ 2 : Even</div> <div>• <flow control> :</div> <div>▸ 0 : Disable Flow Control</div> <div>▸ 1 : Reserved</div> | |

| | | |
|------------|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+UART_CUR? | Designate Command(s) : AT+UART_CUR=<baudrate>,<databits>,<stopbits>,<parity>,<flow control> |
| | ▶ 2 : Reserved ▶ 3 : Enable both RTS & CTS | |
| Note | • This device does not save to Flash • Flow control requires hardware support • Range of Baudrate supported : 80 ~ 1000000 | |
| Examples | AT+UART_CUR=115200,8,1,0,3 | |

2.2.8. AT+UART_DEF—Install UART Setting, and Save to Flash

| | | |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+UART_DEF? | Designate Command(s) : AT+UART_DEF=<baudrate>,<databits>,<stopbits>,<parity>,<flow control> |
| Feedback | +UART_DEF:<baudrate>,<databits>,<stopbits>,<parity>,<flow control> OK | |
| Parameter Description(s) | • <baudrate> : UART baudrate • <databits> : ▶ 5 : 5 bit databit ▶ 6 : 6 bit databit ▶ 7 : 7 bit databit ▶ 8 : 8 bit databit • <stopbits> : ▶ 1 : 1 bit stopbit ▶ 2 : 1.5 bit stopbit ▶ 3 : 2 bit stopbit | |

| | | |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+UART_DEF? | Designate Command(s) : AT+UART_DEF= <baudrate>,<databits>,<stopbits>,<parity>,<flow control> |
| | <ul style="list-style-type: none"> • <parity> : <ul style="list-style-type: none"> ▸ 0 : None ▸ 1 : Odd ▸ 2 : Even • <flow control> : <ul style="list-style-type: none"> ▸ 0 : Disable Flow Control ▸ 1 : Reserved ▸ 2 : Reserved ▸ 3 : Enable both RTS & CTS | |
| Note | <ul style="list-style-type: none"> • This device will save to Flash, in which the saved data remains even after restarting power-on • Flow control requires hardware support • Range of Baudrate supported : 80 ~ 1000000 | |
| Examples | AT+UART_DEF=115200,8,1,0,3 | |

2.2.9. AT+SLEEP—Install Sleep Mode

| | |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : <sleep mode> = 0 AT+SLEEP= <sleep mode> <sleep mode> = 1,3 AT+SLEEP= <sleep mode> , <I/O> <sleep mode> = 2 AT+SLEEP= <sleep mode> , <Duration> , <I/O> |
| Feedback | OK |
| Parameter | <sleep mode> : |
| Description(s) | ▸ 0 : Terminate Smart-sleep mode |

| | |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : <sleep mode> = 0 AT+SLEEP=<sleep mode> <sleep mode> = 1,3 AT+SLEEP=<sleep mode>, <I/O> <sleep mode> = 2 AT+SLEEP=<sleep mode>, <Duration>, <I/O> |
| | ▶ 1 : Activate Smart-sleep mode <I/O> GPIO number to Wakeup ▶ 2 : Enter into Timer-sleep mode <Duration> : Designate the sleep duration of OPL1000 with unit of millisecond. OPL1000 will automatically wake up from sleep mode. <I/O> GPIO number to Wakeup ▶ 3 : Enter into Deep-sleep mode <I/O> GPIO number to Wakeup |
| Examples | AT+SLEEP=0 AT+SLEEP=1,20 // Wake-up by GPIO 20 AT+SLEEP=2,1000, 20 // Wake-up by GPIO 20 AT+SLEEP=3,20 // Wake-up by GPIO 20 |

2.2.10. AT+SYSRAM—Inquiry of Currently Remaining RAM Size

| | |
|--------------------------|------------------------------------|
| Inquiry of Command(s) | AT+SYSRAM? |
| Feedback | +SYSRAM:<remaining RAM size> OK |
| Parameter Description(s) | <remaining RAM size> : Unit: Byte |
| Examples | AT+SYSRAM? +SYSRAM:148408 OK |

2.2.11. AT+MACADDRDEF—Install Device Origin Mac Address Stored to Flash

| | | |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+MACADDRDEF? | Designate Command(s) : AT+MACADDRDEF= <iface>,<type> |
| Feedback | +MACADDRDEF:<iface_0>,<type>,<iface_1>,<type> OK | |
| Parameter Description(s) | <ul style="list-style-type: none">• <iface> : Device Interface<ul style="list-style-type: none">▸ 0 : Wifi Station▸ 1 : BLE• <type> : MAC address origin of set-up<ul style="list-style-type: none">▸ 0 : From OTP▸ 1 : From Flash | |
| Note | <ul style="list-style-type: none">• This device will save to Flash, in which the saved data remains even after restarting power-on.• Default origin of installed set-up for MAC address as OTP• Once successfully installed, it needs to be powered on in restart in order for MAC address set-up to come into effect. | |
| Examples | AT+MACADDRDEF=0,1 | |

2.2.12. AT+RFHP—RF Power Set up

| Command(s) | Inquiry of Command(s) : AT+RFHP? | Designate Command(s) : AT+RFHP=<rf_power> |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| Feedback | +RFHP:<rf_power> OK | OK |
| Parameter Description(s) | <ul style="list-style-type: none"> • <rf_power> : RF Power ▸ 0 : Wi-Fi LPA and BLE LPA ▸ 15 : Wi-Fi LPA and BLE HPA ▸ 240 : Wi-Fi HPA and BLE LPA ▸ 255 : Wi-Fi HPA and BLE HPA | |
| Note | <ul style="list-style-type: none"> • This device will save to Flash, in which the saved data remains even after restarting power-on • Default set-up as "240": Wi-Fi HPA and BLE LPA • Once successfully installed, it needs to be powered on in restart in order for set-up to come into effect. | |
| Examples | AT+RFHP=240 | |

2.2.13. AT+READFLASH—Read FLASH

| Command(s) | Inquiry of Command(s) : N/A | Designate Command(s) : AT+READFLASH= <address>,<number_of_bytes> |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Feedback | N/A | Success : <byte_0>,<byte_1>,<byte_2>, ...,<byte_n> OK Fail : ERROR |
| Parameter Description(s) | <ul style="list-style-type: none"> • <address> : Flash address (Hexadecimal) ▸ Permissible reading range 0x00000000 ~ 0x000FFFFF • <number_of_bytes> : Number of bytes to be read (Decimal) | |

| | | |
|------------|------------------------------------------------------------|-------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : N/A | Designate Command(s) : AT+READFLASH= <address>,< number_of_bytes> |
| Note | •Not to exceed permissible range | |
| Examples | AT+READFLASH=0x00088000,8 FF,FF,FF,FF,FF,FF,FF,FF OK | |

2.2.14. AT+WRITEFLASH—Write Flash

| | | |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : N/A | Designate Command(s) : AT+WRITEFLASH= <address>, <number_of_bytes>,<byte_0>, <byte_1>,...,<byte_n> |
| Feedback | N/A | Success : OK Fail : ERROR |
| Parameter Description(s) | <ul style="list-style-type: none"> • <address> : Flash Address (Hexadecimal) • Permissible reading range 0x00000000 ~ 0x000FFFFF • <number_of_bytes> : Number of bytes to be read (Decimal) • <byte_0>~<byte_n> : Write in value(Hexadecimal) | |
| Note | <ul style="list-style-type: none"> •Not to exceed permissible range •Before write-in, we recommend to execute AT+READFLASH so as to confirm the storage space of Flash reserved for write-in able to accommodate write-in (all values being "0xFF"); If not, please execute AT+ERASEFLASH first to clear all sectors to accommodate write-in. •As AT command only allows maximum 255 characters, so according to the format shown in the examples, there can only be 76 bytes allowed for any single write-in. •If the number designated by <byte_0>~<byte_n> is less than that by <number_of_bytes>, write-in of <byte_n> can be continuously executed until it reaches the cap number represented by <number_of_bytes>, which would ensure all designated sectors are of the same value. | |

| Command(s) | Inquiry of Command(s) : | Designate Command(s) : |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| | N/A | AT+WRITEFLASH= <address>, <number_of_bytes>,<byte_0>, <byte_1>,...,<byte_n> |
| Examples | 1. AT+WRITEFLASH=0x00088000,4,F0,F1,F2,F3 OK AT+READFLASH=0x00088000,8 F0,F1,F2,F3,FF,FF,FF,FF OK 2. AT+WRITEFLASH=0x00089000,8,A0 OK AT+READFLASH=0x00089000,16 A0,A0,A0,A0,A0,A0,A0,A0,FF,FF,FF,FF,FF,FF,FF,FF OK | |

2.2.15. AT+ERASEFLASH—Erase Flash

| Command(s) | Inquiry of Command(s) : | Designate Command(s) : |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| | N/A | AT+ERASEFLASH= <start_add ress_of_sector>,<number_of_ sectors> |
| Feedback | N/A | Succeed : OK Fail : ERROR |
| Parameter Description(s) | <ul style="list-style-type: none"> • <start_address_of_sector> : sector start address ° (Hexadecimal) <ul style="list-style-type: none"> ▸ Permissible value to be 0x00000000, 0x00001000, 0x00002000, ... , 0x0000FE000, or 0x000FF000 • <number_of_sectors> : Number of sectors to be erased (Decimal) <ul style="list-style-type: none"> ▸ Starting with the addresses of the designated sector to be erased | |

| | | |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : N/A | Designate Command(s) : AT+ERASEFLASH= <start_address_of_sector>, <number_of_sectors> |
| ▸ Size of a single sector is 4096 bytes. | | |
| Note | • Erasure of Flash is done by the unit of sector, with each erasure takes out at least 4096 bytes. | |
| Examples | 1. Erase 0x00089000 ~ 0x00089FFF : 4096 bytes AT+ERASEFLASH=0x00089000,1 OK 2. Erase 0x00088000 ~ 0x00089FFF : 8192 bytes AT+ERASEFLASH=0x00088000,2 OK | |

2.2.16. AT+DHCPARPCHK—Set up DHCP ARP Check Procedure

| | | |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+DHCPARPCHK? | Designate Command(s) : AT+DHCPARPCHK= <chk_mode> |
| Feedback | +DHCPARPCHK:<chk_mode> OK | OK |
| Parameter Description(s) | • < chk_mode > : 0 : Disable 1 : Enable | |
| Note | • This device will save to Flash, in which the saved data remains even after restarting power-on. • Default set-up as "Enable" | |

| | | |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+DHCPARPCHK? | Designate Command(s) : AT+DHCPARPCHK=<chk_mode> |
| | •Once successfully installed, it does not need to be powered on in restart, as long as the connection is terminated before re-connected again for set-up to come into effect. | |
| Examples | AT+DHCPARPCHK=0 OK | |

2.2.17. AT+SWITCHDBG—Switch to Debug

| | | |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| Command(s) | Inquiry of Command(s) : N/A | Designate Command(s) : AT+SWITCHDBG |
| Feedback | N/A | Switch: Dbg UART |
| Parameter Description(s) | - | |
| Note | <ul style="list-style-type: none"> •After installation is completed, switch IO pin of "AT UART"and "Debug UART",. •When switching IO, UART will receive some random and meaningless text | |
| Examples | >AT+SWITCHDBG C! Switch: Dbg UART | |

2.2.18. AT+MACDATARATE—Set up Wi-Fi Tx Data Rate

| Command(s) | Inquiry of Command(s) : AT+MACDATARATE? | Designate Command(s) : AT+MACDATARATE= <d ata_rate_id> |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| Feedback | +MACDATARATE:<data_rate_id> OK | OK |
| Parameter Description(s) | -<data_rate_id> : 0 : Auto Rate Adaptation 1 : Fix Mac Tx data rate in 1 Mbps 2 : Fix Mac Tx data rate in 2 Mbps 3 : Fix Mac Tx data rate in 5.5 Mbps 4 : Fix Mac Tx data rate in 11 Mbps | |
| Note | <ul style="list-style-type: none"> •This device will save to Flash, in which the saved data remains even after restarting power-on. •Default set-up being "Auto Rate Adaptation". •Once installation is completed, it would come into effect immediately. | |
| Examples | >AT+MACDATARATE=4 OK | |

2.2.19. AT+WIFIMACCFG—Set up Wi-Fi Related Parameters

| Command(s) | Inquiry of Command(s) : AT+WIFIMACCFG? | Designate Command(s) : AT+WIFIMACCFG= <cfg_ id>,<value> |
|-----------------------------|-------------------------------------------|------------------------------------------------------------------|
| Feedback | +WIFIMACCFG:<cfg_id>,<value> OK | OK |
| Parameter Description(s) | -<cfg_id> : | |

| Command(s) | Inquiry of Command(s) : | Designate Command(s) : |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| | AT+WIFIMACCFG? | AT+WIFIMACCFG= <cfg_id>,<value> |
| | 0: skip DTIM, i.e. the number of DTIM packets to be skipped, ranging from 0 to 255, as the value setting of ZERO means "Not skipping DTIM" , and value-setting of FIVE means "Skipping 5 DTIM packets" . - <value> : Set-Value | |
| Note | <ul style="list-style-type: none"> •This device will save to Flash, in which the saved data remains even after restarting power-on. •Once installation is completed, the set-up comes into effect immediately. •If the set-value of "DTIM Skipped" is too high, it may lead to drop in throughput volume | |
| Examples | >AT+WIFIMACCFG=0,5 OK | |

2.2.20. AT+RFTM—Set up Test Mode

| Command(s) | Inquiry of Command(s) : | Designate Command(s) : |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| | N/A | AT+RFTM= <mode>,<param...> |
| Feedback | N/A | OK |
| Parameter Description(s) | <ul style="list-style-type: none"> • <mode> : RF Testing Mode <ul style="list-style-type: none"> ▸ 1 : RF TX Single-Tone <ul style="list-style-type: none"> •AT+RFTM= <mode>,<Frequency> ▸ 2 : MAC RX Beacon only mode <ul style="list-style-type: none"> •AT+RFTM=2,<OnCtrl> <OnCtrl> Setting: <ul style="list-style-type: none"> ▸ 0 : Normal mode (Default) ▸ 1 : MAC only receive Beacon, no Tx | |

| | | |
|------------|--------------------------------|------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : N/A | Designate Command(s) : AT+RFTM=<mode>, <param...> |
| Note | • | |
| Examples | AT+RFTM=1, 2442 | |

2.2.21. AT+MODE—Set Up WiFi Mode

| | | |
|-----------------------------|-------------------------------------------------------------|---------------------------------------------|
| Command(s) | Inquiry of Command(s) : N/A | Designate Command(s) : AT+MODE=<mode> |
| Feedback | N/A | OK |
| Parameter Description(s) | • <mode> : For WiFi testing mode, please use parameter "3". | |
| Note | • | |
| Examples | AT+MODE=3 Mode is RF OK | |

2.2.22. AT+GO—Set Up WiFi Packet and Speed

| | | |
|-----------------------------|--------------------------------|---------------------------------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : N/A | Designate Command(s) : AT+GO=<preamble>,<d ata_length>,<interval>,< data_rate>,<packet_cou nt> |
| Feedback | N/A | OK |
| Parameter Description(s) | • <preamble>: 1: long | |

| | |
|----------|---------------------------------------------------------------------------------------------------------------------------------|
| | Others for short |
| | • <data_length>: |
| | n bytes |
| | • <interval>: |
| | n us (packet interval) |
| | • <data_rate>: |
| | 1, 2, 5.5, 11 Mbps |
| | • <packet_count>: |
| | 0 for infinite |
| | Others for given number |
| Note | • |
| Examples | AT+GO=1,30,40,1,0 Preamble type: LONG Data length: 30 bytes Interval: 40 us Data rate: 1 Mbps Tx Counts: 0 OK |

2.2.23. AT+CHANNEL—Set Up WiFi Channel

| Command(s) | Inquiry of Command(s) : | Designate Command(s) : |
|--------------------------|----------------------------------------------------------|------------------------|
| | N/A | AT+CHANNEL= <channel> |
| Feedback | N/A | OK |
| Parameter Description(s) | • <channel> : WiFi Channel, with ranging between 1 to 14 | |
| Note | • | |
| Examples | AT+CHANNEL=7 99, 7 OK | |

2.2.24. AT+RESET_CNTS—Clear WiFi Rx Data Volume Count

| | | |
|----------------|--------------------------------|-----------------------------------------|
| Command(s) | Inquiry of Command(s) : N/A | Designate Command(s) : AT+RESET_CNTS |
| Feedback | N/A | OK |
| Parameter | N/A | |
| Description(s) | | |
| Note | • | |
| Examples | AT+RESET_CNTS OK | |

2.2.25. AT+COUNTERS—Read WiFi Rx Data Volume Count

| | | |
|----------------|-------------------------------------------------------|-------------------------------|
| Command(s) | Inquiry of Command(s) : AT+COUNTERS? | Designate Command(s) : N/A |
| Feedback | OK | N/A |
| Parameter | N/A | |
| Description(s) | | |
| Note | • | |
| Examples | AT+COUNTERS? ok: 70558, err: 3836, rssi: -38 OK | |

2.2.26. AT+TX—Activate/Terminate Off WiFi Tx Testing

| | | |
|----------------|--------------------------------|-----------------------------------------|
| Command(s) | Inquiry of Command(s) : N/A | Designate Command(s) : AT+TX= <mode> |
| Feedback | N/A | OK |
| Parameter | • <mode> : | |
| Description(s) | | |

| Command(s) | Inquiry of Command(s) : | Designate Command(s) : |
|------------|------------------------------|------------------------|
| | N/A | AT+TX= <mode> |
| | 1: Activate WiFi Tx Testing | |
| | 0: Terminate WiFi Tx Testing | |
| Note | • | |
| Examples | AT+TX=1 | |
| | OK | |

2.2.27. AT+RX—Activate/Terminate WiFi Rx Testing

| Command(s) | Inquiry of Command(s) : | Designate Command(s) : |
|--------------------------|------------------------------|------------------------|
| | N/A | AT+RX= <mode> |
| Feedback | N/A | OK |
| Parameter Description(s) | • <mode> : | |
| | 1: Activate WiFi Rx Testing | |
| | 0: Terminate WiFi Rx Testing | |
| Note | • | |
| Examples | AT+RX=1 | |
| | OK | |

2.2.28. AT+DTM—Set-Up and Start BLE Tx/Rx Testing

| Command(s) | Inquiry of Command(s) : | Designate Command(s) : |
|--------------------------|----------------------------------|---------------------------------------------------------|
| | N/A | AT+DTM= <mode>, <channel>, <data_length>, <packet_type> |
| Feedback | N/A | OK |
| Parameter Description(s) | • <mode> : | |
| | tx: BLE Tx Testing | |
| | rx: BLE Rx Testing | |
| | end: Terminate BLE Tx/Rx Testing | |

- <channel> :
0 ~ 39
- <data_length> :
n bytes
- <packet_type> :
0: PRBS9
1: Pattern 11110000
2: Pattern 10101010
3: PRBS15
4: Pattern 11111111
5: Pattern 00000000

| | |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Note | • |
| Examples | <ul style="list-style-type: none">•Start BLE Tx Testing AT+DTM=tx,20,30,2 Start DTM Tx Frequency: 20, length: 30, type: 2 OK•Terminate BLE Tx Testing AT+DTM=end RX CNT: 0 CRC OK: 0 CRC FAIL: 0 Packet count: 0 OK•Start BLE Rx Testing AT+DTM=rx,20 Start DTM Rx frequency: 20 OK•Terminate BLE Rx Testing AT+DTM=end |

RX CNT: 28613

CRC OK: 28613

CRC FAIL: 0

Packet count: 28613

OK

3. WIFI FUNCTION AT COMMANDS

3.1. List of WIFI Function AT Commands

| Command(s) | Description |
|---------------|-------------------------------------------------------------|
| AT+CWMODE | Set up Wi-Fi Mode |
| AT+CWLAP | Connect AP |
| AT+CWLAPOPT | Set up CWLAP Command Attributes |
| AT+CWLAP | Scan Currently Available AP |
| AT+CWQAP | Terminate Connection with AP |
| AT+CWDHCP | Set up DHCP |
| AT+CWAUTOCONN | Whether Power-On Would Result in Automatic Connection to AP |
| AT+CWFASTCONN | Whether Quickly Connect to AP |
| AT+CIPSTAMAC | Set up MAC Address of STA Port |
| AT+CIPSAT | Set up IP Address of STA |
| AT+CWHOSTNAME | Set up Station Address of STA |

3.2. Description of WIFI Function AT Commands

3.2.1. AT+CWMODE—Set up Wi-Fi Mode

| Command(s) | AT+CWMODE=? | Inquiry of Command(s) : AT+CWMODE? ° Function: Inquiry of OPL1000’s current Wi-Fi Mode | Designate Command(s) : AT+CWMODE= <mode> ° Function: Set up OPL1000’s current Wi-Fi Mode |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Feedback | <p>If Wi-Fi has not been initialized, inquiry before Return +CWMODE: 0 OK</p> <p>If Wi-Fi has been initialized, inquiry before Return +CWMODE: 1 OK</p> | <p>+CWMODE: <mode> OK</p> | OK |
| Parameter | <mode> : | | |
| Description(s) | ▸ 0 : No Wi-Fi Mode ▸ 1 : Station Mode | | |
| Note | <ul style="list-style-type: none">•Before using WIFI and TCPIP related AT CMD, please first use AT+CWMODE to set up Station Mode•After Wi-Fi is initialized, if mode needs to be changed, then after having restarted AT+RST, initialization may be re-installed.•This command current only support station mode | | |
| Examples | AT+CWMODE=1 | | |

3.2.2. AT+CWJAP—Connect AP

| | | |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+CWJAP? Inquiry of the AP Message of OPL1000 Station has been connected to | Designate Command(s) : AT+CWJAP=<ssid>,<pwd>[,<bssid >] Function: Install the AP OPL1000 Station needs to be connected to. |
| Feedback | +CWJAP:<ssid>,<bssid>,<channel>,<rssi> OK | OK OR +CWJAP:<error code> ERROR |
| Parameter Description(s) | <ul style="list-style-type: none">• <ssid> : String Parameter, SSID of AP• <bssid> : MAC Address of AP• <channel> : Channel Number• <rssi> : Signal Strength | <ul style="list-style-type: none">• <ssid> : SSID of Target AP• <pwd> : The password length must be in 64 bytes with ASCII code• [<bssid>] : MAC Address of Target AP, normally used in the case of having multiple SSID's with the same AP• <error code> : (Only for reference)<ul style="list-style-type: none">▸ 1 : Overtime to making connection▸ 2 : Error in password▸ 3 : Uable to find target AP▸ 4 : Error in connection▸ Other Value: Unknown errors |
| Prompted Message(s) | // If OPL1000 station connects to an AP, it will prompt messages: WIFI CONNECTED WIFI GOT IP // If the WiFi connection ends, it will prompt messages: WIFI DISCONNECT | |
| Note | <ul style="list-style-type: none">•Parameter installation needs to activate Station Mode• If SSID or password contains special characters such as (,) , it is invalid command. | |
| Examples | AT+CWJAP="abc","0123456789" | |

3.2.3. AT+CWLAPOPT—Set up CWLAP Command Attributes

| | |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Designate Command(s) | AT+CWLAPOPT=<sort_enable>,<mask> |
| Feedback | OK |
| Parameter Description(s) | <ul style="list-style-type: none">• <sort_enable> : Whether the scanned result of Command AT+CWLAP is listed according to the signal strength of RSSI values:<ul style="list-style-type: none">▸ 0 : Not in the order▸ 1 : According to the priority order of RSSI• <mask> : If the corresponding bit is to be "1", then the scanned result of Command AT+CWLAP displays the related attributes, and if the corresponding bit is to be "0", then there will be no display, with details as follows:<ul style="list-style-type: none">▸ bit 0 : Whether the scanned result of installation of AT+CWLAP display <ecn>▸ bit 1 : Whether the scanned result of installation of AT+CWLAP display <ssid>▸ bit 2 : Whether the scanned result of installation of AT+CWLAP display <rssi>▸ bit 3 : Whether the scanned result of installation of AT+CWLAP display <mac>▸ bit 4 : Whether the scanned result of installation of AT+CWLAP display <channel> |
| Examples | <p>AT+CWLAPOPT=1,31</p> <p>When the first parameter is "1", it means that subsequently Command AT+CWLAP is used, the scanned result will be displayed in the order of RSSI values of signal strength;</p> <p>When the second parameter is "31", i.e. "0x1F", it indicates that all the related bit of <mask> are all set as "1", and if subsequently Command AT+CWLAP is to be used, the scanned result will display all parameters.</p> |

3.2.4. AT+CWLAP—Scan Currently Available AP

| | |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | AT+CWLAP Function: List the currently available AP's |
| Feedback | +CWLAP:<ecn>,<ssid>,<rssi>,<mac>,<channel> OK |
| Parameter Description(s) | <ul style="list-style-type: none">• <ecn> : Encryption Methods<ul style="list-style-type: none">▸ 0 : OPEN▸ 1 : WEP▸ 2 : WPA_PSK▸ 3 : WPA2_PSK▸ 4 : WPA_WPA2_PSK▸ 5 : WPA2_Enterprise (Currently, AT does not support connection to this type of encrypted AP)• <ssid> : AP SSID String Parameter, SSID of AP• <rssi> : Signal Strength• [<mac>](Parameter Selection): String Parameter, MAC Address of AP• [<channel>](Parameter Selection): Channel Number |
| Examples | AT+CWLAP="WiFi","ca:d7:19:d8:a6:44",6 Or search for AP of designated SSID: AT+CWLAP="WiFi" If there are more than one designated AP "WiFi", all AP's containing "WiFi" in all SSID's will be sorted for east access and reference. |

3.2.5. AT+CWQAP—Terminate Connection with AP

| | |
|----------------|----------|
| Command | AT+CWQAP |
| Execution | |
| Feedback | OK |
| Parameter | - |
| Description(s) | |

3.2.6. AT+CWAUTOCONN—Whether Power-On Would Result in Automatic Connection to AP

| | | |
|-------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+CWAUTOCONN? | Designate Command(s) : AT+CWAUTOCONN=<enable>,<ap_num> Function: Set up AUTOCONN |
| Feedback | +CWAUTOCONN:<enable>,<ap_num> OK | OK OR +CWAUTOCONN:<error code> ERROR |
| Parameter | <enable>: auto connect | • <enable> : |
| Description | <ab_num>: Display the maximum number of stored AP's | ▸ 0 : Power-on without automatic connection to AP ▸ 1 : Power-on with automatic connection to AP • <ap_num> : ▸ Set up the maximum number of stired auto connect AP, with the range of 1 to 3. • <error code> : ▸ 1 : Invalid Parameter ▸ Other Value: Other Errors |
| Note | • This device is stored in Flash | |

| | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|---------------------------------------------------------------------------------------------|
| Command(s)) | Inquiry of Command(s) : AT+CWAUTOCONN? | Designate Command(s) : AT+CWAUTOCONN= <enable>,<ap_num> Function: Set up AUTOCONN |
| <ul style="list-style-type: none"> • By default, power-on results in automatic connection to AP's, maximum of 3 AP's. • After power-on, the Command AT+CWMODE=1 needs to be issued first, before the setup comes into effect. | | |
| Examples | AT+CWAUTOCONN=1,3 | |

3.2.7. AT+CWFASTCONN—Quick Connection to AP

| | | |
|----------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s)) | Inquiry of Command(s) : AT+CWFASTCONN? | Designate Command(s) : AT+CWFASTCONN= <list_id>,<enable> . Function: Install FASTCONN |
| Feedback | +CWFASTCONN:<list_id>,<enable> > OK | OK OR +CWFASTCONN:<error code> ERROR |
| Parameter Description(s)) | <list_id>: Index in the auto connect list <enable>:Whether to activate fast connect | <ul style="list-style-type: none"> • <list_id>:index Indexed from "0" • <enable> : <ul style="list-style-type: none"> ▸ 0 : Power-on without fast connection to AP ▸ 1 : Power-on with fast connection to AP • <error code> : <ul style="list-style-type: none"> ▸ 1 : Invalid parameters ▸ 2: This index does not have AP messages. ▸ Other value: Other Errors |
| Note | • This device is stored in Flash. | |

| | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+CWFASTCONN? | Designate Command(s) : AT+CWFASTCONN= <list_id>,<enable> . |
| Function: Install FASTCONN | | |
| <ul style="list-style-type: none"> • By default, Power-on without fast connection to AP • Need to issue Command AT+CWMODE=1 before the set-up starts to come into effect. • This function needs to be stored in "auto connect" message before it becomes functional | | |
| Examples | AT+CWFASTCONN=0,1 | |

3.2.8. AT+CIPSTAMAC—Set up MAC Address of OPL1000 Station Port

| | | |
|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+CIPSTAMAC? | Designate Command(s) : AT+CIPSTAMAC= <mac> |
| Function: Inquiry of MAC Address of OPL1000 Station | | Function: Install MAC Address of OPL1000 Station |
| Feedback | +CIPSTAMAC:<mac> OK | OK |
| Parameter Description(s) | <mac> : String Parameter, MAC Address of OPL1000 Station | |
| Note | <ul style="list-style-type: none"> • This device is stored in Flash. Command AT+MACADDRDEF=0,1 can be issued to install MAC source as Flash • The bit 0 of the first bite of MAC Address cannot be "1", e.g. MAC Address can be "1a:..." but cannot be "15:...". • "FF:FF:FF:FF:FF:FF" and "00:00:00:00:00:00" are illegal MAC, and hence unable to proceed with installation. • In order for revised MAC address to be effective, AT+RS needs to be used to be reset. | |
| Examples | AT+CIPSTAMAC="18:fe:35:98:d3:7b" | |

3.2.9. AT+CWHOSTNAME—Set up the name of Station Host

| | | |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+CWHOSTNAME? Function: Inquiry of station name of OPL1000 Station | Designate Command(s) : AT+CWHOSTNAME= <hostname> Function: Install the station name of OPL1000 Station |
| Feedback | +CWHOSTNAME:<host name> OK If OPL1000 Station Model is disabled, then RETURN +CWHOSTNAME:<null> OK | If succeed, return:OK ERROR If OPL1000 Station Model is disabled, then prompt "ERROR" |
| Parameter Description(s) | <hostname> : Station Name, supporting 32 bytes maximum | |
| Note | <ul style="list-style-type: none">• This device does not save to Flash, and will be restored to default vaule after reboot.• The default Station ame of OPL1000 Station is "opulink". | |
| Examples | AT+CWMODE=1 AT+CWHOSTNAME="my_test" | |

4. TCP/IP FUNCTION AT COMMAND

4.1. List of TCP/IP Function AT Commands

| Command(s) | Description |
|--------------|------------------------------------------------------------------------------|
| AT+CIPSTATUS | Inquiry of Message of Network Connection |
| AT+CIPDOMAIN | Domain Name Analysis Function |
| AT+CIPSTART | Establish TCP Connection or UDP Transmission |
| AT+CIPSEND | Send Data |
| AT+CIPSENDER | Send Data |
| AT+CIPCLOSE | Terminate TCP/UDP Transmission |
| AT+CIFSR | Inquiry of Local IP Address |
| AT+CIPMUX | Install Multiple Connections |
| AT+CIPSERVER | Establish TCP Server |
| AT+CIPSTO | Set up TCP Server Over-Time |
| AT+CIPDINFO | Whether Prompt for Opposite-End IP and Port During Reception of network data |
| +IPD | Reception of Network Data |
| AT+PING | Ping Function |

4.2. Description of TCP/IP Function AT Commands

4.2.1. AT+CIPSTATUS—Inquiry of Message of Network Connection

| Command | AT+CIPSTATUS |
|-----------|----------------------------------------------------------------------------------------------|
| Execution | |
| Feedback | STATUS:<stat> +CIPSTATUS:<link ID>,<type>,<remote IP>,<remote port>,<local port>,<tetype> |

| | |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command | AT+CIPSTATUS |
| Execution | |
| Parameter | • <stat> : OPL1000 Station Port Status |
| Description(s) | <ul style="list-style-type: none"> ▸ 2 : OPL1000 Station has been connected to AP, and obtained IP address ▸ 3 : OPL1000 Station has established TCP or UDP transmission ▸ 4 : OPL1000 Station terminates network connection ▸ 5 : OPL1000 Station is not connected to AP <ul style="list-style-type: none"> • <link ID> : Network connection ID (0-4), used for multiple-connection scenarios • <type> : String parameter, "TCP" or "UDP". • <remote IP> : String, Remote IP address • <remote port> : Remote Port Value • <local port> : OPL1000 Local Port Value • <tetype> : <ul style="list-style-type: none"> ▸ 0 : OPL1000 as Client End ▸ 1 : OPL1000 As Server |

4.2.2. AT+CIPDOMAIN—Domain Name Analysis Function

| | |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Command | AT+CIPDOMAIN=<domain name> |
| Execution | |
| Feedback | + CIPDOMAIN:<IP address> OK OR ERROR |
| Parameter | <domain name> : Domain name to be analyzed |
| Description(s) | |
| Examples | AT+CWMODE=1 // set Station mode AT+CWJAP="SSID","password" // access to the internet AT+CIPDOMAIN="www.baidu.com" // DNS function |

4.2.3. AT+CIPSTART—Establish TCP Connection or UDP Transmission

■ Establish TCP Connection

| | | |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Designate | TCP single-connect (AT+CIPMUX=0) : | TCP multi-connect (AT+CIPMUX=1) : |
| Command(s) | AT+CIPSTART=<type>,<remote IP>,<remote port>[,<TCP keep alive>] | AT+CIPSTART=<link ID>,<type>,<remote IP>,<remote port>[,<TCP keep alive>] |
| Feedback | OK | |
| Parameter Description(s) | <ul style="list-style-type: none">• <link ID> : Network Connection ID (0~4), used for multiple connection scenarios.• <type> : String parameter, connection type, "TCP", "UDP", or "SSL".• <remote IP> : String, Remote IP address• <remote port> : Remote Port Value• [<TCP keep alive>] : During TCP keep-alive detection, this function is switched off, by default, and we recommend that you set up this function as activated.<ul style="list-style-type: none">▸ 0 : Terminate TCP keep-alive function.▸ 1 ~ 7200 : Detection time, based on the unit of 1 second. | |
| Prompted Message(s) | // If the TCP connection is established, it will prompt message as below [<link ID>,) CONNECT // If the TCP connection ends, it will prompt message as below [<link ID>,) CLOSED | |
| Note | We recommend that when establishing TCP connection, "Keep-Alive"function should be activated. | |
| Examples | AT+CIPSTART="TCP","192.168.101.110",1000 | |

■ Establish UDP Transmission

| Designate | When in Single-Connection Mode | Multiple-Connection Mode |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Command(s) | AT+CIPSTART=<type>,<remote IP>,<remote port>[,(<UDP local port>),(<UDP mode>)] | AT+CIPSTART=<link ID>,<type>,<remote IP>,<remote port>[,<UDP local port>,<UDP mode>] |
| Feedback | OK | |
| Parameter Description(s) | <ul style="list-style-type: none">• <link ID> : Network Connection ID (0~4), used for multiple connection scenarios.• <type> : String parameter, connection type, "TCP", "UDP", or "SSL".• <remote IP> : String, Remote IP address• <remote port> : Remote Port Value• [<UDP local port>] : UDO Local Port• [<UDP mode>] : If the attribute of UDP transmission is "Penetrating", the value should be "0".<ul style="list-style-type: none">▸ 0 : Having received data, without changing remote target, the default value is "0".▸ 1 : Having received data, change remote target once.▸ 2 : Having received data, change remote target. <p>Note :</p> <p>When using <UDP mode>, <UDP local port> must be filled in first.</p> | |
| Prompted Message(s) | // If the UDP transmission is established, it will prompt message as below [<link ID>,) CONNECT // If the UDP transmission ends, it will prompt message as below [<link ID>,) CLOSED | |
| Examples | AT+CIPSTART="UDP","192.168.101.110",1000,1002,2 | |

4.2.4. AT+CIPSEND—Send Data

| | |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Designate Command(s) | <div>1. When making single connection : (+CIPMUX=0)</div> <div>AT+CIPSEND= <length></div> <div>2. When making multiple connection: (+CIPMUX=1)</div> <div>AT+CIPSEND= <link ID>, <length></div> <div>3. If UDP transmission is adopted, remote IP and port and can be installed:</div> <div>AT+CIPSEND=[<link ID>,<length>,<remote IP>,<remote port>]</div> <div>Function: When in normal transmission mode, set length of transmitted data.</div> |
| Feedback | <div>Send data of designated length</div> <div>After having received this command, proceed to RETURN >, and then start to receive serial-port data, and when data length XXXXXXXX, back to normal command mode, awaiting for the next AT command. If connection is not established, or is terminated, RETURN</div> <div>ERROR</div> <div>If data dispatch has succeeded, then RETURN:</div> <div>SEND OK</div> <div>If data dispatch has failed, then RETURN:</div> <div>SENDERFAIL</div> |
| Parameter Description(s) | <div>• <link ID> : Network connection ID (0-4), used for multiple-connection scenarios</div> <div>• <length> : Digital Parameter indicating data transmission speed, with 2048 maximum.</div> <div>• [<remote IP>] : UDP transmission can install opposite-end IP</div> <div>• [<remote port>] : UDP transmission can set ip opposite port</div> |
| Examples | - |

4.2.5. AT+CIPSENDEX—Send Data

| | |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | <p>Designate Command(s) :</p> <p>1. When making single connection: (+CIPMUX=0)</p> <p>AT+CIPSENDEX=<length></p> <p>2. When making multiple connection : (+CIPMUX=1)</p> <p>AT+CIPSENDEX=<link ID>,<length></p> <p>3. If UDP transmission is adopted, remote IP and port and can be installed:</p> <p>AT+CIPSENDEX=[<link ID>,<length>,<remote IP>,<remote port>]</p> <p>Function: When in normal transmission mode, set the length of transmitted data</p> |
| Feedback | <p>Send data of designated speed</p> <p>After having received this command, proceed to RETURN >, and then start to receive serial-port data, and when data speed XXXXXXXX, or encountering character\0, send data.</p> <p>If connection is not established, or is terminated, proceed to RETURN:</p> <p>ERROR</p> <p>If data dispatch has succeeded, then RETURN:</p> <p>SEND OK</p> <p>If data dispatch has failed, then RETURN:</p> <p>SENDFAIL</p> |
| Parameter Description(s) | <ul style="list-style-type: none">• <link ID> : Network connection ID (0-4), used for multiple-connection scenarios• <length> : Digital Parameter indicating data transmission length, with 2048 as maximum length• When received data length is out of range or met char “\0”, sending data will back to normal command mode, awaiting for the next AT command. If connection is not established, or is terminated, RETURN• If user needs to send “\0”, please convert to “\\0”. |

4.2.6. AT+CIPCLOSE—Terminate TCP/UDP Transmission

| | | |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Command(s) | Designate Command(s) (used for multiple connection scenarios) AT+CIPCLOSE= <link ID> Function: Terminate TCP/UDP Transmission | Command Execution (used for single connection scenarios) AT+CIPCLOSE |
| Feedback | OK | |
| Parameter Description(s) | <link ID> : Need to terminate the connected ID number. When ID is "5", terminate all connections. | |
| Prompted Message(s) | // When connection ends, it will prompt message as below [<link ID>,) CLOSED | |

4.2.7. AT+CIFSR—Inquiry of Local IP Address

| | |
|--------------------------|------------------------------------------------------------------------------------------------|
| Command Execution | AT+CIFSR |
| Feedback | +CIFSR:STAIP,<Station IP address> +CIFSR:STAMAC,<Station MACaddress> OK |
| Parameter Description(s) | <IP address> : OPL1000 Station IP Address <MAC address> : OPL1000 Station MAC Address |
| Note | OP1000 Station IP needs to be connected to AP, before it can be subject to inquiry. |

4.2.8. AT+CIPMUX—Set up Multiple Connections

| | | |
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| Command(s) | Inquiry of Command(s) : AT+CIPMUX? | Designate Command(s) : AT+CIPMUX=<mode> Function: Install Connection Type |
| Feedback | +CIPMUX:<mode> OK | OK |
| Parameter | <mode> : | |
| Description(s) | ▸ 0 : Single Connection Mode ▸ 1 : Multiple Connection Mode | |
| Note | <ul style="list-style-type: none">• Single Connection as default• Only through non-penetrating mode (AT+CIPMODE=0), multiple connection can then be installed.• Connection mode can be installed only when no connection has been established.• If TCP server has been established, while wishing to switch to single connection, server must be shut down (AT+CIPSERVER=0), as the server only supports multiple connections. | |
| Examples | AT+CIPMUX=1 | |

4.2.9. AT+CIPSERVER—Establish TCP Server

| | | |
|----------------|-------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+CIPSERVER? | Designate Command(s) : AT+CIPSERVER=<mode>[,<port>] Function: Install Server |
| Feedback | +CIPSERVER:<mode>,<port> OK | OK |
| Parameter | <mode> : | |
| Description(s) | ▸ 0 : Shut down server ▸ 1 : Establish server [<port>] : Fill in parameters. Default serial-port number is "333". | |

| | | |
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| Command(s) | Inquiry of Command(s) : AT+CIPSERVER? | Designate Command(s) : AT+CIPSERVER= <mode>[,<port>] Function: Install Server |
| Prompted Message(s) | // If the connection is established, it will prompt message as below [<link ID>,) CONNECT // If the connection ends, it will prompt message as below [<link ID>,) CLOSED | |
| Note | <ul style="list-style-type: none"> • Server can only be activated under multiple connection scenario (AT+CIPMUX=1) • After establishing server, server surveillance is automatically established. • When client end enters the connection, it would take up a connecting ID. | |
| Examples | <ul style="list-style-type: none"> • Established TCP Server AT+CIPMUX=1 AT+CIPSERVER=1,80 | |

4.2.10. AT+CIPSTO—Set up TCP Server Over-Time

| | | |
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| Command(s) | Inquiry of Command(s) : AT+CIPSTO? Function: Inquiry of TCP Server Over-Time | Designate Command(s) : AT+CIPSTO= <time> Function: Install T Install TCP Server Over-Time |
| Feedback | +CIPSTO:<time> OK | OK |
| Parameter Description(s) | <time> : TCP server over-time, with values ranging between 0 ~ 7200s. | |
| Note | <ul style="list-style-type: none"> • With OPL1000 as TCP server,, it will terminate the TCP client-end connection that is not communicating exceeding over-time period. • If installing AT+CIPSTO=0, over-time will never come into effect, which we do NOT recommend. | |
| Examples | AT+CIPMUX=1 AT+CIPSERVER=1,1001 AT+CIPSTO=10 | |

4.2.11. AT+CIPDINFO—Whether Prompt for Opposite-End IP and Port During Reception of network data

| | |
|----------------|-------------------------------------------------------------------------------------------------|
| Command | AT+CIPDINFO=<mode> |
| Feedback | OK |
| Parameter | <mode> : |
| Description(s) | ▸ 0 : Not displaying opposite-end IP and port) ▸ 1 : Displaying opposite-end IP and port |
| Examples | AT+CIPDINFO=1 |

4.2.12. +IPD—Reception of Network Data

| | | |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Command(s) | When making single connection (+CIPMUX=0)+IPD,<len>[,<remote IP>,<remote port>]:<data> | When making multiple connections, (+CIPMUX=1)+IPD,<link ID>,<len>[,<remote IP>,<remote port>]:<data> |
| Parameter Description(s) | This command is effective under normal command mode, as when OPL1000 receives network data dispatch +IPD and data to serial-port <ul style="list-style-type: none">• [<remote IP>] : Network communication with opposite-end IP, enabled by Command AT+CIPDINFO=1• [<remote port>] : Network communication with opposite-end port, enabled by Command AT+CIPDINFO=1• <link ID> : ID number that receives network connection• <len> : Data length• <data> : Received data | |

4.2.13. AT+PING—Ping Function

| | |
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| Designate | AT+PING= <IP> |
| Command(s) | Function: Ping Function |
| Feedback | +PING:<time> OK OR +PING:TIMEOUT ERROR |
| Parameter | • <IP> : String parameter, IP address |
| Description(s) | • <time> : Ping feedback time |
| Examples | AT+PING="192.168.1.1" AT+PING="www.baidu.com" |

5. BLE RELATED AT COMMANDS

5.1. List of BLE Commands

| Command(s) | Description(s) |
|---------------------|--------------------------------------------|
| AT+BLEINIT | BLE Initiation |
| AT+BLEADDR | Designate BLE Device Address |
| AT+BLENAM | Designate BLE Device Name |
| AT+BLESCANRSPDATA | Install BLE Scan Response |
| AT+BLEADVPARAM | Install Broadcast Parameters |
| AT+BLEADVDATA | Install BLE Broadcast Data |
| AT+BLEADVSTART | Initiate BLE Broadcast |
| AT+BLEADVSTOP | Terminate BLE Broadcast |
| AT+BLECONNP | Renew BLE Connection Parameters |
| AT+BLEDISCONN | Terminate BLE Connection |
| AT+BLEDATALEN | Set up BLE Data Packet Length |
| AT+BLECFGMTU | Set up GATT MTU Length |
| AT+BLEGATTSSRVCRE | GATTS Service Establishment |
| AT+BLEGATTSSRVSTART | GATTS Service Activation |
| AT+BLEGATTSSRVSTOP | GATTS Service Termination |
| AT+BLEGATTSSRV | GATTS Inquiry Service |
| AT+BLEGATTSSCHAR | GATTS Inquiry Service Attributes |
| AT+BLEGATTSSNTFY | GATTS Service Attribute Value Notification |
| AT+BLEGATTSSIND | GATTS Service Attribute Value Indication |
| AT+BLEGATTSSSETATTR | GATTS Service Attribute Value Installation |
| AT+BLEGATTCPRIMSRV | GATTC Basic Service Discovery |
| AT+BLEGATTCINCLSRV | GATTC Included Service Discovery |

5.2. Description of BLE Commands

| | | |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+BLEINIT? Function: Inquiry of whether BLE has been initialized | Designate Command(s) : AT+BLEINIT=<init> Function: Installation of the role of BLE initialization. |
| Feedback | If BLE has not been initialized, then inquiry RETURNS +BLEINIT:0 OK If BLE has been initialized, then inquiry RETURNS +BLEINIT:<role> OK | OK |
| Parameter Description(s) | <init> : ‣ 1 : client role ‣ 2 : server + client role | |
| Note | •Before using BLE related AT commands, this installation command must be adopted to initialize BLE mode. | |
| Examples | AT+BLEINIT=1 | |

5.2.2. AT+BLEADDR—Designate BLE Device Address

| | | |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+BLEADDR? Function: Inquiry of the public address of BLE device | Designate Command(s) : AT+BLEADDR= <addr_type>,<random_addr> Function: Install address of BLE device, as currently it only supports installation of random address. |
| Feedback | +BLEADDR:<BLE_public_addr> OK OK | |
| Parameter | <addr_type> : | |
| Description(s) | ▶ 0 : public address ▶ 1 : random address | |
| Note | <ul style="list-style-type: none"> • Currently, the public address can be installed or inquired, and only the installation of random address can be supported. • Before installing BLE public address, Command AT+BLEINIT=1 is needed to complete BLE initiation. • In order for the modified BLE public address to be effective, Command AT+RST is needed to execute reset. • Random address must have the highest 2 bit to be both of "2", and for details, please refer to BLE spec. | |
| Examples | AT+BLEADDR=1,"08:7f:24:87:1c:f7" | |

5.2.3. AT+BLENAME—Designate BLE Device Name

| | | |
|------------|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+BLENAME? Function: Inquiry of BLE device name | Designate Command(s) : AT+BLENAME= <device_name> Function: Install BLE device name. |
| Feedback | +BLENAME:<device_name> OK | OK |

| | | |
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| Command(s) | Inquiry of Command(s) : AT+BLENAME? FunctionL Inquiry of BLE device name | Designate Command(s) : AT+BLENAME= <device_name> Function: Installl BLE device name. |
| Parameter Description(s) | <device_name> : BLE device name | |
| Note | <ul style="list-style-type: none"> • Default device name is "BLE_AT". • The device name designated by this Command can only be received by the opposite-end device after BLE connection is established, as it actually installs the values of device name characteristic for GAP service, so for details, please refer to BLE core v4.2 vol.3 part C 12.1. • If you need to obtain the device name when scanning for broadcasting packets, then it can only be installed through Command AT+BLEADVDATA. | |
| Examples | AT+BLENAME="opl_demo" | |

5.2.4. AT+BLESCANRSPDATA—Install BLE Scan Response

| | |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLESCANRSPDATA= <scan_rsp_data> Function: Install BLE Scan Feedback. |
| Feedback | OK |
| Parameter Description(s) | Scan feedback. Parameters are actually comprises of HEX bytes. For example, installation scan feedback should be "0x11 0x22 0x33 0x44 0x55", as Command can be installed as "AT+BLESCANRSPDATA="1122334455". |
| Note | The maximum byte supported by scan feedback is 31 bytes. |
| Examples | AT+BLEINIT=2 // Initialized as server AT+BLESCANRSPDATA="1122334455" |

5.2.5. AT+BLEADVPARAM—Set up Broadcast Parameters

| | | |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+BLEADVPARAM? Function: Inquiry of BLE Broadcast Parameter(s) | Designate Command(s) : AT+BLEADVPARAM=<adv_int_min>,<adv_int_max>,<adv_type>,<own_addr_type>,<channel_map>[,<adv_filter_policy>,<peer_addr_type>,<peer_addr>] Function: Designate Broadcast Parameter(s) |
| Feedback | +BLEADVPARAM:<adv_int_min>,<adv_int_max>,<adv_type>,<own_addr_type>,<channel_map>,<adv_filter_policy>,<peer_addr_type>,<peer_addr> OK | |
| Parameter Description(s) | <p>Minimum Broadcast Interval of values ranging from 0x0020 ~ 0x4000, with 20ms as minimum, and 10240ms as maximum.</p> <p>Maximum Broadcast Interval of values ranging from 0x0020 ~ 0x4000, with 20ms as minimum, and 10240ms as maximum.</p> <p><adv_type> : Broadcast Types</p> <ul style="list-style-type: none">▸ 0 : ADV_TYPE_IND▸ 1: ADV_TYPE_DIRECT_IND_HIGH▸ 2 : ADV_TYPE_SCAN_IND▸ 3 : ADV_TYPE_NONCONN_IND <p><own_addr_type> : BLE Address Type</p> <ul style="list-style-type: none">▸ 0 : BLE_ADDR_TYPE_PUBLIC▸ 1 : BLE_ADDR_TYPE_RANDOM <p><channel_map> : Broadcast Channel</p> <ul style="list-style-type: none">▸ 1 : ADV_CHNL_37▸ 2 : ADV_CHNL_38 | |

| | | |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+BLEADVPARAM? Function: Inquiry of BLE Broadcast Parameter(s) | Designate Command(s) : AT+BLEADVPARAM=<adv_int_min>,<adv_int_max>,<adv_type>,<own_addr_type>,<channel_map>[,<adv_filter_policy>,<peer_addr_type>,<peer_addr>] Function: Designate Broadcast Parameter(s) |
| | <div>‣ 4 : ADV_CHNL_39</div> <div>‣ 7 : ADV_CHNL_ALL</div> <div>[<adv_filter_policy>](Fill-in Parameters): Filter Principle</div> <div>‣ 0 : ADV_FILTER_ALLOW_SCAN_ANY_CON_ANY</div> <div>‣ 1 : ADV_FILTER_ALLOW_SCAN_WLST_CON_ANY</div> <div>‣ 2 : ADV_FILTER_ALLOW_SCAN_ANY_CON_WLST</div> <div>‣ 3 : ADV_FILTER_ALLOW_SCAN_WLST_CON_WLST</div> <div>[<peer_addr_type>] ((Fill-in Parameters): BLE Address Types of the Opposite End</div> <div>‣ 0 : PUBLIC</div> <div>‣ 1 : RANDOM</div> <div>[<peer_addr>](Fill-in Parameters): BLE Address of the Opposite End</div> | |
| Note | <adv_filter_policy>,<peer_addr_type>,<peer_addr> Three parameters demands default or not at the same time. | |
| Examples | AT+BLEINIT=2 // Initialized as server AT+BLEADVPARAM=50,50,0,0,4,0,0,"12:34:45:78:66:88" | |

5.2.6. AT+BLEADVDATA—Set up BLE Broadcast Data

| | |
|------------|---------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEADVDATA= <adv_data> Function: Install BLE Broadcast Data |
| Feedback | OK |

| | |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEADVDATA=<adv_data> Function: Install BLE Broadcast Data |
| Parameter | Broadcast Data Packets. Parameters are actually comprised of HEX bytes. |
| Description(s) | For example, installation scan feedback should be "0x11 0x22 0x33 0x44 0x55", as Command can be installed as "AT+BLEADVDATA="1122334455". |
| Note | The maximum length of broadcast packet is 31 bytes. |
| Examples | AT+BLEINIT=2 // Initialized as server. AT+BLEADVDATA="1122334455" |

5.2.7. AT+BLEADVSTART—Initiate BLE Broadcast

| | |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Execute Command : AT+BLEADVSTART Function: Initiate BLE Broadcast |
| Feedback | OK |
| Parameter | N/A |
| Description(s) | |
| Note | <ul style="list-style-type: none"> • If Command Broadcast Parameter (AT+BLEADVPARAM=<adv_parameter>) is not installed, default broadcast parameters can be adopted. • If Command Broadcast Parameter (AT+BLEADVPARAM=<adv_data>) is not installed, all packets of "0" are sent. |
| Examples | AT+BLEINIT=2 // Initialized as server AT+BLEADVSTART |

5.2.8. AT+BLEADVSTOP—Terminate BLE Broadcast

| | |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Execute Command : AT+BLEADVSTOP Function: Terminate Broadcast |
| Feedback | OK |
| Parameter | N/A |
| Description(s) | |
| Note | When broadcast has been initiated, unless BLE connection is successfully establishing, otherwise BLE broadcast will be automatically terminated without having to adopt this Command. |
| Examples | AT+BLEINIT=2 // Initialized as server AT+BLEADVSTART AT+BLEADVSTOP |

5.2.9. AT+BLECONNPARAM—Renew BLE Connection Parameters

| | | |
|----------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+BLECONNPARAM? Function: Inquiry of BLE Connection Parameter(s). | Designate Command(s) : AT+BLECONNPARAM= <conn_index>,<min_interval>,<max_interval>,<latency>,<timeout> Function: Renew BLE Connection Parameter(s) |
| Feedback | +BLECONNPARAM:<conn_index>,<cur_interval>,<latency>,<timeout> OK | OK //Command has been received, and more connection parameters will be updated. +BLECONNPARAM: <conn_index>,0 If update fails, it will be promoted. +BLECONNPARAM: <conn_index>,-1 |
| Parameter | <conn_index> : BLE Connection Number currently only supports single connection with index of 0. | |
| Description(s) | | |

| | | |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+BLECONNPARAM? Function: Inquiry of BLE Connection Parameter(s). | Designate Command(s) : AT+BLECONNPARAM=<conn_index>,<min_interval>,<max_interval>,<latency>,<timeout> Function: Renew BLE Connection Parameter(s) |
| | <p><min_interval> : The minimum connection interval, with values ranging between 0x0006 ~ 0x0C80.</p> <p><max_interval> : The maximum connection interval, with values ranging between 0x0006 ~ 0x0C80.</p> <p><cur_interval> : Current Connecting Interval</p> <p><latency> : Time delay, with values ranging between 0x0000 ~ 0x01F3.</p> <p><timeout> : Over-Time, with values ranging between 0x000A ~ 0x0C80.</p> | |
| Note | This command demands to establish connection first, and only supports BLE client update connection parameters. | |
| Examples | AT+BLEINIT=1 // Initialized as client AT+BLECONN=0,"24:0a:c4:09:34:23" // Establish BLE connection AT+BLECONNPARAM=0,12,14,1,500 // Update BLE connection parameters. | |

5.2.10. AT+BLEDISCONN—BLE Connection

| | |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEDISCONN=<conn_index> Function: Terminate BLE Connection |
| Feedback | +BLEDISCONN:<conn_index>,<remote_address> OK |
| Parameter Description(s) | <p><conn_index> : BLE connection number currently only supports single connection of index of "0".</p> <p><remote_address> : Opposite-end BLE device address</p> |
| Examples | AT+BLEINIT=1 // Initialized as client AT+BLECONN=0,"24:0a:c4:09:34:23" // Establish BLE connection |

| | |
|------------|--------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEDISCONN=<conn_index> Function: Terminate BLE Connection |
| | AT+BLEDISCONN=0 // Terminate BLE connection |

5.2.11. AT+BLEDATALEN—Install BLE Data Packet Length

| | |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEDATALEN=<conn_index>,<pkt_data_len> Function: Install BLE data packet length |
| Feedback | OK |
| Parameter Description(s) | <conn_index> : BLE connection number currently only supports single connection of index of "0". <pkt_data_len> : Data Packet Length, with values ranging from 0x001b ~ 0x00fb. |
| Note | BLE connection needs to be established first, before install packet length. |
| Examples | AT+BLEINIT=1 // Initialized as client AT+BLECONN=0,"24:0a:c4:09:34:23" AT+BLEDATALEN=0,30 |

5.2.12. AT+BLECFGMTU—Set up GATT MTU Length

| | | |
|--------------------------|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLECFGMTU? Function: Inquiry of GATT MTU Length | Designate Command(s) : AT+BLECFGMTU=<conn_index>,<mtu_size> Function: Install GATT MTU Length |
| Feedback | +BLECFGMTU:<conn_index>,<mtu_size> OK | OK // Command has been received |
| Parameter Description(s) | <conn_index> : BLE Connection Number currently only supports single connection with index of 0. | |

| | | |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLECFGMTU? Function: Inquiry of GATT MTU Length | Designate Command(s) : AT+BLECFGMTU=<conn_index>,<mtu_size> Function: Install GATT MTU Length |
| <mtu_size> : The length of the largest transmission unit of BLE | | |
| Note | <ul style="list-style-type: none"> The ultimate actual length of MTU needs to be conferred, as installation command returns OK only means there is attempt to confer on MTU, therefore, the installed length may not come into effect, so we recommend that after installation, Inquiry Command AT+BLECFGMTU can be used to inquire on the actual MTU length. | |
| Examples | AT+BLEINIT=1 // Initialized as client AT+BLECONN=0,"24:12:5f:9d:91:98"// Establish BLE connection AT+BLECFGMTU=0,300 | |

5.2.13. AT+BLEGATTSSRVCRE—GATTS Service Establishment

| | |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Execute Command : AT+BLEGATTSSRVCRE Function: GATTS Service Establishment |
| Feedback | OK |
| Parameter Description(s) | N/A |
| Note | <ul style="list-style-type: none"> After initialization is completed, OPL1000, as a server, should establish service. Once BLE connection is established, service may not be created. |
| Examples | AT+BLEINIT=2 // Initialized as server AT+BLEGATTSSRVCRE |

5.2.14. AT+BLEGATTSSRVSTART—GATTS Service Activation

| | | |
|----------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Command(s) | Execute Command : AT+BLEGATTSSRVSTART Function: GATTS activates all services | Designate Command(s) : AT+BLEGATTSSRVSTART=<srv_index> Function: GATTS activates a designated service. |
| Feedback | OK | |
| Parameter | N/A | Service serial number, starting in ascending order from "1". |
| Description(s) | | |
| Examples | AT+BLEINIT=2 // Initialized as server AT+BLEGATTSSRVCRE AT+BLEGATTSSRVSTART | |

5.2.15. AT+BLEGATTSSRVSTOP—GATTS Service Termination

| | | |
|----------------|-------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Command(s) | Execute Command : AT+BLEGATTSSRVSTOP Function: GATTS terminates all services | Designate Command(s) : AT+BLEGATTSSRVSTOP=<srv_index> Function: GATTS terminates a designated service. |
| Feedback | OK | |
| Parameter | N/A | <srv_index> : Service serial number, starting in ascending order from "1". |
| Description(s) | | |
| Examples | AT+BLEINIT=2 // Initialized as server AT+BLEGATTSSRVCRE AT+BLEGATTSSRVSTART AT+BLEGATTSSRVSTOP | |

5.2.16. AT+BLEGATTSSRV—GATTS Discovery Service

| | |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+BLEGATTSSRV? Function: GATTS Discovery Service |
| Feedback | +BLEGATTSSRV:<srv_index>,<start>,<srv_uuid>,<srv_type> OK |
| Parameter Description(s) | <srv_index> : Service serial number, starting in ascending order from "1". <start> : ▸ 0 : Service not yet activated ▸ 1 : Service already activated <srv_uuid> : Service UUID <srv_type> : Service Types ▸ 0 : Secondary Service ▸ 1 : Primary Service |
| Examples | AT+BLEINIT=2 // Initialized server AT+BLEGATTSSRVCRE AT+BLEGATTSSRV? |

5.2.17. AT+BLEGATTCHAR—GATTS Discovery Service Attributes

| | |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+BLEGATTCHAR? Function: GATTS Discovery Service Attributes |
| Feedback | //Regarding service attribute messages, they area displayed as follows: +BLEGATTCHAR:"char",<srv_index>,<char_index>,<char_uuid>,<char_prop> //Regarding descriptor messages, they area displayed as follows: +BLEGATTCHAR:"desc",<srv_index>,<char_index>,<desc_index> OK |

| | |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Inquiry of Command(s) : AT+BLEGATTCHAR? Function: GATTS Discovery Service Attributes |
| Parameter | <srv_index> : Service serial number, starting in ascending order from "1". |
| Description(s) | <char_index> : Service attributes serial number, starting in ascending order from "1". <char_uuid> : Service attributes UUID <char_prop> : Property of Service attributes <desc_index> : Attributes Descriptor Serial Number |
| Examples | AT+BLEINIT=2 // Initialized as server AT+BLEGATTSSRVCRE AT+BLEGATTSSRVSTART AT+BLEGATTCHAR? |

5.2.18. AT+BLEGATTSENTFY—GATTS Notification Service Attribute Values

| | |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEGATTSENTFY=<conn_index>,<srv_index>,<char_index>,<length> > Function: GATTS Notification Service Attribute Values |
| Feedback | After having received this command, proceed to RETURN >, and then start to receive serial-port data, and when data length reaches <length>, then execute notification operation. If notification operates successfully, then prompt OK. |
| Parameter | <conn_index> : BLE Connection currently only supports single connection of index of "0". |
| Description(s) | <srv_index> : Service serial numbers can be inquired with Command AT+BLEGATTCHAR?. <char_index> : Service attributes can be inquired with Command AT+BLEGATTCHAR?. <length> : Data Length |
| Examples | Below are the simple examples of "notify" |

| | |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEGATTSENTFY=<conn_index>,<srv_index>,<char_index>,<length> > Function: GATTS Notification Service Attribute Values |
| | AT+BLEINIT=2 // Initialized as server AT+BLEGATTSSRVCRE AT+BLEGATTSSRVSTART AT+BLEADVSTART// Initiate broadcast, until connection with client, while installed to receive "notify". AT+BLEGATTSSCHAR?//Inquiry of allowed "notify" attributes //For example, use data of No. 6 attribute notification of No. 3 service with data length of 4 AT+BLEGATTSENTFY=0,3,6,4 // After prompting ">" symbol, enter 4-byte data, such as "1234". |

5.2.19. AT+BLEGATTSSIND—GATTS Indication Service Attribute Values

| | |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEGATTSSIND=<conn_index>,<srv_index>,<char_index>,<length> > Function: GATTS Indication Service Attribute Values |
| Feedback | After having received this command, proceed to RETURN >, and then start to receive serial-port data, and when data length reaches <length>, then execute notification operation. If notification operates successfully, then prompt OK. |
| Parameter Description(s) | <conn_index> : BLE Connection currently only supports single connection of index of "0" <srv_index> : Service attributes can be inquired with Command AT+BLEGATTSSCHAR?. <char_index> : Service attributes can be inquired with Command AT+BLEGATTSSCHAR?. <length> : Data Length |

| | |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | <p>Designate Command(s) :</p> <p>AT+BLEGATTSIND=<conn_index>,<srv_index>,<char_index>,<length></p> <p>Function: GATTS Inidication Service Attribute Values</p> |
| Examples | <p>Below are the simple examples of "indicate"</p> <p>AT+BLEINIT=2 // Initialized as server</p> <p>AT+BLEGATTSSRVCRE</p> <p>AT+BLEGATTSSRVSTART</p> <p>AT+BLEADVSTART// Once broadcast is initiated, and wait for client to connect, and once client end has been connected, it would be installed as reception indication.</p> <p>AT+BLEGATTSCCHAR?// Inquiry of allowed "indicate" attributes</p> <p>//For example, use data of No. 7 attribute notification of No. 3 service with data length of 4</p> <p>AT+BLEGATTSIND=0,3,7,4</p> <p>// After prompting ">" symbol, enter 4-byte data, such as "1234".</p> |

5.2.20. AT+BLEGATTSSETATTR—GATTS Installation Service Attribute Values

| | |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | <p>Designate Command(s) :</p> <p>AT+BLEGATTSSETATTR=<srv_index>,<char_index>[,<desc_index>],<length></p> <p>Function: GATTS Installation Service Attribute (Descriptor) Values</p> |
| Feedback | <p>After having received this command, proceed to RETURN >, and then start to receive serial-port data, and when data length reaches <length>, then execute notification operation. If notification operates successfully, then prompt OK.</p> |
| Parameter Description(s) | <p><srv_index> : Service discovery result serial numbers can be inquired with Command AT+BLEGATTSCCHAR?.</p> <p><char_index> : Service attributes can be inquired with Command AT+BLEGATTSCCHAR?.</p> |

| | |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | <p>Designate Command(s) :</p> <p>AT+BLEGATTSSSETATTR=<srv_index>,<char_index>[,<desc_index>],<length></p> <p>Function: GATTS Installation Service Attribute (Descriptor) Values</p> |
| Note | <p>[<desc_index>](Fill-in Parameter): Attribute Descriptor Serial Number. If filled in, the value of descriptor will be installed. If not filled in, default value will be installed.</p> <p><length> : Data Length</p> |
| Examples | <p><length> cannot exceed the maximum length supported by this attribute (descriptor). For example, this service attribute value is "0x30 0x31", with maximum length of "2", and if the installed <length> being "3" which exceeds the maximum length, ERROR would be prompted.</p> <p>AT+BLEINIT=2 // Initialized as server</p> <p>AT+BLEGATTSSRVCRE</p> <p>AT+BLEGATTSSRVSTART</p> <p>AT+BLEGATTSSCHAR?</p> <p>//For example, use data of No. 1 attribute notification of No. 1 service with data length of 4</p> <p>AT+BLEGATTSSSETATTR=1,1,,4</p> <p>// After prompting ">" symbol, enter 4-byte data, such as "1234".</p> |

5.2.21. AT+BLEGATTCPRIMSRV—GATTC Basic Discovery Service

| | |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Command(s) | <p>Designate Command(s) :</p> <p>AT+BLEGATTCPRIMSRV=<conn_index></p> <p>Function: GATTC Discovery Basic Service</p> |
| Feedback | <p>+BLEGATTCPRIMSRV:<conn_index>,<srv_index>,<srv_uuid>,<srv_type></p> <p>OK</p> |
| Parameter Description(s) | <p><conn_index> : BLE Connection currently only supports single connection of index of "0".</p> |

| | |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEGATTCPRIMSRV=<conn_index> Function: GATT Discovery Basic Service |
| | <srv_index> : Service discovery result serial number, starting in ascending order from "1". <srv_uuid> : Service UUID <srv_type> : Service Types ▸ 0 : Secondary Service ▸ 1 : Primary Service |
| Note | To adopt this Command, BLE connection needs to be established first. |
| Examples | AT+BLEINIT=1 // Initialized as client AT+BLECONN=0,"24:12:5f:9d:91:98"// Establish BLE connection AT+BLEGATTCPRIMSRV=0 |

5.2.22. AT+BLEGATTCINCLSRV—GATT Discovery Inclusion Service

| | |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEGATTCINCLSRV=<conn_index>,<srv_index> Function: GATT Discovery Inclusion Service |
| Feedback | +BLEGATTCINCLSRV:<conn_index>,<srv_index>,<srv_uuid>,<srv_type>,<included_srv_uuid>,<included_srv_type> OK |
| Parameter Description(s) | <conn_index> : BLE Connection currently only supports single connection of index of "0". <srv_index> : Service discovery result serial numbers can be inquired with Command AT+BLEGATTCPRIMSRV=<conn_index>. <srv_uuid> : Service UUID <srv_type> : Service Types ▸ 0 : Secondary Service ▸ 1 : Primary Service <included_srv_uuid> : UUID Including service |

| | |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEGATTCINCLSRV=<conn_index>,<srv_index> Function: GATTC Discovery Inclusion Service |
| | <included_srv_type> : Type Including service ▸ 0 : Secondary Service ▸ 1 : Primary Service |
| Note | To adopt this Command, BLE connection needs to be established first. |
| Examples | AT+BLEINIT=1 // Initialized as client AT+BLECONN=0,"24:12:5f:9d:91:98"// Establish BLE Connection AT+BLEGATTCPRIMSRV=0 AT+BLEGATTCINCLSRV=0,1//According to the inquiry result of the previous command, designate index for inquiry. |

5.2.23. AT+BLEGATTCCHAR—GATTC Discovery Service Attributes

| | |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEGATTCCHAR=<conn_index>,<srv_index> Function: GATTC Discovery Service Attributes |
| Feedback | //Regarding service attribute message, and they are displayed as below: +BLEGATTCCHAR:"char",<conn_index>,<srv_index>,<char_index>,<char_uuid>,<char_prop> //Regarding descriptor messages, and they are displayed as below: +BLEGATTCCHAR:"desc",<conn_index> · <srv_index>,<char_index>,<desc_index>,<desc_uuid> OK |
| Parameter Description(s) | <conn_index> : BLE Connection currently only supports single connection of index of "0". <srv_index> : Service discover result serial can be inquired with command AT +BLEGATTCPRIMSRV=<conn_index> <char_index> : Service attributes serial number, starting in ascending order from "1". |

| | |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEGATTCCHAR=<conn_index>,<srv_index> Function: GATTC Discovery Service Attributes |
| | <char_uuid> : Service Attribute UUID <char_prop> : Property of Service Attribute Attributes <desc_index> : Attribute Descriptor Serial Number <desc_uuid> : Attribute Descriptor UUID |
| Note | To adopt this Command, BLE connection needs to be established first. |
| Examples | AT+BLEINIT=1 //Initialized as client AT+BLECONN=0,"24:12:5f:9d:91:98"// Establish BLE connection AT+BLEGATTCPRIMSRV=0 AT+BLEGATTCCHAR=0,1//According to the inquiry result of the previous command, designate index for inquiry. |

5.2.24. AT+BLEGATTCRD—GATTC Read Service Attribute Values

| | |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEGATTCRD=<conn_index>,<srv_index>,<char_index>[,<desc_index>] Function: GATTC Read Service Attribute (Descriptor) Values |
| Feedback | +BLEGATTCRD:<conn_index>,<len>,<value> OK |
| Parameter Description(s) | <conn_index> : BLE Connection currently only supports single connection of index of "0" <srv_index> : Service discovery result serial numbers can be inquired with Command AT+BLEGATTCPRIMSRV=<conn_index>. <char_index> : Service Attribute serial numbers can be inquired with Command AT+BLEGATTCCHAR=<conn_index>,<srv_index>. |

| | |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | <p>Designate Command(s) :</p> <p>AT+BLEGATTCD=<conn_index>,<srv_index>,<char_index>[,<desc_index>]</p> <p>Function: GATT Read Service Attribute (Descriptor) Values</p> <p>[<desc_index>](Fill-in Parameter): Attribute Descriptor Serial Number. If not filled in, default value will be read. If filled in, the value of descriptor will be read.</p> <p><len> : Data Length</p> <p><value> : HEX String</p> <p>▸ If the reading of the value of service attributes is done through Command AT+BLEGATTCD=<conn_index>,<srv_index>,<char_index>, e.g. Command READ RETURN "+BLEGATTCD:0,1,30" means that attribute value length is of 1 byte, with content of HEX string "0x30".</p> <p>▸ If the reading of the value of service attributes is done through Command AT+BLEGATTCD=<conn_index>,<srv_index>,<char_index>,<desc_index>, e.g. Command READ RETURN "+BLEGATTCD:0,4,30313233" means that attribute value length is of 4 bytes, with content of HEX string "0x30 0x31 0x32 0x33".</p> |
| Note | <ul style="list-style-type: none">• To adopt this Command, BLE connection needs to be established first.• If this service attribute does not support read operation, then command will prompt "ERROR". |
| Examples | <p>AT+BLEINIT=1 // Initialized as client</p> <p>Initialized as client</p> <p>AT+BLECONN=0,"24:12:5f:9d:91:98"// Establish BLE Connection</p> <p>AT+BLEGATTCPRIMSRV=0</p> <p>AT+BLEGATTCCCHAR=0,3//According to the inquiry result of the previous command, designate index for inquiry.</p> <p>AT+BLEGATTCD=0,3,2,1// For example, read the No. 1 descriptor message of the No.2 attribute of the No. 3 service</p> |

5.2.25. AT+BLEGATTCWR—GATTC Write Service Attribute Values

| | |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEGATTCWR=<conn_index>,<srv_index>,<char_index>[,<desc_index>],<length> Function: GATTC Read Service Attribute (Descriptor) Values |
| Feedback | After having received this command, proceed to RETURN >, and then start to receive serial-port data, and when data length reaches <length>, then execute read operation. If read operates successfully, then prompt OK. |
| Parameter Description(s) | <conn_index> : BLE Connection currently only supports single connection of index of "0" <srv_index> : Service discovery result serial numbers can be inquired with Command AT+BLEGATTCPRIMSRV=<conn_index>. <char_index> : Service attributes can be inquired with Command AT+BLEGATTCCHAR=<conn_index>,<srv_index>. [<desc_index>](Fill-in Parameter): Attribute Descriptor Serial Number. If not filled in, default value will be installed. If filled in, the value of descriptor will be installed. <length> : Data Length |
| Note | <ul style="list-style-type: none">• To adopt this Command, BLE connection needs to be established first.• If this service attribute does not support write operation, then command will prompt "ERROR". |
| Examples | AT+BLEINIT=1 // Initialized as client AT+BLECONN=0,"24:12:5f:9d:91:98"// Establish BLE Connection AT+BLEGATTCPRIMSRV=0 AT+BLEGATTCCHAR=0,3// According to the inquiry result of the previous command, designate index for inquiry. // For example, use data of No. 4 attribute notification of No. 3 service to write in the data length of 6 |

| | |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEGATTCWR=<conn_index>,<srv_index>,<char_index>[,<desc_index>],<length> Function: GATT Read Service Attribute (Descriptor) Values |
| | AT+BLEGATTCWR=0,3,4,,6 // After prompting ">" symbol, enter data of "123456" through serial port |

5.2.26. AT+DTM—BLE Testing Mode

| | |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+DTM=TX,<channel>,<data length>,<packet type> Function: Test BLE TX AT+DTM=RX,<channel> Function: Test BLE RX AT+DTM=END Function: Terminate BLE Testing Mode |
| Feedback | Execute AT+DTM=END to enter BLE Testing Mode, before the result can be displayed. RX CNT: AAA CRC OK: BBB CRC FAIL: CCC RSSI: DDD AAA: Total number of packets received BBB: The correct number of packets from CRC in the meantime. CCC: The incorrect number of packets from CRC in the meantime. DDD: RSSI Value |
| Parameter Description(s) | <channel> : 0~39 <data length> : Packet Length <packet type> : Packet Type <ul style="list-style-type: none">● 0: PRBS9● 1: Pattern 11110000 |

| | |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+DTM=TX,<channel>,<data length>,<packet type> Function: Test BLE TX AT+DTM=RX,<channel> Function: Test BLE TX AT+DTM=END Function: Terminate BLE Testing Mode |
| | <ul style="list-style-type: none"> ● 2: Pattern 10101010 ● 3: PRBS15 ● 4: Pattern 11111111 ● 5: Pattern 00000000 |
| Examples | // TX-end Device AT+DTM=TX, 20, 27, 2 AT+DTM=END //RXXX-end Device AT+DTM=RX, 20 AT+DTM=END |

5.2.27. AT+BLEPHYREAD—Read of Currently Connected PHY

| | |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEPHYREAD=< conn_index > Function: Read of currently connected PHY setting |
| Feedback | OK |
| Parameter Description(s) | <conn_index> : BLE Connection currently only supports single connection of index of "0" |
| Note | To adopt this Command, BLE connection needs to be established first. |
| Examples | AT+BLEINIT=2 // Initialized as server AT+BLEADVSTART // Initiate broadcast, and waiting for connection AT+BLEPHYREAD=0 +BLEPHYREAD:0,0,1,1 // <conn_index>,<status>,<phy_tx>,<phy_rx> |

| | |
|------------|-------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEPHYREAD=< conn_index > Function: Read of currently connected PHY setting |
| Feedback | Status: 0: 0: Success – 1: Error (no phy_tx, phy_rx) |
| Parameters | Phy_tx: 1: 1M 2: 2M Phy_rx: 1: 1M 2: 2M |

5.2.28. AT+BLEPHYSET—Set up of Currently Connected PHY

| | |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command(s) | Designate Command(s) : AT+BLEPHYSET=< conn_index > < phy_tx > < phy_rx> Function: Install the currently connected PHY setting |
| Feedback | OK |
| Parameter Description(s) | <conn_index> : BLE Connection currently only supports single connection of index of "0" < phy_tx >: 1: 1M 2: 2M 3: 1M+2M < phy_rx >: 1: 1M 2: 2M 3: 1M+2M |
| Note | To adopt this Command, BLE connection needs to be established first. |
| Examples | AT+BLEINIT=2 // Initialized as server AT+BLEADVSTART //Initiate broadcast, and waiting for connection AT+BLEPHYSET=0,2,2 +BLEPHYSET:0,0,2,2 // <conn_index>,<status>,<phy_tx>,<phy_rx> |
| Feedback | Status: 0: Success -1: Failure : No phy_tx, phy_rx) |
| Parameters | Phy_tx: 1: 1M 2: 2M Phy_rx: 1: 1M 2: 2M |

5.3. BLE AT CMD Error Code

| Code | Description |
|------|------------------------|
| 1 | BLE is not initialized |

| Code | Description |
|------|----------------------------------------------------------------------------|
| 2 | The memory is not enough |
| 3 | No such command |
| 4 | Invalid parameter |
| 5 | Invalid state |
| 6 | Command is in progress |
| 7 | Fail |
| 8 | Already (in the wanted state) |
| 9 | Wrong role |
| 10 | Busy |
| 11 | No random address |
| 12 | No peer address |
| 13 | The number of connections is out of max (only one connection is supported) |
| 14 | Service does not start |
| 15 | Invalid characteristic property |
| 16 | No GATT service |
| 17 | No GATT include service |
| 18 | No GATT characteristic |
| 19 | No GATT characteristic descriptor |
| 20 | No read permission |
| 21 | No write permission |
| 22 | GATT read fail |
| 23 | GATT write fail |
| 24 | Invalid characteristic value length |

6. EXAMPLES OF AT COMMAND APPLICATIONS

This section will introduce several types of examples of common AT command application

6.1. Single-Connection to TCP Client

1 · Set up Wi-Fi Mode

```
AT+CWMODE=1      // Station mode
```

Feedback

OK

2 · Scan AP

```
AT+CWLAP
```

Feedback

```
+CWLAP:2,Opulinks,-22,30:fc:68:90:a8:a1,1
```

```
+CWLAP:3,Opulinks-S,-24,00:d0:41:df:1e:25,6
```

OK

3 · Connection to Router

```
AT+CWJAP="SSID","password"
```

Feedback

OK

WIFI CONNECTED

WIFI GOT IP

4 · Inquiry of IP message of device

```
AT+CIFSR
```

Feedback

```
+CIFSR:STAIP,"169.254.119.102"
```

```
+CIFSR:STAMAC,"22:33:44:55:66:76"
```

OK

- 5 · Set up PC to be connected with OPL000 via the same router, and use network testing assistant on PC to establish UDP transmission:



OPL00 serves as the client end to be connected to TCP server

AT+CIPSTART="TCP","192.2168.1.101",8080 // protocol 、 server IP & port

Feedback

CONNECT

OK

- 6 · Send Data

AT+CIPSEND=4

OK

>ABCD

Recv 4 bytes

SEND OK

- 7 · Data Reception

+IPD,n:xxxxx // received n bytes, data=xxxxx

6.2. UDP Transmission

1. Set up Wi-Fi Mode

AT+CWMODE=1 // Station mode

Feedback

OK

2. Scan AP

AT+CWLAP

Feedback

+CWLAP:2,Opulinks,-22,30:fc:68:90:a8:a1,1

+CWLAP:3,Opulinks-S,-24,00:d0:41:df:1e:25,6

OK

3. Connection to Router

AT+CWJAP="SSID","password"

Feedback

OK

WIFI CONNECTED

WIFI GOT IP

4. Inquiry of IP message of device

AT+CIFSR

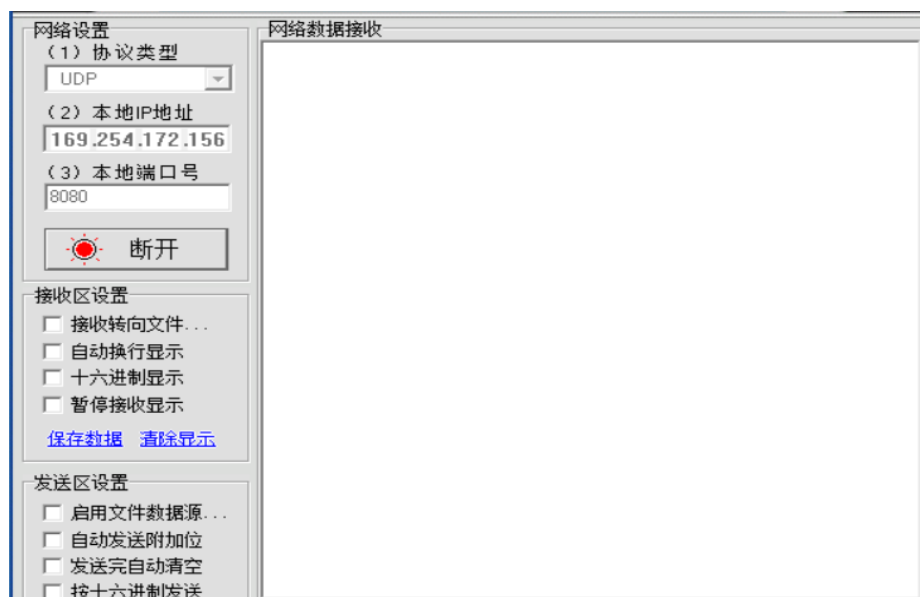
Feedback

+CIFSR:STAIP,"169.254.119.102"

+CIFSR:STAMAC,"22:33:44:55:66:76"

OK

5. Set up PC to be connected with OPL000 via the same router, and use network testing assistant on PC to establish UDP transmission:



Below are the two examples of UDP communication.

6.2.1. Fixed Remote UDP Communication

The fixed remote UDP communication is determined by the last parameter of "0" of AT+CIPSTART command, and a connection number is distributed to the said fixed remote connection, as the message to the remote end will not be altered during the connected period

1 · Enable Multiple Connection

AT+CIPMUX=1

Feedback

OK

2 · Establish UDP Transmission, e.g. Set distribution Connection ID as "4".

AT+CIPSTART=4,"UDP","192.168.1.101",8080,1112,0

Feedback

4,CONNECT

OK

3 · Send Data

```
AT+CIPSEND=4,5
```

```
OK
```

```
> ABCDE
```

```
Recv 5 bytes
```

```
SEND OK
```

4 · Data Reception

```
+IPD,n:xxxxx // received n bytes, data=xxxxx
```

5 · Terminate UDP Transmission

```
4,CLOSED
```

```
OK
```

6.2.2. Variable Remote UDP Communication

1. Establish UDP Transmission, the last parameter set as "2".

```
AT+CIPSTART="UDP","192.168.1.101",8080,1112,2
```

```
Feedback
```

```
CONNECT
```

```
OK
```

2. Send Data

```
AT+CIPSEND=5
```

```
OK
```

```
> ABCDE
```

```
Recv 5 bytes
```

```
SEND OK
```

3. Data Reception

```
+IPD,n:xxxxx // received n bytes, data=xxxxx
```

4. Terminate UDP Transmission

```
0,CLOSED
```

```
OK
```

6.3. Multiple-Connection TCP Server

OPL000 only supports establishing one TCP server with multiple connections.

As OPL000 can only serve as Station, therefore connection to router needs to be established before setting up the server.

1. Set up Wi-Fi Mode:

```
AT+CWMODE=1
```

```
Feedback
```

```
OK
```

2. Scan AP

```
AT+CWLAP
```

```
Feedback
```

```
+CWLAP:2,Opulinks,-22,30:fc:68:90:a8:a1,1
```

```
+CWLAP:3,Opulinks-S,-24,00:d0:41:df:1e:25,6
```

```
OK
```

3. Connection to Router

```
AT+CWJAP="SSID","PASSWD"
```

```
Feedback
```

```
OK
```

```
WIFI CONNECTED
```

```
WIFI GOT IP
```

4. Check IP Message:

```
AT+CIFSR
```

```
Feedback
```

```
+CIFSR:STAIP,"192.168.1.103"
```

```
+CIFSR:STAMAC,"22:33:44:55:66:76"
```

```
OK
```

5. Enable Multiple-Connection

AT+CIPMUX=1

Feedback

OK

6. TCP SERVER :

Set up TCP SERVER:

AT+CIPSERVER=1,8080

Feedback

OK

0,CONNECT // Display after establishing TCP Client Connection on PC

7. Data Reception

+IPD,0,7,192.168.1.104,54789:abcdefg

+IPD,0,7,192.168.1.104,54789:abcdefg0,CLOSED

CONTACT

sales@Opulinks.com